Horizons Regional Council Horizons Flood Vulnerability (Task 4 FVA)

February 2026

horizons
REGIONAL COUNCIL

Prepared for:

Jon Roygard
Catchment Operations Group Manager

February 2026
Report No. 2026/EXT/2002
ISBN. 978-1-991448-05-7

Prepared by:
WSP

CONTACT **24 hr Freephone 0508 800 800** **help@horizons.govt.nz** **www.horizons.govt.nz**

SERVICE CENTRES	**Kairanga** Cnr Rongotea and Kairanga-Bunnythorpe Roads Palmerston North **Marton** Hammond Street **Taumarunui** 34 Maata Street	**REGIONAL HOUSES**	**Palmerston** North 11-15 Victoria Avenue **Whanganui** 181 Guyton Street	**DEPOTS**	**Taihape** Torere Road Ohotu **Woodville** 116 Vogel Street

POSTAL ADDRESS Horizons Regional Council, Private Bag 11025, Manawatū Mail Centre, Palmerston North 4442

F 06 9522 929

Horizons Regional Council

Horizons Flood Vulnerability Assessment

12 February 2026

Horizons Flood Vulnerability Assessment

Horizons Regional Council

WSP New Zealand Limited
Wellington
L9 Majestic Centre
100 Willis Street
Wellington 6011, New Zealand
+64 4 471 7000
wsp.com/nz

REV	DATE	DETAILS
00	23/01/2026	Draft Report for Review
01	05/02/2026	Final for Issue

	NAME	DATE	SIGNATURE
Prepared by:	Danielle Barnhill Azura Patterson-Ng Jaime Delano Emma Rowling Melissa Goldsworthy	23/01/2026	
Reviewed & Approved by:	Richard Woods	23/01/2026	

12 February 2026

This report (‘Report’) has been prepared by WSP exclusively for [Horizons Regional Council] (‘Client’) in relation to developing a comprehensive flood vulnerability study for the region (‘Purpose’) and in accordance with CCCS 4th Edition Dec 2017 dated 21 July 2025.The findings in this Report are based on and are subject to the assumptions specified in the Report [and Horizons Vulnerability Assessment Contract with the Client dated 21 July 2025]. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

WSP
Wellington
L9 Majestic Centre
100 Willis Street
Wellington 6011, New Zealand
+64 4 471 7000

TABLE OF CONTENTS

KEY DEFINITIONS I

ABBREVIATIONS III

EXECUTIVE SUMMARY IV

1 INTRODUCTION 1

1.1 HORIZONS REGION FLOOD MODELLING CONTEXT 1

1.2 REPORT STRUCTURE 5

1.2.1 SUPPORTING DOCUMENTS 5

1.3 PURPOSE AND SCOPE OF VULNERABILITY ASSESSMENT 6

1.3.1 LIMITATIONS 7

2 METHODOLOGY 9

2.1 DESKTOP STUDY 9

2.1.1 HORIZONS FLOOD MODELLING AND MAPPING GUIDELINE 9

2.1.2 CURRENT STATE ANALYSIS REPORT 10

2.2 FLOOD VULNERABILITY ASSESSMENT METHOD 13

2.2.1 REGIONAL FLOOD MODELLING 13

2.2.2 VULNERABILITY ASSESSMENT 14

2.2.3 FLUVIAL MODELLING CASE STUDIES 17

2.2.4 ASSET CONDITION REPORT 18

2.3 LOWER MANAWATŪ HYDRAULIC MODEL 19

2.3.1 MOUTOA GATES MODEL 19

2.4 REPORTING 20

3 HORIZONS REGION RESULTS 21

3.1 REGIONAL SUMMARY RESULTS 21

3.1.1 REGIONAL FLOOD VULNERABILITY: CURRENT CLIMATE 21

3.1.2 REGIONAL FLOOD VULNERABILITY: WARMING SCENARIOS 24

3.1.3 REGIONAL FLOOD VULNERABILITY: DEFENCES DOWN 28

3.2 HORIZONS REGIONAL SUMMARY BY DISTRICT – CURRENT CLIMATE (0°C) WITH EXISTING DEFENCES UP 33

3.3 HORIZONS REGIONAL SUMMARY BY DISTRICT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C

WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP 42

3.4 HORIZONS REGIONAL SUMMARY BY DISTRICT – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN 49

3.5 HORIZONS REGIONAL SUMMARY BY DISTRICT – CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN 55

3.6 REGIONAL RESULTS: TOWNS AND SETTLEMENTS 59

3.6.1 RANKING OF REGIONAL RESULTS 59

4 DISTRICT RESULTS 66

4.1 PALMERSTON NORTH CITY 66

4.1.1 CITY OVERVIEW 66
4.1.2 FLOOD MANAGEMENT SCHEMES 67
4.1.3 CITY FLOOD VULNERABILITY RESULTS 68

4.2 WHANGANUI DISTRICT 82

4.2.1 DISTRICT OVERVIEW 82
4.2.2 FLOOD MANAGEMENT SCHEMES 84
4.2.3 DISTRICT FLOOD VULNERABILITY RESULTS 84

4.3 HOROWHENUA DISTRICT 97

4.3.1 DISTRICT OVERVIEW – HOROWHENUA 97
4.3.2 FLOOD MANAGEMENT SCHEMES 99
4.3.3 DISTRICT FLOOD VULNERABILITY RESULTS 99

4.4 MANAWATŪ DISTRICT 113

4.4.1 DISTRICT OVERVIEW – MANAWATŪ 113
4.4.2 FLOOD MANAGEMENT SCHEMES 115
4.4.3 DISTRICT FLOOD VULNERABILITY RESULTS 115

4.5 TARARUA DISTRICT 135

4.5.1 DISTRICT OVERVIEW – TARARUA 135
4.5.2 FLOOD MANAGEMENT SCHEMES 137
4.5.3 DISTRICT FLOOD VULNERABILITY RESULTS 137

4.6 RANGITĪKEI DISTRICT 150

4.6.1 DISTRICT OVERVIEW – RANGITĪKEI 150
4.6.2 FLOOD MANAGEMENT SCHEMES 151
4.6.3 DISTRICT FLOOD VULNERABILITY RESULTS 151

4.7 RUAPEHU DISTRICT 166

4.7.1 DISTRICT OVERVIEW – RUAPEHU 166
4.7.2 FLOOD MANAGEMENT SCHEMES 167
4.7.3 DISTRICT FLOOD VULNERABILITY RESULTS 167

4.8 SUMMARY OF DISTRICT VULNERABILITY RESULTS 181

5 RECOMMENDATIONS 184

5.1 USING THE FVA WITHIN A FIT-FOR-PURPOSE CONTEXT 184

5.2 USING THE FVA TO INFORM THE INFRASTRUCTURE STRATEGY 184

5.3 USING THE FVA TO INFORM THE FUTURE FLOOD MODELLING PROGRAMME 185

5.4 USING THE FVA TO INFORM EMERGENCY MANAGEMENT 185

5.5 USING THE FVA TO INFORM ASSET MANAGEMENT (CRITICALITY, RENEWALS, CONSEQUENCES) 186

5.6 INTEGRATED FLOOD & STORMWATER MODELLING AND ALIGNED PLANNING CYCLES 186

6 CONCLUSION 187

7 LIMITATIONS 188

APPENDIX A – LETTER OF COMPLETION 189

APPENDIX B – REGIONAL FLOOD MODELLING FOR HORIZONS FLOOD VULNERABILITY ASSESSMENT (ESNZ) 190

APPENDIX C – VULNERABILITY ASSESSMENT METHODOLOGY (ESNZ) 191

APPENDIX D3 (APPENDIX C) – DISTRICT RESULTS 195

APPENDIX E – METHODOLOGY FOR RISK OUTPUT POST PROCESSING 196

APPENDIX G – METHODOLOGY MEMO FOR DIFFERENTIATING FLUVIAL AND PLUVIAL FLOODING 198

APPENDIX H – FLUVIAL FLOOD MODELLING OF FOUR URBAN AREAS FOR THE HORIZONS REGION (ESNZ) 199

8 REFERENCES 201

LIST OF TABLES

TABLE 1: KEY DEFINITIONS. I

TABLE 2: ABBREVIATIONS USED THROUGHOUT REPORT. III

TABLE 3: REGIONAL FLOOD MODELLING FRAMEWORK FOR HORIZONS REGIONAL COUNCIL (WSP & NIWA, 2025A). 12

TABLE 4: RISK MODELLING CONDITIONS APPLIED FOR EACH MODEL RUN FOR THE HORIZONS FVA. 15

TABLE 5: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 5% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 33

TABLE 6: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 2% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 34

TABLE 7: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 1% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 35

TABLE 8: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 36

TABLE 9: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.2% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 37

TABLE 10: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.1% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 38

TABLE 11: TOTAL NUMBER OF BUILDINGS BY TYPE, AND NUMBER OF BUILDINGS IMPACTED BY FLOODING BY TYPE FOR 0.5% AEP FLOOD SCENARIO[1], CURRENT CLIMATE, DEFENCES UP. NOTE THAT PRIMARY AND SECONDARY STRUCTURES HAVE BEEN COMBINED. 41

TABLE 12: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIO[1] WITH CLIMATE WARMING (1°C) AND WITH FLOOD DEFENCES UP. 42

TABLE 13: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (2°C) AND WITH FLOOD DEFENCES UP. 43

TABLE 14: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C) AND WITH FLOOD DEFENCES UP. 44

TABLE 15: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL

RESULTS FOR A 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 45
TABLE 16: NUMBER OF BUILDINGS IMPACTED BY TYPE FOR A 0.5% AEP FLOOD IN 1°C, 2°C, 3°C AND 3°C +SLR CLIMATE WARMING SCENARIOS[1]. NOTE THAT THE PRIMARY AND SECONDARY STRUCTURES HAVE BEEN COMBINED. 48
TABLE 17: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 5% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 49
TABLE 18: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 2% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 50
TABLE 19: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 1% AEP FLOOD SCENARIOS[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 51
TABLE 20: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIO[1] WITH NO CLIMATE WARMING (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN....52
TABLE 21: NUMBER OF BUILDINGS EXPOSED TO FLOODING BY BUILDING TYPE FOR A 0.5% AEP FLOOD SCENARIO[1] IN CURRENT CLIMATE FOR DEFENCES UP AND DEFENCES DOWN. NOTE THAT PRIMARY AND SECONDARY STRUCTURES HAVE BEEN COMBINED. 54
TABLE 22: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C) AND WITH EXISTING FLOOD DEFENCES DOWN....55
TABLE 23: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (2°C) AND WITH EXISTING FLOOD DEFENCES DOWN....56
TABLE 24: REGIONAL SUMMARY BY DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS FOR A 0.5% AEP FLOOD SCENARIOS[1]

WITH CLIMATE WARMING (3°C) AND WITH EXISTING FLOOD DEFENCES DOWN.....57
TABLE 25: TOWN/SETTLEMENT RANKINGS FOR 0.5% AEP FLOOD EVENT IN THE CURRENT CLIMATE WITH FLOOD DEFENCES UP, SHOWING TOTAL NUMBER OF BUILDINGS, TOTAL NUMBER EXPOSED, AND THE PERCENT BASED ON BUILDING TYPE. 61
TABLE 26: FLOOD MANAGEMENT SCHEMES PROTECTING THE PALMERSTON NORTH CITY (HORIZONS REGIONAL COUNCIL, 2025). 68
TABLE 27: PALMERSTON NORTH CITY– VULNERABILITY METRICS FOR 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 70
TABLE 28: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2% AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 74
TABLE 29: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 75
TABLE 30: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C AND 2°C) AND WITH FLOOD DEFENCES UP.....76
TABLE 31: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 77
TABLE 32: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 78
TABLE 33: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 79
TABLE 34: PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH

CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN.....80
TABLE 35: FLOOD MANAGEMENT SCHEMES IN THE WHANGANUI DISTRICT (HORIZONS REGIONAL COUNCIL, 2025). 84
TABLE 36: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 86
TABLE 37: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2% AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 89
TABLE 38: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP.....90
TABLE 39: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C AND 2°C) AND WITH FLOOD DEFENCES UP. 91
TABLE 40: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 92
TABLE 41: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN.....93
TABLE 42: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN.....94
TABLE 43: WHANGANUI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN.....95
TABLE 44: SUMMARY OF HORIZONS REGIONAL COUNCIL RIVERS MANAGEMENT SCHEMES IN THE HOROWHENUA DISTRICT (HORIZONS REGIONAL COUNCIL, 2025). 99

TABLE 45: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 101
TABLE 46: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2% AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 105
TABLE 47: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 106
TABLE 48: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C AND 2°C) AND WITH FLOOD DEFENCES UP. 107
TABLE 49: HOROWHENUA DISTRICT VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 108
TABLE 50: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 109
TABLE 51: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 110
TABLE 52: HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 111
TABLE 53: FLOOD MANAGEMENT SCHEMES IN THE MANAWATŪ DISTRICT (HORIZONS REGIONAL COUNCIL, 2025). 115
TABLE 54: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 117
TABLE 55: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2%

AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 121
TABLE 56: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 123
TABLE 57: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH FLOOD DEFENCES UP. 125
TABLE 58: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 126
TABLE 59: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 128
TABLE 60: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 130
TABLE 61: MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 132
TABLE 62: FLOOD MANAGEMENT SCHEMES IN THE TARARUA DISTRICT (HORIZONS REGIONAL COUNCIL, 2025). 137
TABLE 63: TARARUA DISTRICT – VULNERABILITY METRICS FOR 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 139
TABLE 64: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2% AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 142
TABLE 65: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE

CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 143
TABLE 66: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C AND 2°C) AND WITH FLOOD DEFENCES UP. 144
TABLE 67: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 145
TABLE 68: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 146
TABLE 69: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 147
TABLE 70: TARARUA DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 148
TABLE 71: FLOOD MANAGEMENT SCHEMES IN THE RANGITĪKEI DISTRICT (HORIZONS REGIONAL COUNCIL, 2025). 151
TABLE 72: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 153
TABLE 73: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2% AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 157
TABLE 74: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 158
TABLE 75: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C AND 2°C) AND WITH FLOOD DEFENCES UP. 159

TABLE 76: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 160
TABLE 77: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 161
TABLE 78: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 162
TABLE 79: RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN. 163
TABLE 80: FLOOD MANAGEMENT SCHEMES IN THE RUAPEHU DISTRICT (HORIZONS REGIONAL COUNCIL, 2025). 167
TABLE 81: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS IN THE CURRENT CLIMATE (0°C) AND CLIMATE WARMING (1°C, 2°C, 3°C, AND 3°C WITH SEA LEVEL RISE), WITH EXISTING FLOOD DEFENCES UP. 169
TABLE 82: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5%, 2% AND 1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 173
TABLE 83: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5%, 0.2% AND 0.1% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES UP. 174
TABLE 84: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C AND 2°C) AND WITH FLOOD DEFENCES UP. 175
TABLE 85: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (3°C AND 3°C SEA LEVEL RISE) AND WITH FLOOD DEFENCES UP. 176

TABLE 86: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 5% AND 2% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN....177
TABLE 87: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 1% AND 0.5% AEP FLOOD SCENARIOS[1] IN THE CURRENT CLIMATE (0°C) AND WITH EXISTING FLOOD DEFENCES DOWN....178
TABLE 88: RUAPEHU DISTRICT – VULNERABILITY METRICS FOR LEVEL A REGIONAL MODEL RESULTS 0.5% AEP FLOOD SCENARIOS[1] WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND WITH EXISTING FLOOD DEFENCES DOWN....179

LIST OF FIGURES

FIGURE 1: COMPARISON OF FLOOD EXPOSURE AND COSTS FOR PEOPLE AND BUILDINGS, AS WELL AS BUILDINGS CONTRIBUTING TO BUILDING REINSTATEMENT COSTS, FOR THE 0.5% AEP EVENT, WITH CHANGES IN CLIMATE AND DEFENCES. VI
FIGURE 2: MAP OF HORIZONS REGION SHOWING THE 10 DISTRICTS WITHIN THE REGION. WAITOMO, STRATFORD AND TAUPŌ DISTRICTS HAVE BEEN EXCLUDED FROM THIS FLOOD VULNERABILITY ASSESSMENT. 2
FIGURE 3: MAP OF TOWNS/SETTLEMENTS IN THE HORIZONS REGION. NOTE THAT BUILDINGS AND POPULATION OUTSIDE OF THE TOWN AND SETTLEMENT AREAS HAS STILL BEEN INCLUDED WITHIN THE FLOOD VULNERABILITY ASSESSMENT. TOWN AND SETTLEMENTS BOUNDARIES FROM LAND INFORMATION NEW ZEALAND (2023). 3
FIGURE 4: RIVERS WITHIN HORIZONS REGION. RIVERS HAVE BEEN RANKED BY STREAM ORDER. LOWER-ORDER TRIBUTARIES HAVE SMALLER VALUES, WHILE MAJOR RIVERS ARE REPRESENTED BY HIGHER STREAM ORDERS. RIVER DATA FROM NZ LOCAL RIVER NAMES (REC2) LAYER (NIWA OPEN DATA, 2022).... 4
FIGURE 5: NUMBER OF EXPOSED BUILDINGS FOR THE FLUVIAL CASE STUDY LOCATIONS COMPARED TO THE REGIONAL PLUVIAL AND FLUVIAL EXPOSURE RESULTS (APPENDIX I). 18

FIGURE 6: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD EVENTS WITH CURRENT CLIMATE AND DEFENCES UP FOR THE HORIZONS REGION. 22
FIGURE 7: NUMBER OF PEOPLE EXPOSED FOR 5% TO 0.1% AEP FLOOD EVENTS WITH CURRENT CLIMATE AND DEFENCES UP FOR THE HORIZONS REGION. 22
FIGURE 8: AREA OF INUNDATION IN HECTARES ACROSS DIFFERENT RANGES FOR THE 5%, 0.5% AND 0.1% AEP FLOOD EVENTS UNDER CURRENT CLIMATE AND WITH DEFENCES UP FOR THE HORIZONS REGION. 23
FIGURE 9: NUMBER OF BUILDINGS EXPOSED FOR A 0.5% AEP EVENT WITH CURRENT CLIMATE AND DEFENCES UP SCENARIO, BY BUILDING TYPE FOR THE HORIZONS REGION. 24
FIGURE 10: PERCENTAGE CHANGE IN TOTAL BUILDING REINSTATEMENT COSTS FOR CURRENT CLIMATE VS 3 °C WARMING SCENARIO (BOTH 0.5% AEP EVENTS). 25
FIGURE 11: TOTAL AREA OF INUNDATION WITHIN THE HORIZONS REGION IN 0.5% AEP SCENARIOS WITH DEFENCES UP IN CURRENT CLIMATE, COMPARED TO THE 1°C, 2°C, AND 3°C WARMING SCENARIOS. 26
FIGURE 12: COMPARISON OF NUMBER OF FATALITIES RESULTING FROM FLOODING WITH DEFENCES UP FOR 0.5% AEP FLOOD EVENTS AT DIFFERENT CLIMATE SCENARIOS (0°C - 3°C + SLR) ACROSS THE HORIZONS REGION. 27
FIGURE 13: COMPARISON OF NUMBER OF BUILDINGS EXPOSED TO FLOODING WITH DEFENCES UP AND DOWN FOR 5% TO 0.5% AEP FLOOD EVENTS (CURRENT CLIMATE) ACROSS THE DISTRICTS WITHIN THE HORIZONS REGION. 29
FIGURE 14: COMPARISON OF AREA OF LAND INUNDATED FROM FLOODING IN 5% AEP AND 0.5% AEP FOR DEFENCES UP AND DEFENCES DOWN. 30
FIGURE 15: COMPARISON OF AREA OF LAND INUNDATED ABOVE AND BELOW 1 M FROM FLOODING IN 5% AEP AND 0.5% AEP FOR DEFENCES UP AND DOWN. 31
FIGURE 16: TOTAL BUILDING REINSTATEMENT COSTS BY DISTRICT FOR CURRENT CLIMATE FLOOD SCENARIOS WITH DEFENCES UP. 39
FIGURE 17: CHANGES TO BUILDING EXPOSURE AND BUILDING REINSTATEMENT COSTS BETWEEN THE 5% AND 0.1% AEP FLOOD EVENTS WITH CURRENT CLIMATE AND DEFENCES UP. 39

FIGURE 18: TOTAL NUMBER OF FATALITIES BY DISTRICT FOR CURRENT CLIMATE FLOOD SCENARIOS WITH DEFENCES UP. 40
FIGURE 19: TOTAL BUILDING REINSTATEMENT COSTS BY DISTRICT FOR 0.5% AEP, CLIMATE WARMING SCENARIOS WITH DEFENCES UP. 46
FIGURE 20: CHANGES TO BUILDING EXPOSURE AND BUILDING REINSTATEMENT COSTS BETWEEN THE 0.5% AEP FLOOD EVENTS WITH 1°C AND 3°C WARMING SCENARIOS AND DEFENCES UP. 46
FIGURE 21: TOTAL NUMBER OF FATALITIES BY DISTRICT FOR 0.5% AEP, CLIMATE WARMING SCENARIOS WITH DEFENCES UP. 47
FIGURE 22: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.5% AEP FLOOD EVENTS WITH CURRENT CLIMATE AND DEFENCES DOWN. 53
FIGURE 23: NUMBER OF FATALITIES FOR 5% TO 0.5% AEP FLOOD EVENTS WITH CURRENT CLIMATE AND DEFENCES DOWN. 53
FIGURE 24: TOTAL NUMBER OF BUILDINGS EXPOSED BY DISTRICT FOR CLIMATE WARMING SCENARIOS WITH DEFENCES DOWN. 58
FIGURE 25: TOTAL NUMBER OF FATALITIES BY DISTRICT FOR CLIMATE WARMING SCENARIOS WITH DEFENCES DOWN 58
FIGURE 26: TOTAL BUILDINGS EXPOSED TO FLOODING AGAINST TOTAL BUILDINGS CONTRIBUTING TO REINSTATEMENT COSTS FOR EACH TOWN/SETTLEMENT FOR 0.5% AEP EVENT WITH CURRENT CLIMATE AND DEFENCES UP. TOWNS AND SETTLEMENTS HAVE BEEN ORDERED BY POPULATION NUMBER. 64
FIGURE 27: TOTAL BUILDINGS EXPOSED TO FLOODING AGAINST TOTAL BUILDINGS CONTRIBUTING TO REINSTATEMENT COSTS FOR EACH TOWN/SETTLEMENT FOR 0.5% AEP EVENT WITH CURRENT CLIMATE AND DEFENCES UP. TOWNS AND SETTLEMENTS HAVE BEEN FILTERED TO EXCLUDE THE FOUR MAIN URBAN CENTRES AND 'OTHER'. 65
FIGURE 28: MAP OF PALMERSTON NORTH CITY WITH TOWN AND SETTLEMENT BOUNDARIES. 67
FIGURE 29: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR PALMERSTON NORTH CITY. 69
FIGURE 30: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C

AND 3 °C WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR PALMERSTON NORTH CITY.....70
FIGURE 31: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER TODAY'S CLIMATE WITH AND WITHOUT FLOOD DEFENCES FOR PALMERSTON NORTH CITY. 72
FIGURE 32: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER TODAY'S CLIMATE WITH AND WITHOUT FLOOD DEFENCES FOR PALMERSTON NORTH CITY (EXCLUDING PALMERSTON NORTH). 72
FIGURE 33: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF PALMERSTON NORTH CITY. 73
FIGURE 34: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF PALMERSTON NORTH CITY (EXCLUDING PALMERSTON NORTH). 73
FIGURE 35: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE PALMERSTON NORTH CITY.....81
FIGURE 36: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR TOWN/SETTLEMENT WITHIN THE PALMERSTON NORTH CITY (EXCLUDING PALMERSTON NORTH). 82
FIGURE 37: MAP OF WHANGANUI DISTRICT WITH TOWN AND SETTLEMENT BOUNDARIES. NOTE RAETIHI EXTENDS INTO WHANGANUI DISTRICT; HOWEVER, THERE ARE NO BUILDINGS WITHIN THIS EXTENT SO HAS BEEN EXCLUDED FROM THE LIST VULNERABILITY RESULT REPORTING FOR WHANGANUI DISTRICT. FOR THE PURPOSE OF REPORTING, ANY BUILDINGS OUTSIDE OF A TOWN OR SETTLEMENT BOUNDARY HAVE BEEN CATEGORISED AS ‘OTHER’.....83
FIGURE 38: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR WHANGANUI. 85
FIGURE 39: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C AND 3 °C WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR WHANGANUI. 86

FIGURE 40: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE CONDITIONS WITH AND WITHOUT FLOOD DEFENCES FOR WHANGANUI DISTRICT. 87
FIGURE 41: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF WHANGANUI DISTRICT. 88
FIGURE 42: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF WHANGANUI DISTRICT (EXCLUDING WHANGANUI). 88
FIGURE 43: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE WHANGANUI DISTRICT. 96
FIGURE 44: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE WHANGANUI DISTRICT (EXCLUDING WHANGANUI). 97
FIGURE 45: MAP OF HOROWHENUA DISTRICT WITH TOWN AND SETTLEMENT BOUNDARIES. FOR THE PURPOSE OF REPORTING, ANY BUILDINGS OUTSIDE OF A TOWN OR SETTLEMENT BOUNDARY HAS BEEN CATEGORISED AS 'OTHER'. 98
FIGURE 46: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR HOROWHENUA. 100
FIGURE 47: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C AND 3 °C WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR HOROWHENUA. 101
FIGURE 48: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE HOROWHENUA DISTRICT. 102
FIGURE 49: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE HOROWHENUA DISTRICT (EXCLUDING LEVIN, FOXTON AND 'OTHER'). 103
FIGURE 50: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF HOROWHENUA DISTRICT. 103

FIGURE 51: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF HOROWHENUA DISTRICT (EXCLUDING LEVIN). 104
FIGURE 52: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE HOROWHENUA DISTRICT. 112
FIGURE 53: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE HOROWHENUA DISTRICT (EXCLUDING LEVIN). 113
FIGURE 54: MAP OF MANAWATŪ DISTRICT WITH TOWN AND SETTLEMENT BOUNDARIES. FOR THE PURPOSE OF REPORTING, ANY BUILDING OUTSIDE OF A TOWN OR SETTLEMENT BOUNDARY HAS BEEN CATEGORISED AS 'OTHER'....114
FIGURE 55: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR MANAWATŪ....116
FIGURE 56: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C AND 3 °C WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR MANAWATŪ. 117
FIGURE 57: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE MANAWATŪ DISTRICT. 118
FIGURE 58: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE MANAWATŪ DISTRICT (EXCLUDING FEILDING AND 'OTHER'). 119
FIGURE 59: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF MANAWATŪ DISTRICT. 119
FIGURE 60: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF MANAWATŪ DISTRICT (EXCLUDING FEILDING AND 'OTHER'). 120
FIGURE 61: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE MANAWATŪ DISTRICT. 134

FIGURE 62: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE MANAWATŪ DISTRICT (EXCLUDING FEILDING AND 'OTHER'). 135
FIGURE 63: MAP OF TARARUA DISTRICT WITH TOWN AND SETTLEMENT BOUNDARIES. NOTE THAT THE PALMERSTON NORTH TOWN AND SETTLEMENT BOUNDARY EXTENDS INTO THE TARARUA DISTRICT BOUNDARY; HOWEVER, HAS NOT BEEN INCLUDED WITHIN RESULTS FOR THIS DISTRICT. FOR THE PURPOSE OF REPORTING, ANY BUILDINGS OUTSIDE OF A TOWN OR SETTLEMENT BOUNDARY HAVE BEEN CATEGORISED AS 'OTHER'. 136
FIGURE 64: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR TARARUA. 138
FIGURE 65: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C AND 3 °C WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR TARARUA. 139
FIGURE 66: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE TARARUA DISTRICT. 140
FIGURE 67: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE TARARUA DISTRICT (EXCLUDING WOODVILLE). 141
FIGURE 68: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF TARARUA DISTRICT....141
FIGURE 69: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE TARARUA DISTRICT. 149
FIGURE 70: MAP OF RANGITĪKEI DISTRICT WITH TOWN AND SETTLEMENT BOUNDARIES. FOR THE PURPOSE OF REPORTING, ANY BUILDINGS OUTSIDE OF A TOWN OR SETTLEMENT BOUNDARY HAVE BEEN CATEGORISED AS 'OTHER'....150
FIGURE 71: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR RANGITĪKEI DISTRICT. 152

FIGURE 72: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C AND 3 °C DEG WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR RANGITĪKEI DISTRICT. 153
FIGURE 73: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER TODAY'S CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE RANGITĪKEI DISTRICT. 154
FIGURE 74: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER TODAY'S CLIMATE COMPARING DEFENCES UP AND DOWN FOR THE RANGITĪKEI DISTRICT (EXCLUDING TAIHAPE)....155
FIGURE 75: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF RANGITĪKEI DISTRICT. 155
FIGURE 76: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF RANGITĪKEI DISTRICT (EXCLUDING MARTON, BULLS AND 'OTHER').....156
FIGURE 77: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE RANGITĪKEI DISTRICT.....164
FIGURE 78: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE RANGITĪKEI DISTRICT (EXCLUDING MARTON, BULLS AND 'OTHER'). 165
FIGURE 79: MAP OF RUAPEHU DISTRICT WITH TOWN AND SETTLEMENT BOUNDARIES. FOR THE PURPOSE OF REPORTING, ANY BUILDINGS OUTSIDE OF A TOWN OR SETTLEMENT BOUNDARY HAVE BEEN CATEGORISED AS 'OTHER'.....166
FIGURE 80: NUMBER OF EXPOSED BUILDINGS AND PEOPLE FOR 5% TO 0.1% AEP FLOOD EVENTS WITH DEFENCES UP FOR RUAPEHU DISTRICT. 168
FIGURE 81: NUMBER OF BUILDINGS EXPOSED FOR CURRENT DAY AND EACH WARMING SCENARIO (1 °C, 2 °C AND 3 °C DEG WARMING INCLUDING WITH SEA LEVEL RISE) FOR THE 0.5% AEP FLOOD EVENT WITH DEFENCES DOWN FOR RUAPEHU DISTRICT. 169
FIGURE 82:TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE WITH AND WITHOUT FLOOD DEFENCES FOR THE RUAPEHU DISTRICT. 170

FIGURE 83: TOTAL LIFE COSTS FOR THE 0.5% AEP EVENT UNDER CURRENT CLIMATE WITH AND WITHOUT FLOOD DEFENCES FOR THE RUAPEHU DISTRICT (EXCLUDING TAUMARUNUI AND OTHER). 171
FIGURE 84: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF RUAPEHU DISTRICT. 171
FIGURE 85: CHANGE IN BUILDING EXPOSURE FOR 5% TO 0.5% AEP FLOOD EVENTS FOR DEFENCES DOWN IN TOWNS/SETTLEMENTS OF RUAPEHU DISTRICT (EXCLUDING TAUMARUNUI, OHAKUNE AND 'OTHER'). 172
FIGURE 86: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE RUAPEHU DISTRICT. 180
FIGURE 87: NUMBER OF BUILDINGS EXPOSED FOR 5% TO 0.1% AEP FLOOD SCENARIO UNDER CURRENT CLIMATE WITH DEFENCES UP FOR EACH TOWN/SETTLEMENT WITHIN THE RUAPEHU DISTRICT (EXCLUDING TAUMARANUI, OHAKUNE AND 'OTHER'). 181

KEY DEFINITIONS

Table 1: Key Definitions.

Term	Definition
Annual Exceedance Probability (AEP)	The probability that a flood of a certain size will occur in any given year. For example, a 1% AEP means there is a 1 in 100 chance of that flood happening in a year.
Building exposed to flooding	Buildings that meet the conditions for 5 cm floor height and 50% exposure ratio.
Building contributing to costs	Buildings that contribute to reinstatement costs based on flood risk. Includes buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.
Defences Up/Down	Design storm scenarios were modelled with and without stopbanks. Where stopbanks have been removed, the scenario is referred to as 'Defences Down', and when they remain in place the scenario is referred to as 'Defences Up'.
Design storm event	A hypothetical rainfall event used in modelling to simulate flood scenarios. It is defined by its intensity, duration, and frequency (e.g., a 100-year 24-hour storm) and helps assess flood risk under certain conditions.
Exposed ratio	The percentage of the building footprint exposed to flooding as a minimum threshold for whether that building is included in exposure or risk calculations. For this study an exposed ratio of 50% was used.
Flood Vulnerability Assessment (FVA)	A quantitative estimate of the potential impacts of flooding. In this context, the FVA is based on region-wide flood models and uses these flood layers with building and population datasets to quantify impacts on communities across the Horizons Region.
Floor level	Flood model parameter representing the assumed elevation of a buildings finished floor above ground level, used as a threshold determine whether modelled floodwater depth exceeds the floor and results in building exposure or damage. For this study the minimum floor level threshold used was 5 cm and 20 cm respectively
Fluvial flooding	Flooding caused by rivers or streams overflowing their banks due to excessive rainfall or snowmelt. It typically occurs in areas adjacent to watercourses.
Level A Flood Model	Level of detail of flood model output based on Regional Flood Modelling Framework developed for Horizons Region. Level A is a regional scale model, low resolution and includes flood depth as an output.
Life cost	Cost due to fatalities and injuries for each populated building. One life is estimated at NZD $12.5 million based on the New Zealand Transport Agency (New Zealand Transport Agency, 2025) value of statistical life.
Pluvial flooding	Flooding resulting from intense rainfall that overwhelms drainage systems or cannot be absorbed by the ground. It occurs independently of rivers or water bodies and is common in urban areas.
Primary structure	Any structure within a property that is equal to or greater than 70.1 m^2.
Reinstatement cost	Modelled cost to reinstate proportion of building that has been damaged from flooding. Reported in NZD (000's) and based on based on expected average annualised losses (AAL) from modelled monetary represented by replacement value (NZD 2024). Note that this does not represent the cost to reinstate the whole building.

RiskScape	A modelling tool developed by Earth Sciences New Zealand that assesses the impacts of natural hazards (like floods, earthquakes, and tsunami) on people, buildings, infrastructure and the environment (RiskScape, n.d.). It supports risk analysis and decision making for disaster resilience.
Secondary structure	Any structure within a property that is between 10.1 m^2 and 70 m^2 .
Threat to life	Potential level of threat to human life when people come into contact with flood water. Is based on the depth and velocity of flooding. Ranges from None to Extreme.
Towns/Settlements	52 geographic boundaries identified by Horizons to include within the assessment. The boundaries are from the NZ Suburbs and Localities dataset (Land Information New Zealand, 2023).
Towns/Settlements – Other	Represents any building/property outside of a town/settlement but within a district within the region.

ABBREVIATIONS

Table 2: Abbreviations used throughout report.

Horizons	Horizons Regional Council
ESNZ	Earth Sciences New Zealand
AEP	Annual exceedance probability
FVA	Flood vulnerability assessment
NIWA	National Institute of Water and Atmospheric Research

EXECUTIVE SUMMARY

Horizons Regional Council, in collaboration with WSP New Zealand Ltd and Earth Sciences New Zealand (ESNZ, formerly National Institute of Water and Atmospheric Research (NIWA)), has undertaken a comprehensive Flood Vulnerability Assessment (FVA). This initiative supports Horizons' ten-year flood hazard mapping programme and aims to consolidate flood hazard data, enhance institutional knowledge, and inform regulatory planning and infrastructure investment.

The assessment uses Level A regional flood modelling to evaluate flood exposure and potential impacts across the region for a range of design storm events (from 5% to 0.1% Annual Exceedance Probability (AEP)), climate warming scenarios (1°C to 3°C and 3°C with sea level rise), and with existing flood defences both in place and removed.

Study Context: This vulnerability study has been undertaken to understand the relative flood risk from a range of design flood events across the Horizons Region. When interpreting the results of the study, or using the risk results, the reader must consider the following:

- The study utilises regional flood modelling to understand flood vulnerability across the Horizons Region for a range of design storm events.
- These scenarios combine pluvial and fluvial flooding and assume that the entire region experiences the same magnitude event simultaneously.
- The models are not calibrated to historic flood events, and they do not include stormwater networks.
- The FVA is intended for regional comparison and high-level decision support only.

The study findings, particularly for urban areas and for more frequent design events, are likely to be higher than what would occur in reality and should not be:

- Used for site-specific assessment.
- Directly compared to the results of other flood studies that have been modelled at high resolution such as Palmerston North city stormwater or Woodville flood risk modelling.
- Compared to actual damage observations from any particular flood event as these are only useful for calibration of localised, not regional, risk models.

Report and Study Overview

Regional-scale modelling has been carried out for fluvial and pluvial flooding across multiple design storm events (5%, 2%, 1%, 0.5%, 0.2%, and 0.1% Annual Exceedance Probability (AEP)), incorporating climate warming scenarios and the removal of flood defences. Using ESNZ's RiskScape software, the assessment quantified potential impacts on people and buildings throughout the region.

The regional-scale modelling assumes a uniform flood event across the region, combines fluvial and pluvial flooding, and does not include urban stormwater networks or calibration against historic events. As a result, exposure and cost estimates may be overstated, particularly in urban areas and for more frequent events; however, the results provide a robust comparative assessment that identifies relative vulnerability across districts, towns and settlements. Vulnerability results reported on include:

- Number of buildings exposed to flooding
- Number of buildings contributing to building reinstatement costs
- Total building reinstatement costs
- Number of people exposed to flooding
- Number of fatalities (Threat to life included in Appendix D1 (Appendix D))
- Total life costs

The results of the vulnerability assessment provide a robust evidence base to guide future flood risk management, adaptation strategies, and investment decisions.

Key Findings

Regional Results

Flooding poses a risk to buildings and people throughout the Horizons Region. Results of the vulnerability assessment show that as the flood severity increases, so does exposure and costs to people and buildings. The change in vulnerability is not uniform throughout the region, with some areas more vulnerable than others.

Current Climate Conditions:

In current climate conditions with flood defences in place, the number of buildings exposed to flooding increases by approximately 45% when comparing the 5% and 0.1% AEP flood events. Population exposure increases by 40% for these same flood events. Building reinstatement costs double, while the estimated number of fatalities increases from 33 to 198, a rise of approximately 500%.

Climate Change Impacts:

Flood risk throughout the region increases in climate warming scenarios. When comparing current climate conditions with a 3°C warming scenario for the 0.5% AEP event, regional building exposure increases by 30%. Building reinstatement costs increase by approximately 70%, and fatalities by 454% from 70 to 388. The addition of sea level rise to the 3°C warming scenario results in only minor further increases, reflecting the region's predominately fluvial and pluvial flood risk.

Removal of Flood Defences:

The removal of flood defences produces a complex set of results across the region, with results varying by district, town and settlement. At the regional scale, modelling shows that for more frequent, lower intensity events (such as 5% and 2% AEP floods), total exposure and reinstatement costs can decrease when defences are removed, largely influenced by the response of Palmerston North. However, this regional-level trend does not apply consistently across all districts, or local areas, where some areas show increased exposure for more frequent events. For less frequent, higher-intensity floods, such as the 0.5% AEP event, the removal of defences consistently increases exposure and costs across most of the region. These results highlight that the influence of flood defences is highly location-specific, and regional summaries should be interpreted as generalised patterns rather than precise indicators of localised flood behaviour.

Summary of Results for 0.5% AEP Event

Figure 1 below provides a comparison of the regional flood exposure and risk in different scenarios for the 0.5% AEP flood event. This includes current and future climate warming scenarios, and with flood defences in place and removed. This allows a direct comparison of how vulnerability throughout the region changes with changes to climate and flood protection infrastructure. To provide context for interpreting the results, the Horizons Region contains 247,914 buildings and an estimated population of 194,665 in the models used for this study.

For a 0.5% AEP event, the following key insights can be made:

- Exposure of buildings and people, along with associated building reinstatement costs and life costs, increase as flood scenarios become more severe due to climate warming.
- The removal of flood defences leads to an increase in exposure and costs throughout the region when viewing as a whole, however patterns can vary by district, town or settlement.

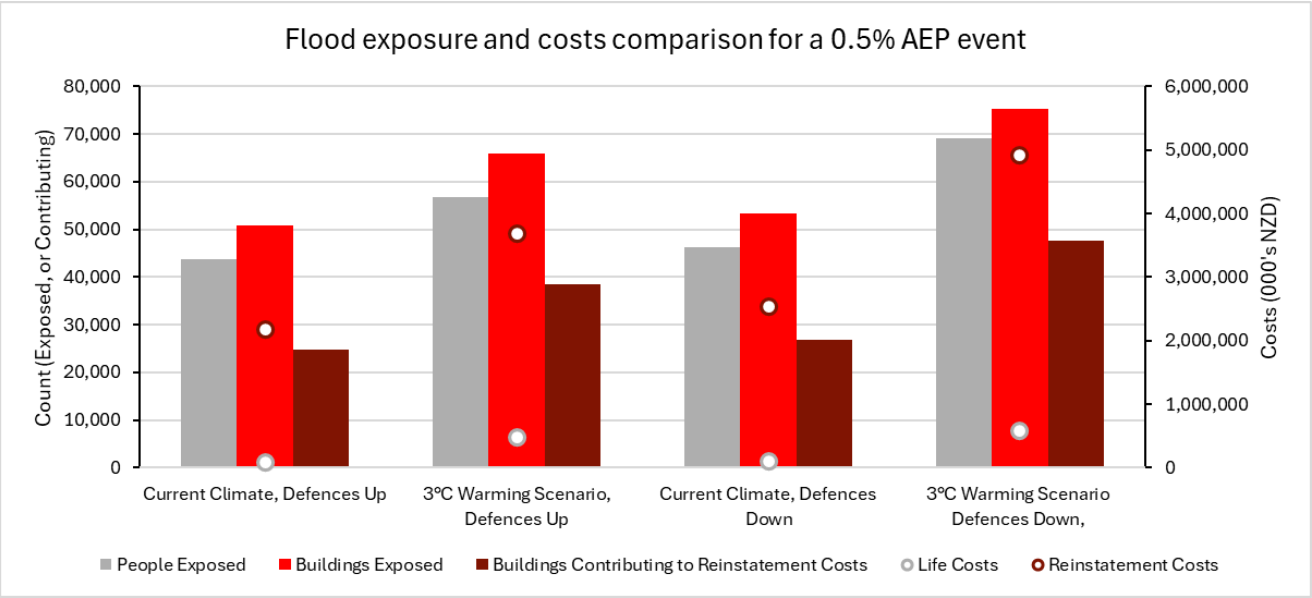


Figure 1: Comparison of flood exposure and costs for people and buildings, as well as buildings contributing to building reinstatement costs, for the 0.5% AEP event, with changes in climate and defences.

Building Type:

Across the Horizons Region, residential buildings are the most common building use type, making up 63% or 156,500 of 247,914 total buildings. In the 0.5% AEP current climate defences up scenario, 74% of total exposed buildings are residential buildings, 38,407 of 51,257 total in the region, reflecting the overall regional pattern. Commercial and industrial buildings, although fewer, can experience relatively high exposure rates during severe flood events, which increases their contribution to reinstatement costs. Region wide results show that around 30% or 2,764 of 8,942 total commercial and industrial buildings are exposed in the 0.5% AEP current climate defences up scenario. Rural buildings form a notable portion of exposure in smaller settlements and in the 'Other' category, where many isolated properties sit outside major flood protection schemes. Rural buildings are also the most common type outside towns and settlements, with 60% exposed, 2,912 of 4,801 total, in the same scenario.

Inundation Patterns:

The largest areas of inundation occur in shallow-depth flooding (0.05 to 0.19 m), which cover more than 80,000 hectares across flood scenarios. This shallow but widespread flooding affects many residential buildings, explaining the dominance of residential exposure in the regional results.

District Results

Across districts, exposure, building reinstatement and life costs rise in 0.5% AEP events and higher climate warming scenarios.

Palmerston North City District: has the highest building and population exposure for the region, accounting for over 90% of district-level risk. This demonstrates that Palmerston North City is the largest city in the Horizons Region and comprises most of the district. For a 0.5% AEP event, climate warming of 3°C results in a 49% increase in life costs and a 59% increase in building reinstatement costs compared with current climate conditions. Removal of major schemes (e.g., Lower Manawatū) reduces exposure for frequent smaller events but amplifies exposure and losses for higher magnitude infrequent events.

Whanganui District: The greatest exposure increases are in Whanganui City, which has a steep increase in exposure for higher magnitude infrequent events (0.2% and 0.1% AEP). For the district in a 0.5% AEP event, climate warming of 3°C results in a 1630% increase in life costs and a 152% increase in reinstatement costs compared with current climate conditions. Defence removal shows negligible impact. Case study results focusing on fluvial only flooding shows an increase in the dominance of fluvial flooding under climate change conditions.

Horowhenua District: Levin is the primary building and population exposure hotspot for the district, with flood risk influenced heavily by pluvial flooding. Results show over $265M in reinstatement costs and over $5M in life costs in a 0.5% AEP event under current climate conditions for the district. As Levin has little fluvial flooding, the addition of 3°C warming produces a smaller increase in impacts than in places where fluvial flooding makes a larger contribution to overall flood risk.

Manawatū District: Feilding and rural communities show steep increases in building exposure and losses as the flood severity increases. For a 0.5% AEP event, climate warming of 3°C results in a 112% increase in life costs and a 61% increase in building reinstatement costs compared with current climate conditions for the district. Defence removal increases exposure of buildings by up to 33%, highlighting the critical role of major schemes such as the Lower Manawatū.

Tararua District: Has a smaller population than other Districts, however experiences a disproportionate increase in life costs (771%) compared to that of building reinstatement (22%) when considering the change in flood vulnerability due to climate warming. Further detailed modelling will improve understanding of exposure under climate change conditions to better inform flood risk management decisions for this district.

Rangitīkei District: Has a smaller population than other Districts, however, when reviewing results for climate warming life costs increase by over 150%. Many buildings outside of towns and settlements in Rangitīkei District are exposed to flooding, suggesting dispersed vulnerability within the district. Additional detailed modelling outside of town and settlement boundaries would improve understanding on vulnerabilities within these areas.

Ruapehu District: Has a smaller population than other Districts however under climate warming scenarios reinstatement costs increase by 129% and life costs by over 170%. Minimal changes are reported when flood defences are removed. Results for Ruapehu District emphasise the need for targeted resilience measures, particularly for buildings and populations outside main settlements.

Towns and Settlements Results

This report also includes a regional summary ranking of the vulnerability of the selected 52 towns and settlements within the Horizons Region. This is based on the vulnerability results for the 0.5% AEP flood event with current climate and existing defences. The ranking is based on the total building reinstatement costs for that flood scenario.

The following general trends can be derived from the report:

- Urban centres such as Palmerston North and Whanganui dominate regional risk. Palmerston North City has the highest number of buildings exposed to flooding (12,968) with over $804M in reinstatement costs, while Whanganui City follows with over $394M in reinstatement costs and 8,017 buildings exposed for the 0.5% AEP event.
- Vulnerability is not solely driven by large urban centres; smaller towns with limited protection or concentrated development within floodplains can experience the most severe proportional impacts. This is observed in Woodville, where 40% of all buildings contribute to reinstatement costs of over $135M. Despite having a smaller number of buildings, Woodville has the third highest reinstatement costs for the region.

- Some small towns and settlements, such as Tangimoana, Koitiata, Waitārere Beach, experience a high proportion of damage, with over 80% of buildings exposed to flooding contributing to reinstatement costs.
- Buildings that are outside of towns and settlement boundaries (classified as 'Other') represent a notable risk. While dispersed throughout the region, they contribute to over $200M of reinstatement costs.

Recommendations

The Flood Vulnerability Assessment identifies several strategic priorities to guide Horizons Regional Council's future planning, investment, and flood risk management. The recommendations reflect insights from regional-scale modelling, vulnerability analysis, and supporting technical reports, and are as below:

- Use the FVA within a fit-for-purpose context.
- Use the FVA to inform the infrastructure strategy.
- Use the FVA to inform the future food modelling programme.
- Use the FVA to inform emergency management.
- Use the FVA to inform asset management (criticality, renewals, consequences).
- Integrate flood and stormwater modelling and aligned planning cycles.

Together, these recommendations form a cohesive pathway for strengthening risk-based decision-making, improving alignment across teams and organisations, and ensuring the FVA becomes an enduring foundation for regional resilience.

Limitations

This study utilises Level A regional flood modelling to understand flood vulnerability across the Horizons Region for a range of design storm events. These scenarios combine pluvial and fluvial flooding and assume that the entire region experiences the same magnitude event simultaneously. The models are not calibrated to historic flood events and they do not include stormwater networks. As a result, the findings, particularly for urban areas and for more frequent flood events, are likely to be higher than what would occur in reality and should not be used for site-specific assessment. The FVA is intended for regional comparison and high-level decision support only.

1 INTRODUCTION

Horizons Regional Council (Horizons) is currently undertaking a ten-year flood hazard mapping programme, with a focus on supporting regulatory planning and infrastructure investment. This cross-organisational initiative informs a range of Horizons' activities, including the District Advice service, river flood and drainage scheme management, regional planning, and emergency management. However, much of the historical flood modelling information is dispersed across systems and individuals, creating challenges for institutional knowledge retention and accessibility.

With growing interest from Territorial Authorities, particularly around district plan updates and the implementation of the One Plan, there is a clear need for a more structured and accessible approach to flood risk information. Horizons recently completed Infrastructure Strategy, which identifying the $1.2 billion in flood protection assets, highlights key challenges in maintaining existing infrastructure and meeting future demand.

Horizons engaged WSP New Zealand Ltd (WSP) and Earth Sciences New Zealand (ESNZ, formally National Institute of Water and Atmospheric Research (NIWA)) to deliver a comprehensive flood vulnerability study for the region. The project aimed to consolidate existing flood modelling data, conduct a thorough flood vulnerability assessment, and provide actionable recommendations for flood risk strategy. Leveraging the combined expertise of WSP and ESNZ, the study established a robust evidence base to inform flood risk management, adaptation strategies and future investment decisions.

1.1 HORIZONS REGION FLOOD MODELLING CONTEXT

The Horizons Region spans over 22,200km^2, from Ruapehu in the north to Horowhenua in the south, and from Whanganui in the west to Tararua in the east. The region has a total population of 251,412 and a total of 107,883 private dwellings according to the 2023 census (Stats NZ, 2025).

The region is comprised of 10 districts which are reflective of a mix of urban, rural and agriculture (Figure 2). This includes Palmerston North City, which has the largest city of the region (Palmerston North) and is a hub for education, research and commercial activity, and Whanganui District which is centred around the Whanganui River. Surrounding these urban areas are districts dominated by agriculture, horticulture, and forestry, alongside key natural environments such as the Tongariro National Park and coastal environments. For the purpose of this flood vulnerability study, the part districts of Waitomo, Stratford and Taupō have been excluded.

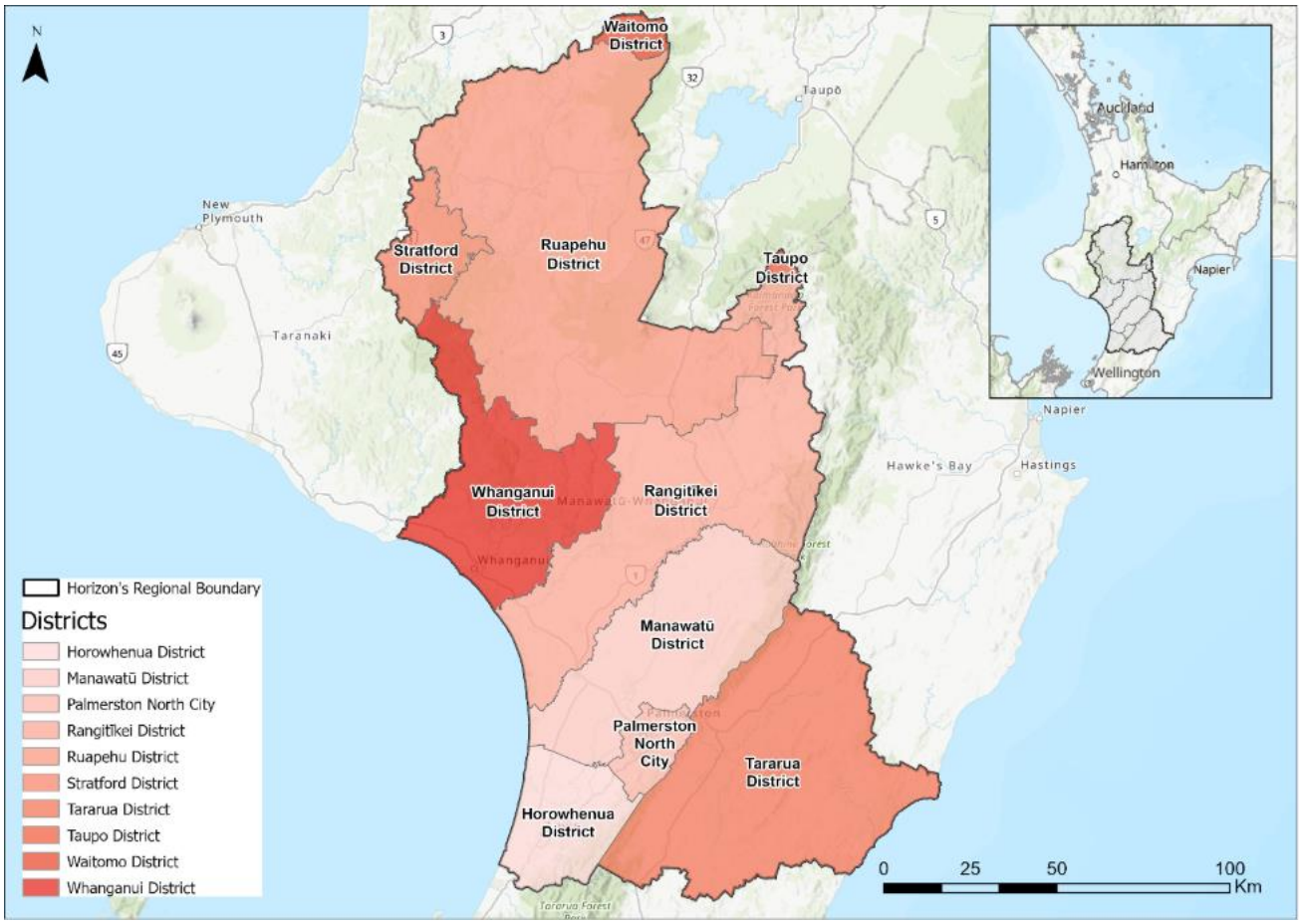


Figure 2: Map of Horizons Region showing the 10 districts within the Region. Waitomo, Stratford and Taupō Districts have been excluded from this flood vulnerability assessment.

Much like the districts, the key towns and settlements with the region, shown in Figure 3, offer a mix of urban, rural and agricultural influence. Key urban areas include Palmerston North and Whanganui. Surrounding these are smaller towns such as Feilding, Levin, Marton, Bulls, Taihape and Dannevirke, which support thriving agricultural and horticultural economies. Coastal towns and settlements include Foxton and Himatangi.

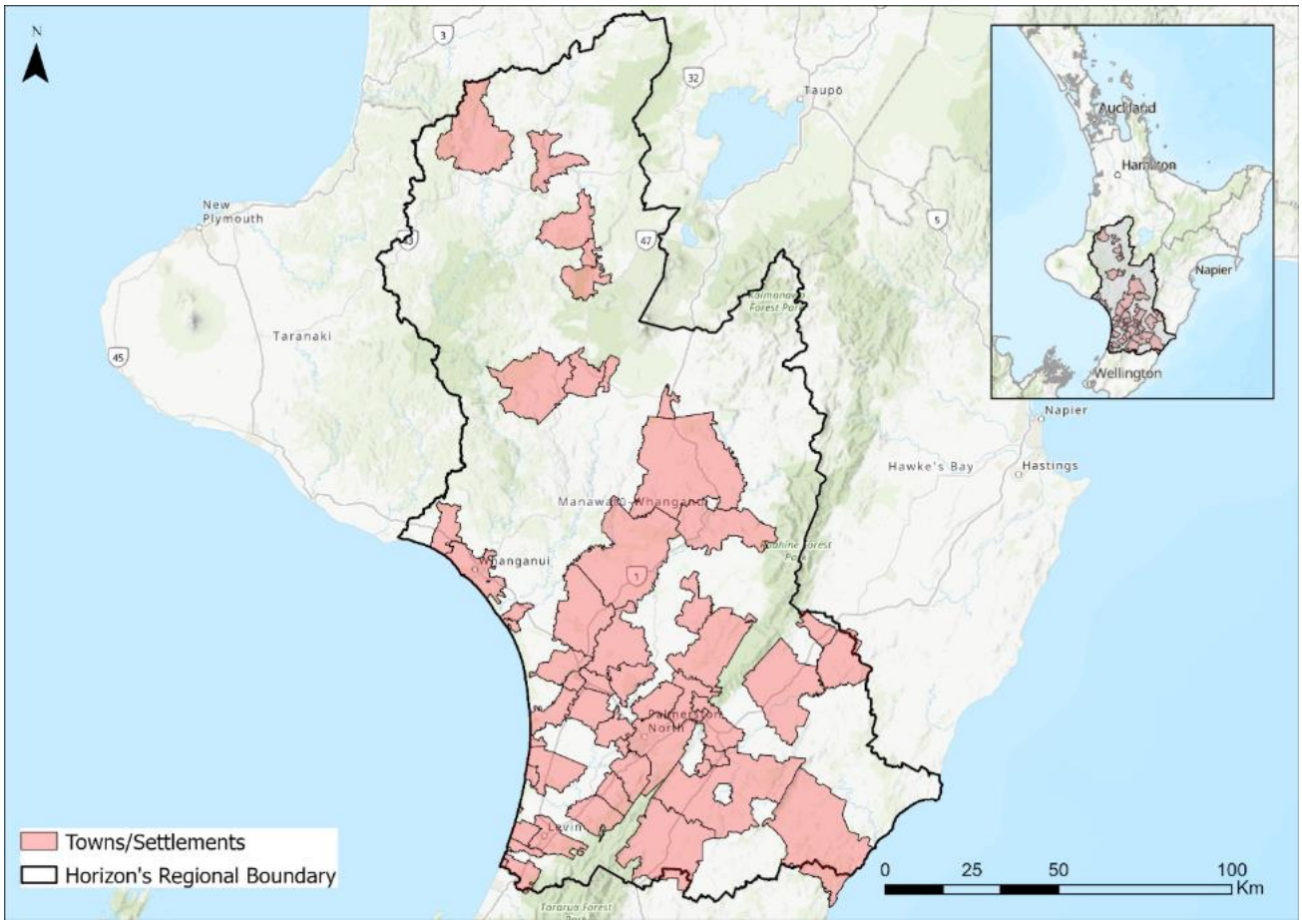


Figure 3: Map of towns/settlements in the Horizons Region. Note that buildings and population outside of the town and settlement areas has still been included within the flood vulnerability assessment. Town and settlements boundaries from Land Information New Zealand (2023).

The region is defined by several major river systems (Figure 4) that shape its ecology and influence the flood risk profile. These include:

- Manawatū River – flows through Palmerston North and supports agricultural and urban development. The Manawatū River is within the Manawatū Catchment, which drains much of the central region and is a focal point for flood protection schemes such as the Lower Manawatū Scheme.
- Whanganui River – is a culturally and historically significant river that flows through Whanganui. This river is within the Whanganui Catchment which features steep hill country and native forest in its upper reaches.
- Rangitīkei River – is a key waterway with tributaries affecting rural communities such as Marton and Bulls. The Rangitīkei River, along with other key tributaries such as Maowhango and Mangawhararikiki Rivers, are within the Rangitīkei Catchment.

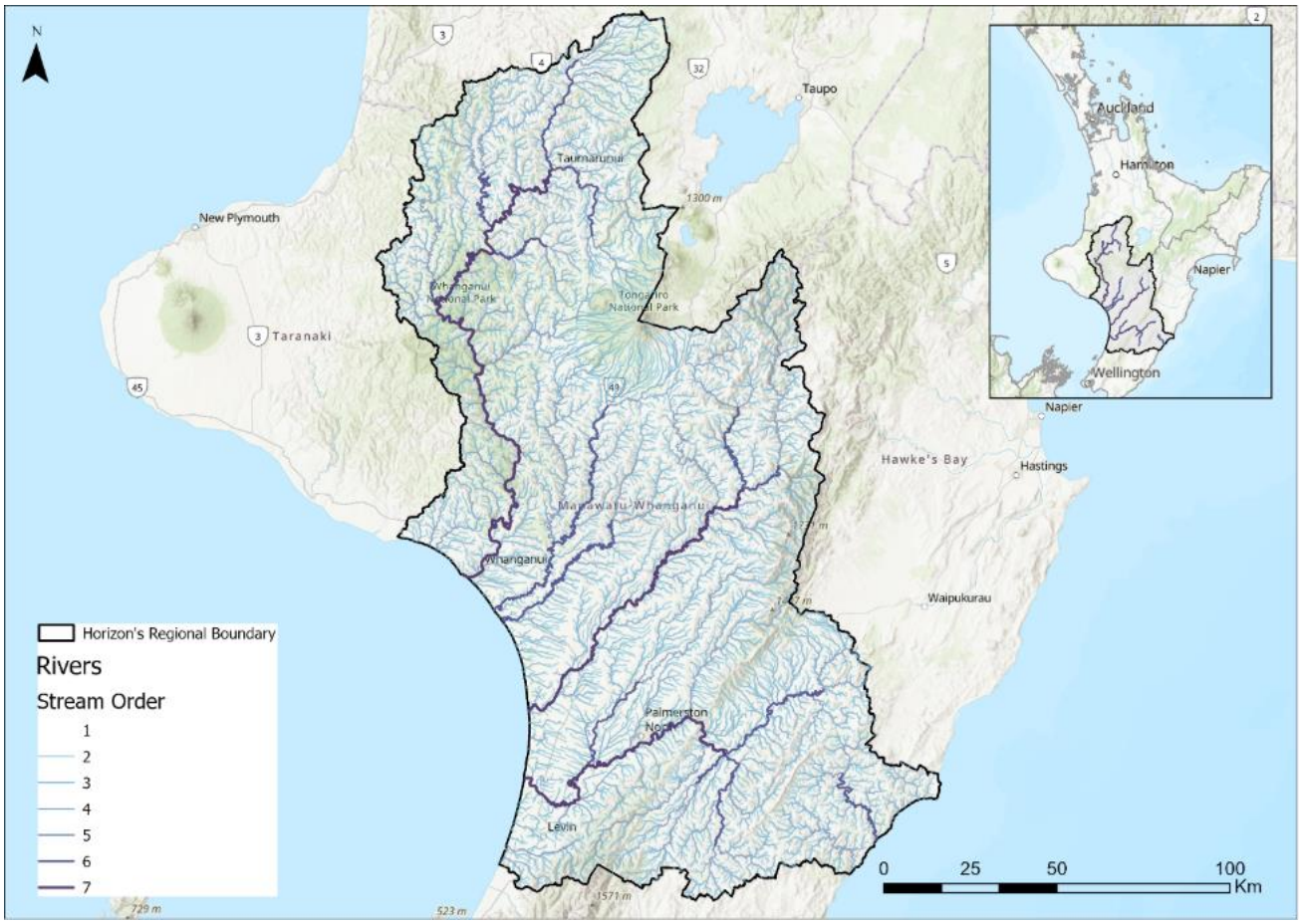


Figure 4: Rivers within Horizons Region. Rivers have been ranked by stream order. Lower-order tributaries have smaller values, while major rivers are represented by higher stream orders. River data from NZ Local River Names (REC2) Layer (NIWA Open Data, 2022).

These rivers and their drainage networks create low-lying floodplains that are highly productive but vulnerable to flooding. Flood risk within the region is not uniform and varies depending on the geography, land use and presence of flood protection infrastructure. Areas of high exposure include Palmerston North and Feilding on the Manawatū floodplains, Whanganui City along the Whanganui River, Marton and Bulls on the Rangitīkei River, as well as rural valleys in Horowhenua, Tararua and Ruapehu Districts.

As of June 2024, Horizons Regional Council manages 3,794 flood protection assets across 34 river and drainage schemes, collectively valued at approximately $1.2 billion (Horizons Regional Council, 2025). These schemes are designed to protect people, property, and infrastructure from flooding, while also supporting the productive use of land. Their complexity varies: some focus on maintaining channel capacity, while others involve diverse infrastructure requiring intensive management and maintenance.

Key Schemes include the Lower Manawatū Scheme, which provides protection for Palmerston North and surrounding communities through 851 assets including extensive stopbanks, the Moutoa Floodgates and major pump stations. This scheme provides protection for floods up to a 1% AEP event and has a higher level of protection for Palmerston North (0.2% AEP). The Rangitīkei Scheme protects communities like Marton and Bulls along the Rangitīkei River, with protection ranging from a 1% to a 2% AEP flood.

1.2 REPORT STRUCTURE

This report presents the methodology and results of the Horizons Region Flood Vulnerability Study.

Section 2 outlines the methodology and approach used for the Flood Vulnerability Assessment (FVA), including a record of the detailed results. The methodology comprises of four main sections:

- Desktop Study.
- Flood Vulnerability Study.
- Lower Manawatū Model.
- Reporting.

Section 3 outlines the results of the Flood Vulnerability Assessment for the Horizons Region. The results cover the entire region, allowing for a comparison of risk across the region. Results are provided for the following flood scenarios:

- Current Climate and Existing Flood Defences Up,
- Climate Warming (1°C, 2°C, 3°C and 3°C with sea level rise) and Existing Defences Up,
- Current Climate and Existing Flood Defences Down, and
- Climate Warming (1°C, 2°C, 3°C and 3°C with sea level rise) and Existing Flood Defences Down.

Section 3 includes a regional summary by district and provides a ranking of 52 towns and settlements within the region.

Section 4 presents the results of the Flood Vulnerability Study broken down for the districts within the region. This includes Palmerston North City, Whanganui District, Horowhenua District, Manawatū District, Tararua District, Rangitīkei District and Ruapehu District. For the purpose of this study, Stratford, Taupō and Waitomo Districts (which extend into other regions) have been excluded. Within each district, a summary is provided of the results for the towns and settlements within that district.

Section 5 presents a consolidation of recommendations from task specific reports produced as parts of the wider flood vulnerability assessment. Results are categorised into the following:

- Hydraulic Flood Modelling and Mapping Programme,
- Strategic Asset Management Programme,
- Flood Vulnerability Product Roadmap, and
- Other Natural Hazard and Climate Risk.

1.2.1 SUPPORTING DOCUMENTS

This report should be read in conjunction with the supporting documents provided within the appendices, and listed below:

- Appendix A – Letter of Completion
- Appendix B – Regional flood modelling for Horizons Flood Vulnerability Assessment (ESNZ)
- Appendix C – Vulnerability Assessment Methodology (ESNZ)
- Appendix D – Flood Hazard Classification Tables and Vulnerability Results Letter Report 2
- Appendix D1 – Detailed Results Tables
- Appendix D2 – Regional Results
- Appendix D3 – District Results
- Appendix E – Methodology for Risk Output Post Processing

- Appendix F – Sensitivity Analysis Letter Report 1
- Appendix G – Methodology Memo for Differentiating Fluvial and Pluvial Flooding
- Appendix H – Fluvial Flood Modelling of Four Urban Areas for the Horizons Region (ESNZ)
- Appendix I – Results Memo for Differentiating Fluvial and Pluvial Flooding
- Appendix I2 – Case Study Maps

This project has comprehensively addressed various aspects of flood vulnerability in the Horizons region. Throughout the course of the project, several detailed reports have been produced, each focusing on specific tasks and providing targeted recommendations. The reports delivered include:

- Task 2-2 Flood Modelling and Mapping Guideline Report (WSP & NIWA, 2025a)
- Task 2-3 Current State Analysis Report (WSP & NIWA, 2025b)
- Task 3-2 Asset Condition and Problem Definition Report (WSP & NIWA, 2025c)
- Task 3-3 Flood Frequency Analysis Report (NIWA, 2025)
- Task 3-5 Vulnerability Assessment Geospatial Viewer and Guidelines Memo
- Task 5 Lower Manawatū Model Report (WSP, 2025a)
- Task 6 Moutoa Gates Model Report (WSP, 2025b)
- One Page Flood Summaries for 52 towns and settlements

1.3 PURPOSE AND SCOPE OF VULNERABILITY ASSESSMENT

This study utilises Level A (WSP & NIWA, 2025a) regional flood modelling (refer to Section 2.2) to understand flood vulnerability across the Horizons Region for a range of design storm events (5% AEP to 0.1% AEP). These scenarios combine pluvial and fluvial flooding and assume that the entire region experiences the same magnitude event simultaneously. For example, under the 0.5% AEP scenario, all rivers, streams and pluvial areas are modelled as flooding to that level at the same time.

The purpose of this assessment is to rank the vulnerability of towns and settlements within the Horizons Region, and to understand how flooding changes within different modelled flood scenarios. This provides a consistent regional perspective on flood vulnerability and allows for a calculation of comparative risk across the region. The results offer insight into which areas, buildings and populations may be impacted by a flood event of a particular magnitude and broadly reflect that where there are more buildings and people around rivers and floodplains there is an increase in exposure, damage and life loss as flood events increase in magnitude.

The results from this study can inform high level decision making about future flood protection work, such as asset prioritisation of management and implementation, and inform the future modelling programme. Further phases for this study include comparing the results against national reports that calculate flood risk for the Horizons Region, and against other localised models and observed historic flood events. The results suggest that further detailed modelling (Level C or D) is required to better understand flood risk at a local scale, particularly in urbanised areas. Further phases may also include refining the modelling approaches used through inclusion of the stormwater network or calibration of results to improve accuracy or benchmark against known events.

1.3.1 LIMITATIONS

In an actual flood event, rainfall intensity and flooding would vary across the region, with different areas experiencing different levels of impacts. This means that the exposure and cost estimates produced from this study may be overstated, particularly in dense urban areas, and for more frequent flood events (5% and 2% AEP).

As this is a regional scale Level A model based on design storm events it has not been calibrated against actual flood events. Calibration of results against historic events would require a more detailed level of flood modelling, which was beyond the scope of this study. Results cannot be directly compared to historic floods such as the 2004 or 2015 flood events.

The purpose and input data used to produce the flood modelling outputs to a Level A regional model for this study will differ to those for other flood models including those reviewed as part of the Current State Analysis (WSP & NIWA, 2025b) and other existing flood models such as the national flood model. In many cases, particularly for the models reviewed under the Current State Analysis, the inputs will have a higher level of detail including representation of the stormwater network and will be to a higher resolution and often modelled at a Level B or C (WSP & NIWA, 2025a). The results from this study should not be compared to the results of other flood models.

Urban stormwater networks have been excluded from the modelling methodology. Four case studies were completed for Whanganui, Levin, Palmerston North and Feilding which showed a pattern of pluvial sources contributing to flooding. This influence means that that results may be overestimated particularly in dense urban areas and for more frequent flood events where pluvial flooding has a greater influence.

This assessment does not provide a detailed property-level assessment of risk; a different level of modelling (such as site-specific) would be required for this. Readers should not interpret the results as an indication of flooding at individual properties. If a property appears affected in this model it does not necessarily mean that flooding will occur.

Due to the methodology used for this assessment, including the regional scale of modelling and the exclusion of stormwater networks as mentioned above, the results are likely to show overestimations of impacts. Caution should be applied when interpreting specific figures such as the number of buildings flooded, population exposed, and the estimated costs of building reinstatement. The results are intended to provide a comparative ranking of flood risk across the region and should not be used for localised or property-level decision making.

Due to different aspects of the vulnerability assessment methodology, some results are non-linear e.g. having larger flood events, in some instances, does not necessarily mean larger losses or higher impacts. As a general trend, results tend to increase as the AEP decreases from 5% to 0.1%. However, because the ESNZ flood model adjusts its flood extent calculations dynamically, the mapping resolution can be lower in rural areas. This can influence the risk outputs (such as exposure, fatalities and building losses) which may lead to instances where higher AEP events (higher frequency, lower magnitude) show slightly higher results than lower AEP events (lower frequency, higher magnitude). Some examples of these include:

- Palmerston North City fatalities (Figure 17) – 0.2% AEP shows 23 fatalities, and 0.1% AEP shows 22 fatalities.
- Tararua District reinstatement cost (Figure 19) – the cost for the 0.5% AEP with 2°C warming is higher than the 3°C warming and sea level rise scenarios.
- Palmerston North City reinstatement and life costs (Table 27) – the costs are lower for the sea level rise scenarios, when it may be expected that higher sea levels should increase impacts.

Building and population values used in this study will differ from Census 2023 data because they have been derived from national building-level datasets rather than directly from census counts. As explained in Appendix C, residential buildings are based on object-level footprints developed by GNS Science and NIWA, which include modelled attributes such as floor area, floor height and replacement cost. Population values are

taken from a New Zealand population model (Scheele et al., 2021) that downscales 2018 SA2 census data to individual residential buildings. Only the usually-resident population assigned to each building is used for estimating flood exposure. As a result of this downscaling and building-level allocation, population and building results will differ from Census 2023 figures that are reported on when providing regional and district summaries.

2 METHODOLOGY

This section outlines the methodology and approach used for the Flood Vulnerability Assessment (FVA), including a record of the detailed results. The methodology is comprised of the following sections:

- Desktop Study
- Flood Vulnerability Study
    - Regional Flood Modelling
    - Vulnerability Assessment
    - Sensitivity Analysis
    - Fluvial/Pluvial Case Studies
    - Asset Condition Report
- Lower Manawatū Model
    - Moutoa Gates Model
- Reporting

To ensure the vulnerability results provided a robust understanding of regional risk, several configurations of the risk model were completed with interim reports published in June and August. Appendix A details the Letter of Completion issued from the June modelling round.

2.1 DESKTOP STUDY

This phase captured how flood mapping and modelling are currently utilised by end users within Horizons. The phase included a desktop review of international best practices for applying flood models in planning and decision-making. Based on this, a baseline framework was developed to guide how flood models, maps, and data can support Horizon's work. Existing data and models were reviewed against this framework, with recommendations provided for data consolidation and improved usability.

2.1.1 HORIZONS FLOOD MODELLING AND MAPPING GUIDELINE

This report aims to provide a thorough review of international and domestic best practice for flood modelling and mapping practices and provide a regional flood modelling framework for Horizons that is based on focusing on the flood risk use cases identified by Horizons and relevant Territorial Authorities (WSP & NIWA, 2025a).

Flood modelling and mapping are an important part of the flood risk management process and is important to identify and understanding flood risk. This forms the foundation for identifying strategies to improve resilience and minimize the consequences of flooding. Strategies can include:

- Engineering or nature-based solutions to reduce the frequency and extent of flooding.
- Land use planning and zoning to avoid development in flood prone areas.
- Retreat from areas that may experience frequent flooding.
- Adaptation to lessen the impact of flooding, through planning guidelines like design guidelines for buildings and infrastructure, or early warnings systems.

The following key findings were identified from the desktop review:

> For flood modelling internationally and within New Zealand, the typical flood modelling and mapping process consists of developing a method statement, collecting relevant data, developing hydrologic and hydraulic models, modelling of design events, and production of flood maps or outputs. Additional practices that contribute to the best outcomes for flood modelling and mapping include:

    - Identifying the end user within the method statement and using this to understand the outputs required.
    - Developing modelling scenarios that incorporate climate change, changes within the catchment and future growth.
    - Developing modelling assessment levels that can be used to guide the type of modelling and the outputs and uses.
- Within New Zealand there is no standard approach or regulation for flood modelling, meaning that councils have developed their own tools to manage flood risk. This is prevalent throughout New Zealand's water industry and has resulted in the development of national guidelines for stormwater modelling.
- Frameworks have been developed to assess liquefaction and landslide hazard in NZ that include different levels of assessment to ensure outputs are fit for purpose for a range of users.

Workshops were held with Horizons and local authorities to understand how flood modelling and mapping is used within the region, and to present an initial framework for regional flood modelling. A follow up survey was sent to the local authorities to gain further insight into how flood modelling and mapping outputs are used. Following the workshops and survey, six user personas have been developed for the following roles (WSP & NIWA, 2025a):

- Regional District Advice.
- Planning.
- Asset Management.
- Emergency Management.
- Investigations and Design.
- District Advice – Territorial Authority.

Appendix B of the Flood Modelling and Mapping Guideline Review Task 2-2 Report presents the context of the role, how flood modelling and mapping outputs are used and output requirements for each persona (WSP & NIWA, 2025a).

A regional flood modelling framework (Table 3) was developed collaboratively with Horizons and can be found in Section 4 of the Horizons Modelling and Mapping Guidelines (WSP & NIWA, 2025a). This framework employs a staged approach based on the required detail of output and available data, allowing for assessments at different scales. The goal was to build on existing national hazard frameworks and develop a comparable structure to allow for multi-hazard assessment. This framework facilitates user specific flood modelling that is tailored to the information available, or the output required by the user. The framework developed features four levels of assessment, ranging from a regional level down to a site-specific detailed level. Output features and the key uses are linked to each assessment level.

The framework can be used by Horizons to understand the applicability of existing flood modelling outputs for different uses within the region, and can also guide the level of modelling assessment for future modelling based on the intended outcome and use.

2.1.2 CURRENT STATE ANALYSIS REPORT

The Current State Analysis Task 2-3 Report presents an overview of the current state of the flood data provided to WSP for this FVA (WSP & NIWA, 2025b). Existing flood modelling reports were provided to WSP and reviewed against a range of parameters including input data, modelling scenarios, extent and types of outputs, and calibration methods. The reports have also been reviewed against the Regional Flood Modelling Framework that has been developed collaboratively between WSP and Horizons. The report summarises the

relevance and applicability of the current models and identified if major changes or model re-runs are recommended. By establishing a solid baseline, the current state analysis highlights how existing models, data, and maps can be effectively utilised and identify any gaps that need addressing. This report also presents a summary of the existing asset data and documentation provided by Horizons.

The modelling reports provided to WSP were compared against the Regional Modelling Framework (Table 3). 59 reports were submitted, 47 were assessed. 12 were not assessed; as these were duplicates, not reports, or has a superseded version. Of the 47 reports reviewed, 2 reports were Level A, 10 were Level B, 34 were Level C, and 1 was Level D.

The current state analysis involved reviewing existing models developed for Horizons and combining these insights with regional modelling outputs related to building losses. Based on the comparison of the provided modelling reports against the Regional Flood Risk Assessment Framework, several recommendations and a prioritised programme of future modelling work has been developed.

Table 3: Regional Flood Modelling Framework for Horizons Regional Council (WSP & NIWA, 2025a).

Level of Detail	Key Features	Output Features	Uses
Level A – Basic Desktop Assessment	Regional model Validated against extents Structures/assets identified from LiDAR Calibration/sensitivity includes check of selected locations against historic records	Low resolution may include flood depth. Approximate map scale down to 1:5,000 or greater. Could be greater than 1:25,000 Unlikely to have velocity Suitable to understand the extent of flooding for further detailed investigation Exposure assessments and prioritising areas for further investigation	Emergency management readiness and recovery planning Regional policy and development plan High level community engagement High level asset management and long-term planning for flood infrastructure
Level B – Basic Validated Desktop Assessment	Regional model Validated against extents Structures/assets identified from lidar Calibration/sensitivity includes check of selected locations against historic records	Low resolution may include flood depth. Approximate map scale down to 1:5,000 or greater Unlikely to have velocity (aspire to have velocity) Suitable to understand the extent of flooding for further detailed investigation Exposure assessments and prioritising areas for further investigation	Asset management for flood infrastructure Local Government (Regional and District) policy setting Readiness, recovery and high-level response planning Contingency and evacuation planning District scale planning or policy adjustments Zoning as a function of spatial planning Long-term infrastructure planning
Level C – Localised Catchment Model	Detailed catchment model Includes some assets and streams Sensitivity testing. Validation of model parameters to extents and some levels. Starting to look at gauge calibration.	Refined model Approximate scale down to 1:1,250-1:500 May have velocity and depth Shows exposure (spatial extent) Flows at gauges Water levels, depths and velocities at critical infrastructure/areas Flood hazard classification	Strategic catchment and infrastructure planning Regional and district policy setting Urban growth and land use planning Decision support for Integrated Catchment management (ICM) Climate adaptation planning Resource Management Act Consents (including land-use, subdivision and resource) Zoning as a function of spatial planning Readiness and recovery planning Community response planning
Level D – Specific Detailed Assessment	Site specific model Includes all assets/structures Often a property/parcel level Sensitivity testing. Calibration at gauges for multiple events and comparison with historic records.	High resolution Approximate map scale down to 1:500 (or less) Includes depth, velocity along with spatial extent Flood hazard classification	LIMS – public use case for property-specific decision making Detailed design of flood protection assets Emergency management response and recovery during a flood Urban growth and land use planning decisions Detailed site planning and development controls Resource Management Act Consents (including land-use, subdivision and resource) Building Consents and site considerations

2.2 FLOOD VULNERABILITY ASSESSMENT METHOD

This section outlines the approach implemented to assess flood vulnerability across the Horizons Region. It details the development of regional-scale flood models, the integration of multiple flood scenarios, including climate change and defences down, and the subsequent vulnerability assessment using advanced risk modelling techniques. The methodology combines hydrological and hydrodynamic modelling with geospatial analysis to quantify potential impacts on buildings and communities. In addition, sensitivity testing and targeted case studies were undertaken to refine model accuracy and explore limitations in distinguishing flood sources. The findings inform both regional risk management strategies and asset condition reporting, serving as a strong foundation in supporting a robust foundation for evidence-based decision-making and long-term resilience planning.

2.2.1 REGIONAL FLOOD MODELLING

To enable a consistent approach for the vulnerability assessment, ESNZ developed a regional-scale flood model incorporating multiple flood scenarios. Twelve inundation domains were defined to cover the floodplains and river corridors within the Horizons Region. The upper catchments of these domains were simulated using a hydrological model, while flood inundation within the domains was represented using a 2D hydrodynamic model. Further detail on the flood model can be found in the Appendix B which presents the methodology used to develop the regional flood model and provides an overview of the results (NIWA, 2025).

A list of the inundation domain model locations, including catchment and computational area, presence of stopbanks, overlapping domains, and the design storm duration used for the modelling can be found within Appendix B. Design storm events ranged from 6 hours to 60 hours.

For each inundation domain, flood extents were modelled for rainfall design storms with annual exceedance probabilities (AEPs) of 5%, 2%, 1%, 0.5%, 0.2% and 0.1%. Climate change scenarios were also assessed for the 200-year design storm, including temperature increases of +1°C, +2°C, +3°C, and +3°C combined with sea-level rise (the latter applied only to coastal domains). Coastal domains were merged with inland domains to provide a full region model. For domains with stopbanks, additional “stopbanks-down” scenarios, where stopbanks were removed, were modelled. Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region. For all flood scenarios, several model outputs were generated including:

- maximum of water height along the simulation (hmax)
- maximum of water surface elevation (zsmax)
- maximum of water height times velocity (humax)
- water rising rate up to 1.2m (rising_rate_12)

All outputs have been reprojected on an 8 m x 8 m grid.

All layers were exported in geospatial.TIFF format. Because some flood domains overlapped, areas with duplicate inundation were identified. To address this, ESNZ provided “filled” geospatial layers for the hmax and zsmax datasets, ensuring overlaps were removed. The humax and rising_rate_12 datasets are specific outputs used for risk assessments to specifically evaluate the risk to people. Across all scenarios, a total of 1,770 geospatial files were produced for the twelve flood domains.

Appendix B details the methodology applied in the regional modelling study and provides an overview of the results provided to Horizons, which served as inputs for the vulnerability assessment.

This phase also involved updating flood frequency assessments using extreme value analysis to provide a more accurate estimation of flood peaks and their return periods, which are important for effective flood risk management and planning.

2.2.2 VULNERABILITY ASSESSMENT

The vulnerability assessment utilised ESNZ's RiskScape loss modelling software to quantitatively estimate the potential impacts of flooding on communities across the region. It used the regional model flood layers and ESNZ's national building and population datasets to quantify several impacts, including:

- No. of Buildings Exposed
- Building Reinstatement Cost
- No. of Buildings Contributing to Reinstatement Costs
- Total Population Exposed
- Total Life Cost
- Number of Fatalities
- Threat to Human Safety (note results of this are included within Appendix D1 and not reported on within this report)

Appendix C outlines the risk assessment methodology applied in RiskScape. The results were exported as .CSV files, comprising over 12 million rows of risk data. These outputs were then post-processed using Python scripts to generate the reporting metrics agreed with Horizons (Appendices D and E).

As explained in Section 1.3.1 and in Appendix C, the population and building counts that have been reported on will differ to those from Census data. Building numbers are derived from object-level footprints that have been developed by ESNZ, while population estimates are downscaled from 2018 SA2 census data to individual buildings using a population model (Scheele et al., 2021). The total number of buildings reported for each town and settlement was verified using geospatial sampling methods. The variability between the number of buildings and exposed population is reflective of how the population has been allocated within the model. As detailed in Appendix D1.7.1, population and building numbers have been provided and confirmed through internal verification.

To ensure the risk model produces meaningful results, different conditions have been applied during implementation (Table 4). For example, the initial risk model configuration run for the FVA estimated risk for residential buildings only, without applying any condition for Exposed Ratio (Section 2.2.2.1). To confirm that the model outputs were appropriate for estimating regional flood vulnerability, a sensitivity analysis was conducted to identify optimal modelling conditions. Further detail can be found below in 2.2.2.1 or in the Appendix F.

Table 4: Risk modelling conditions applied for each model run for the Horizons FVA.

Deliverable	June	August	December
No. of Exposed Buildings	Floor Level ≥ 50mm, Exposure Ratio > 0%	Floor Level ≥ 200mm, Exposure Ratio = 100%	Floor Level ≥ 50mm, Exposure Ratio ≥ 50%
Reinstatement Cost	Floor Level ≥ 50mm, Exposure Ratio > 0%	Floor Level ≥ 200mm, Exposure Ratio = 100%	Floor Level ≥ 200mm, Exposure Ratio ≥ 50%
Types of Buildings	Residential and appurtenant structures	Residential only	All buildings >10m^2 categorised by building use (residential, commercial/industrial, rural and other) and primary and secondary structure type.

Results of the vulnerability assessment are presented within this report. Results are separated into a Regional Summary (Section 3) and District Summaries (Section 4).

To ensure the vulnerability results provided a robust understanding of regional risk, several configurations of the risk model were completed with interim reports published in June 2025 (WSP & NIWA, 2025d) and August 2025 (WSP & NIWA, 2025e).

2.2.2.1 VULNERABILITY MODEL SENSITIVITY TESTING

To identify the optimal modelling conditions for the Horizons FVA, sensitivity testing was conducted using the Whanganui Flood Model Extent (Appendix F). The sensitivity testing was carried out using a 0.5% Annual Exceedance Probability (AEP) scenario with defences up. To explore the range of potential impacts, the analysis incorporated varying exposed ratios and floor levels:

- Exposed Ratio: The percentage of the building footprint exposed to flooding as a minimum threshold for whether that building is included in exposure or risk calculations. The sensitivity analysis used the exposure ratios of 1%, 20%, 50% and 100% to represent different proportions of the building footprint that experiences flooding.
- Floor level: a minimum floor level threshold for whether that building is included in exposure or risk calculations. Varying floor levels of 50mm, 150mm, 200mm, 300mm, 400mm and 500mm were analysed as part of the sensitivity testing.

WSP and ESNZ applied risk modelling best practices and used empirical observation data to calibrate the risk model based on the exposure ratios and floor levels noted above. Across the different exposure ratios and floor levels, a clear trend emerged: as floor level increased, reinstatement costs decreased.

RESULTS COMPARISON – OBSERVATIONS FROM 2015 WHANGANUI FLOOD

Estimates from the sensitivity analysis were compared against observations made from placard information for the Whanganui June 2015 flood event. This flood event was estimated to be within the 100- and 130-year annual recurrence interval (ARI). Observations were compared against 1% AEP regional flood model output with 50% exposed ratio and 50 mm floor height. A detailed comparison can be found in Appendix F.

The modelled estimates were much higher than the total recorded placards, however this is due to the combined pluvial and fluvial design-storm approach. Results were also conservative due to there being no representation of the stormwater network, leading to an overestimation of exposed buildings from pluvial

flooding. While fluvial only estimates were similar to the number of red and yellow placards, this is considered an underestimate as white placards have not been recorded.

COMPARISON WITH FEILDING

A relative comparison of exposed buildings between the Whanganui study and GHD's Feilding 2024 study was conducted. Due to a difference in building numbers, our figures were scaled by 0.37. When scaled, the results of Whanganui's exposure numbers are broadly in line with Feilding's. Further detail on this comparison can be found in Appendix F.

COMPARISON WITH MFE REPORT

A comparison was undertaken between the Horizons FVA sensitivity approach and the methodology applied in the Ministry for the Environment (MfE) National Flood Risk Assessment. While both studies estimate building exposure and damage from flooding, different methodologies are used. The MfE study applies a 0.4 m floor height at the building centroid, which introduces uncertainty. Our approach samples all inundation grid cells intersecting each building footprint to determine the maximum water depth and the proportion of the building inundated. This footprint-based method provides a more detailed representation of exposure when high-resolution flood grids are available and avoids assigning damage to buildings where only a small portion of the footprint is affected. Research indicates that centroid sampling can under-represent exposure, so the 200 mm proxy used in the Horizons FVA is considered a more appropriate and conservative approach for this assessment.

RECOMMENDED APPROACH

Following the sensitivity analysis, the recommended configuration was to use a 50% exposed ratio with a 50 mm floor level for a conservative estimate of building exposure, and a 50% exposed ratio with a 200 mm floor level for reinstatement cost estimations (Appendix F). This configuration was implemented in the updated risk model run in November and delivered in December 2025.

2.2.2.2 VULNERABILITY RESULTS CONSIDERATIONS

Tabulated results from the vulnerability assessment modelling were provided along with considerations for the results interpretation. This can be found in Appendix F. The following considerations are explained further within Appendix F.

BUILDING EXPOSURE

Instances were identified where the building exposure results were lower for the 0.1% and 0.2% AEP scenarios than the 0.5% AEP. It was identified that ESNZ's flood model produced higher resolution outputs for the lower frequency AEPs resulting in more pixelated, larger flood extents for the more frequent scenarios. This difference occurs due to the modelling methodology used by ESNZ for the regional flood modelling, where the model processes at a higher resolution in areas where more flooding is present. This resulted in larger pixelated areas of pluvial flooding in the more frequent AEPs and inconsistent exposure results for some smaller towns and settlements.

The following approach was agreed with Horizons to address the inconsistencies in exposure results across the different AEP events. The process involved:

- Buildings exposed to flooding in the 0.1% AEP event were identified and used as the reference set.
- Building IDs from the 0.1% AEP event were compared against those in more frequent AEP events.
- Any buildings not present in the 0.1% AEP event were excluded from the results for higher frequency events. This step ensured any inconsistencies caused by larger pixel sizes in more frequent AEPs did not skew the results.

By applying this method, only buildings confirmed as exposed in the 0.1% AEP event were included in comparisons.

HALCOMBE BUILDING ANOMALY

When compiling risk results for Halcombe, one building was identified that was included within Rangitīkei District, with all other buildings within Halcombe included within the Manawatū District results. This anomaly occurred as the Halcombe polygon includes both districts and was interpreted to be due to the coarse resolution boundary between the two districts. Following consultation with Horizons, this building was reassigned to the Manawatū District results.

CROSS BOUNDARIES

Town and settlement boundaries were sourced from the Suburbs and Localities geospatial layer from Land Information New Zealand (2023). Within the region, some town and settlement boundaries overlap multiple district boundaries. An example can be seen in Appendix F where Ashhurst overlaps Manawatū, Palmerston North and Tararua Districts resulting in buildings within the results of all three districts.

FATALITY NUMBERS

The method used to quantify fatalities uses a ratio and is derived from a curve, causing results to be reported as decimals. For the purpose of reporting, ESNZ and WSP proposed that for any fatalities between 0 and 1 to be reported as 0, and for any fatalities of 1 or above be rounded to the nearest whole number.

2.2.3 FLUVIAL MODELLING CASE STUDIES

Following the initial regional risk modelling run delivered in June, it was identified that pluvial flooding may be dominating risk results calculated in urban areas (Appendix G). The nature of the regional flood risk method combined with no stormwater infrastructure representation in the underlying regional model were identified as possible causes. It was recognised that the approach used for the regional-scale modelling had limitations including:

- The combined probability of fluvial and pluvial events was assumed but not explicitly quantified. Historical records suggest that whilst combined sources of flooding are known to occur, it is more likely that a single event is predominantly driven by either fluvial or pluvial.
- The model outputs did not clearly distinguish between fluvial and pluvial sources of flooding making it difficult to interpret flood depths and extents.

This distinction is important in urban areas such as Palmerston North, where understanding the source of flooding is important for making informed decisions on flood risk management. To address this, ESNZ developed hydraulic models with fluvial only (river-only) inflow scenarios for Palmerston North, Levin, Whanganui and Feilding. The results of the updated modelling and vulnerability assessment illustrate the importance of river flooding versus rainfall-runoff. Results were provided in the June (WSP & NIWA, 2025d) and August (WSP & NIWA, 2025e) Horizons Flood Vulnerability Reports.

In October following a review by Horizons, the decision was made to expand the case study model's coverage to also include fluvial flooding from the Makino Stream in the Feilding case-study area and the Mangaone Stream in the Palmerston North case study area.

Appendix I presents the results of the fluvial modelling cases studies following the inclusion of Makino and Mangaone Streams. The case study results are for a subset of the buildings within each of the four urban areas listed previously. Under current climate conditions all areas are dominated by pluvial flooding, with fluvial flooding contributing only a small proportion of total exposure and reinstatement cost (Figure 5). This pattern changes under climate warming, where fluvial flooding becomes more influential in Palmerston North and Whanganui.

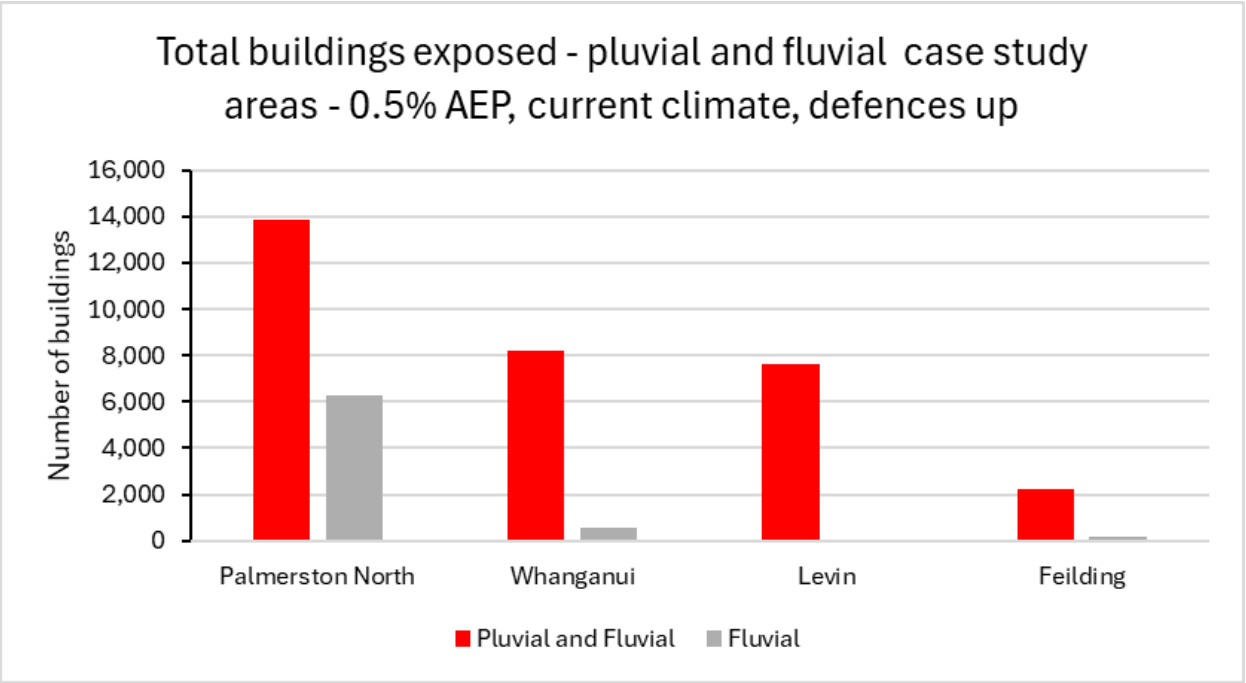


Figure 5: Number of exposed buildings for the fluvial case study locations compared to the regional pluvial and fluvial exposure results (Appendix I).

Case study results may change depending on resolution and flood modelling methodology (including feature representation and modelling resolution).

2.2.4 ASSET CONDITION REPORT

Flood protection assets are a vital component of managing flood risk across the Horizons Region. These assets play a crucial role in safeguarding communities, infrastructure, and productive land from the impacts of flooding. However, Horizons Regional Council (Horizons) faces a range of challenges in effectively managing these assets, as outlined in their Infrastructure Strategy and Long-term plan.

Historically, Horizons' asset management approach has been largely reactive, addressing issues as they arise. The current approach to condition assessment and defect prioritisation has a reliance on prioritising visual condition inspections based on asset type and criticality. While this provides a useful starting point, it could be improved to provide a more comprehensive basis for prioritisation.

This report outlines a series of recommendations aimed at strengthening Horizons' flood protection asset management to improve risk-based decision making (WSP & NIWA, 2025c). Key recommendations include:

- Expanding the use of asset criticality by incorporating additional consequence and likelihood factors to better reflect service importance, performance reduction, and downtime across the asset portfolio.
- Use the updated asset service level information in conjunction with the results of the Flood Vulnerability Assessment to understand areas that are highly vulnerable to flooding, as a basis for targeting in-depth studies of asset level of service through detailed modelling (such as Level C).
- Refining the risk framework to integrate asset criticality and outputs from the Flood Vulnerability Assessment, enabling more targeted decision-making.
- Broadening inspection methodologies to include drone and remote imagery, technical inspections, and remote monitoring; improving the accuracy and depth of condition assessments.
- Implementing geospatial data collection and dashboards to streamline inspection workflows, automate risk scoring, and support real-time decision-making and reporting.

These strategies are flexible and can be adopted individually or in combination, allowing Horizons to adapt and scale their approach as more data becomes available. By adopting these recommendations, Horizons can transition to a more proactive, risk-informed asset management model. This will not only improve the efficiency and effectiveness of maintenance, repair, and renewal activities but also strengthen the long-term resilience of flood protection infrastructure, ultimately enhancing the safety and well-being of the communities they serve.

To support implementation, the report also outlines how these recommendations align with Horizons' existing asset management improvement initiatives, including risk register development, data cleansing, and repair programme planning. It further recommends the development of key performance indicators (KPIs) and a dedicated risk management improvement plan to monitor progress and ensure continuous improvement.

2.3 LOWER MANAWATŪ HYDRAULIC MODEL

As part of the broader FVA project, WSP was engaged by Horizons to build an updated 'Level B' hydraulic model covering the full Lower Manawatū catchment (WSP, 2025a). The aim of this work was to develop an updated catchment-scale hydraulic model of the Lower Manawatū catchment to support Horizons future operational and design-use purposes. To achieve this aim, a methodology was developed to represent identified key channels and tributaries, to include key assets such as stopbanks, roads and floodgates, and produce flood maps showing the extents and depths across key catchment locations of five selected flood events.

The main model elements included:

- TUFLOW HPC model developed to represent catchment-scale flood risk mechanisms.
- Model terrain defined mostly by LiDAR, with 2023 watercourse survey used to create an interpolated channel surface on the Manawatū River.
- Main watercourses and flowpaths included in areas of refined 2-8 m cell sizes.
- Stopbanks and Roads modelled as breaklines along their crests to represent key spilling mechanisms.
- Key structures modelled including Moutoa Gates, Flygers Line Spillway, Mangaone Bridges.
- 29 inflows, including 8 intervening inflows, along key watercourses.
- Mean High Water Spring (MHWS) downstream boundary at Foxton.
- Five events simulated: 2% AEP present day, 1% AEP present day, 1% AEP 3°C climate change, 0.5% AEP present day, 0.5% AEP 3°C climate change.
- Nine key flood risk areas were established: Feilding, Palmerston North, Ōroua South Floodplain, Ōroua North Floodplain, Mangaone Floodplain, Linton Drain Floodplain, Southern Moutoa Floodplain, Eastern Moutoa Floodplain, Aratangata Drain Floodplain.
- Flood Mapping for extents included all five scenarios, while the report included depths and velocities for the 0.5% AEP 3°C climate change event.

2.3.1 MOUTOA GATES MODEL

The purpose of this phase was to understand relative flood risk as a result of gate maintenance operations at the Moutoa Gates. Modelling of the Moutoa Gates model was undertaken for one calibration and one validation scenario where the gates were fully closed to ensure the model represented the channel and floodplain hydraulics for the two events (WSP, 2025b).

The Moutoa Gates were then simulated as opened, based on operating rules used during a large historical flow event. We then undertook sensitivity testing for a range of gate closures. The model was used to simulate 9 gates fully open, 7 gates fully open and 6 gates fully open with remaining gates staying closed to understand the potential impacts associated with reduced gate capacity during Moutoa upgrade works.

In the immediate term, we used the outputs of this work to identify locations of additional inundation during closed-gate maintenance periods. In the long-term the model has the potential to be used to assist with operational management planning and procedures for Horizons.

2.4 REPORTING

This report presents a summary of the vulnerability assessment methodology and the key results for the Horizons Region and the districts within the region. It also provides a consolidation of recommendations from task-specific reports produced from the stages listed above that form other parts of the study.

3 HORIZONS REGION RESULTS

This section presents the results and describes some of the observations for the flood vulnerability of the Horizons Region, with results for current and future climate conditions, as well as an assessment of the flood vulnerability with the removal of flood defences. The results are derived from Level A regional scale flood modelling which provides a regional-scale vulnerability assessment and comparative risk analysis for the entire Horizons Region. The following should be considered when reviewing the results:

- The study methodology incorporates multiple flood scenarios and assumes a uniform flood event across the region, with all rivers and pluvial areas flooding simultaneously. This means results may be overstated, and do not represent actual flood events.
- The results have not been calibrated against historic flood events.
- Urban stormwater networks have been excluded from the modelling methodology. This means results may be overestimated for dense urban areas where pluvial flooding has a greater influence.
- Due to the regional scale of modelling used for this assessment, the results are not suitable for site specific decision-making.

This section of the report presents the results as follows:

- Section 3.1 provides a regional summary of the results broken down by:
    - Current Climate
    - Warming Scenarios
    - Defences Down Scenarios
- Sections 3.2-3.5 provide the tabulated results for the region broken down by District for the following:
    - Current Climate and Existing Flood Defences Up
    - Climate Warming (1°C, 2°C, 3°C and 3°C with sea level rise) and Existing Defences Up
    - Current Climate and Existing Flood Defences Down
    - Climate Warming (1°C, 2°C, 3°C and 3°C with sea level rise) and Existing Flood Defences Down
- Section 3.6 provides a summary ranking of the 52 towns and settlements throughout the region based on the 0.5% AEP flood event with current climate and defences up.

3.1 REGIONAL SUMMARY RESULTS

3.1.1 REGIONAL FLOOD VULNERABILITY: CURRENT CLIMATE

Under current climate conditions with flood defences in place, results of the vulnerability assessment highlight that with increasing flood severity (from 5% AEP to 0.1% AEP) there is a higher exposure to buildings (Figure 6) and people (Figure 7). As flood severity increases, exposure to population and buildings rises. The increase is not linear or uniform across all districts, indicating local vulnerabilities. This pattern underscores the need for district-specific flood resilience strategies that considers how exposure changes under different events.

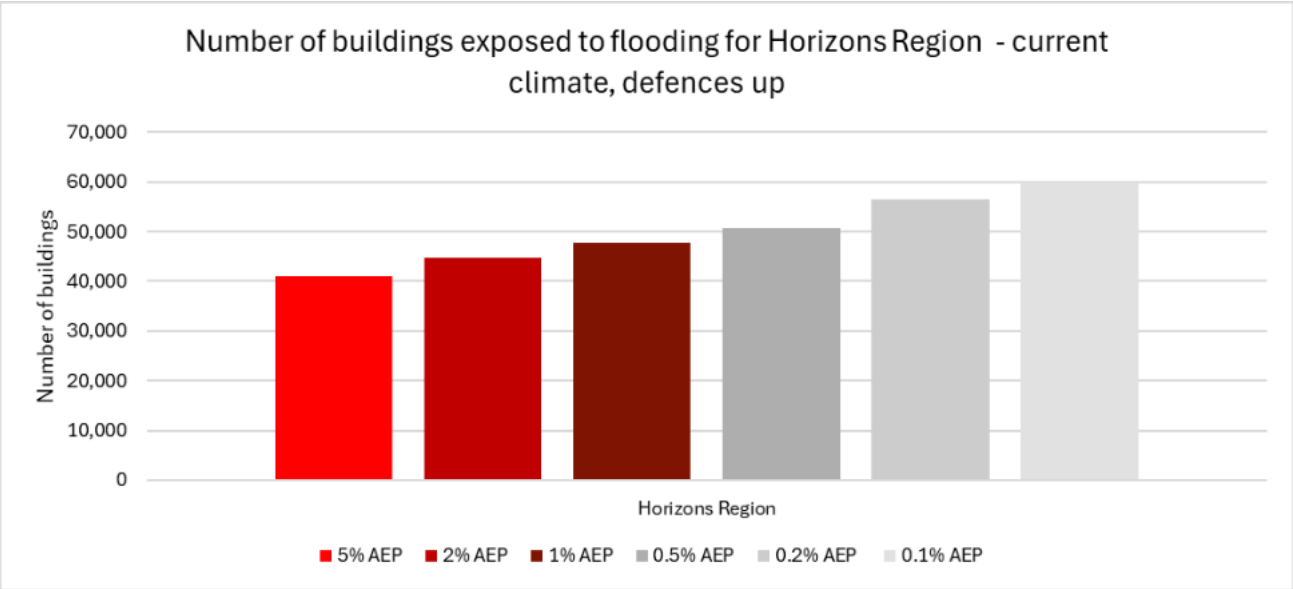


Figure 6: Number of buildings exposed for 5% to 0.1% AEP flood events with current climate and defences up for the Horizons Region.

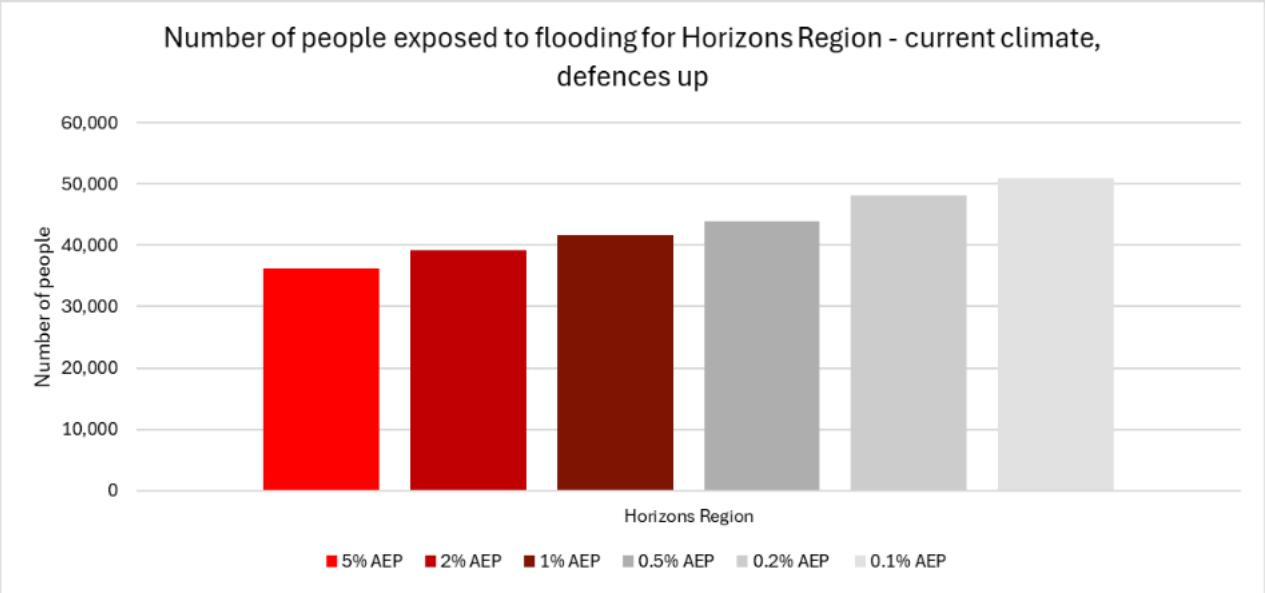


Figure 7: Number of people exposed for 5% to 0.1% AEP flood events with current climate and defences up for the Horizons Region.

3.1.1.1 RESULTS COMPARISON FOR 5% TO 0.1% AEP FLOOD SCENARIO

Results below present a comparison of the 5%, 0.5% and 0.1% AEP vulnerability results. While the results are presented for the entire region, it is important to note that we would not expect all areas to flood simultaneously. The modelling assumes a single large event occurring everywhere, which is a simplification for regional-scale analysis. This, along with the exclusion of stormwater network and calibration against historical and observed floods, means that results will be overstated (explained in Section 1.3). The results provide a high-level comparative indicator of regional risk. The comparison between the 5%, 0.5% and 0.1% AEP events highlights a clear trend that as flood magnitude increases, exposure and impacts increase

throughout the entire Horizons Region. This trend can be seen in Figure 8 which presents the area of land flooded in hectares for the 5%, 0.5% and 0.1% AEP events. As the flood magnitude increases, the area of land flooded within each flood depth range increases. For all events the largest impacted area occurs at shallow depths (0.05-0.19 m) which exceeds 80,000 hectares across all scenarios.

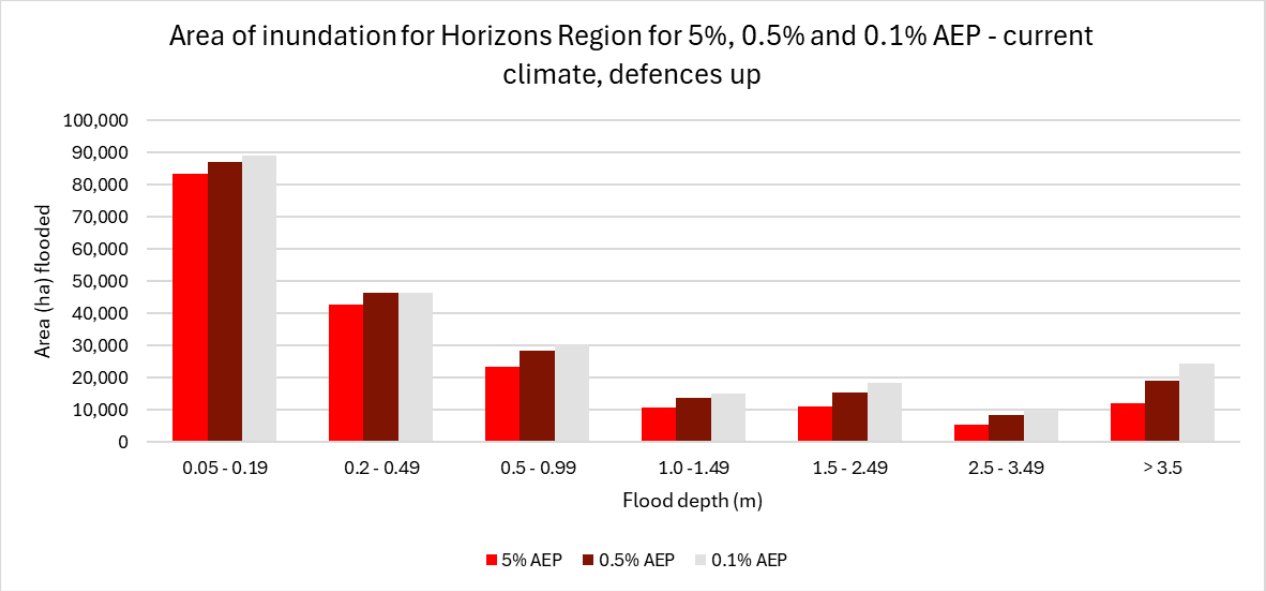


Figure 8: Area of inundation in hectares across different ranges for the 5%, 0.5% and 0.1% AEP flood events under current climate and with defences up for the Horizons Region.

Based on the regional modelling, for the **5% AEP** flood event under current climate conditions, the region has a total of over 41,000 buildings exposed to flooding, ranging from 1,995 in Ruapehu District to 11,703 within Palmerston North City. Of all building categories and types within the region that are exposed to flooding, 42% (17,500) are modelled to be damaged by flooding, with a reinstatement cost of nearly $1.5B. Almost 36,000 people are exposed to flooding, with life costs of approximately $40M and up to an estimated 33 fatalities throughout the entire region.

At the **0.5% AEP** flood event, total building exposure increases to 50,760 buildings, with building exposure ranging from 2,594 in Ruapehu to 14,120 in Palmerston North City. Of those exposed, nearly 50% (25,000) buildings throughout the region contribute to reinstatement costs of almost $2.2B. A regional total of almost 40,000 people (ranging from 1,109 to 17,039 throughout the districts) are exposed to flooding, with life costs estimated at around $89M and an estimated 70 fatalities.

For the **0.1% AEP** event under current climate conditions, building exposure of all building categories and types increases to almost 60,000 buildings (ranging from 3,478 to 15,150 within districts), with 55% of these (nearly 33,500) contributing to building reinstatement costs of over $3B for the region. Exposure of population also increases, with almost 51,000 people exposed to flooding, resulting in life costs of approximately $245M and up to an estimated 198 fatalities. Population exposure within the districts ranges from 1,746 to 18,133.

When comparing the results for the regional modelling for the 5% and 0.1% AEP events, population exposure rises by 40% (Figure 7), leading to a 500% increase in fatalities throughout the region. Across the region, residential buildings dominate, with a total of 156,500 primary and secondary residential buildings, resulting in higher exposure for this category and 24% of all residential buildings within the region exposed to flooding. This is illustrated in Figure 9, which shows building exposure to flooding by building type for the 0.5% AEP event. Figure 9 shows that while there are 2,764 commercial and industrial buildings exposed to flooding, this

accounts for 30% of all buildings within this building type within the region. Rural buildings form a notable portion of exposure in smaller settlements. Further breakdown of the number of buildings for each building type, and the number exposed to flooding can be seen in Table 11.

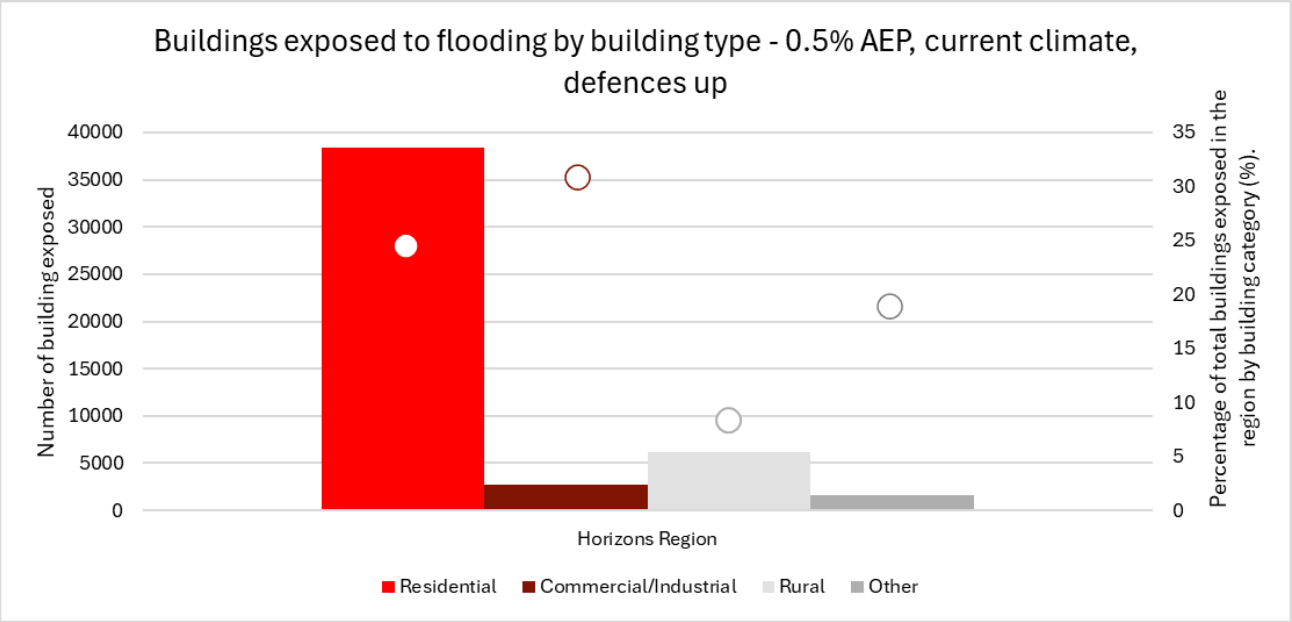


Figure 9: Number of buildings exposed for a 0.5% AEP event with current climate and defences up scenario, by building type for the Horizons Region.

3.1.2 REGIONAL FLOOD VULNERABILITY: WARMING SCENARIOS

The results of the regional vulnerability assessment show an escalation in the exposure and flood risk to people and buildings as warming scenarios increase. This can be seen in Figure 10, which shows the increase in total building reinstatement costs when comparing the results of a 0.5% AEP event with current climate, to the same event with 3.0°C warming. There is a 70% increase in building reinstatement costs for all building category and types when comparing the current climate 0.5% AEP event with the same event with 3.0°C warming (Figure 10). Changes across the region are variable throughout the different districts, with building reinstatement costs increasing by 152% in Whanganui and by 129% in Ruapehu. While Palmerston North has the highest building exposure, results from the vulnerability assessment suggest that under climate warming scenarios the change in building reinstatement costs is proportionally less than what is reported for other districts. As with the results presented in the previous section, the results presented in this section are likely overstated due to the methodology used for the flood modelling (Refer to Section 1.3). The results provide a comparison of how climate change and sea level influences flood vulnerability from a regional perspective.

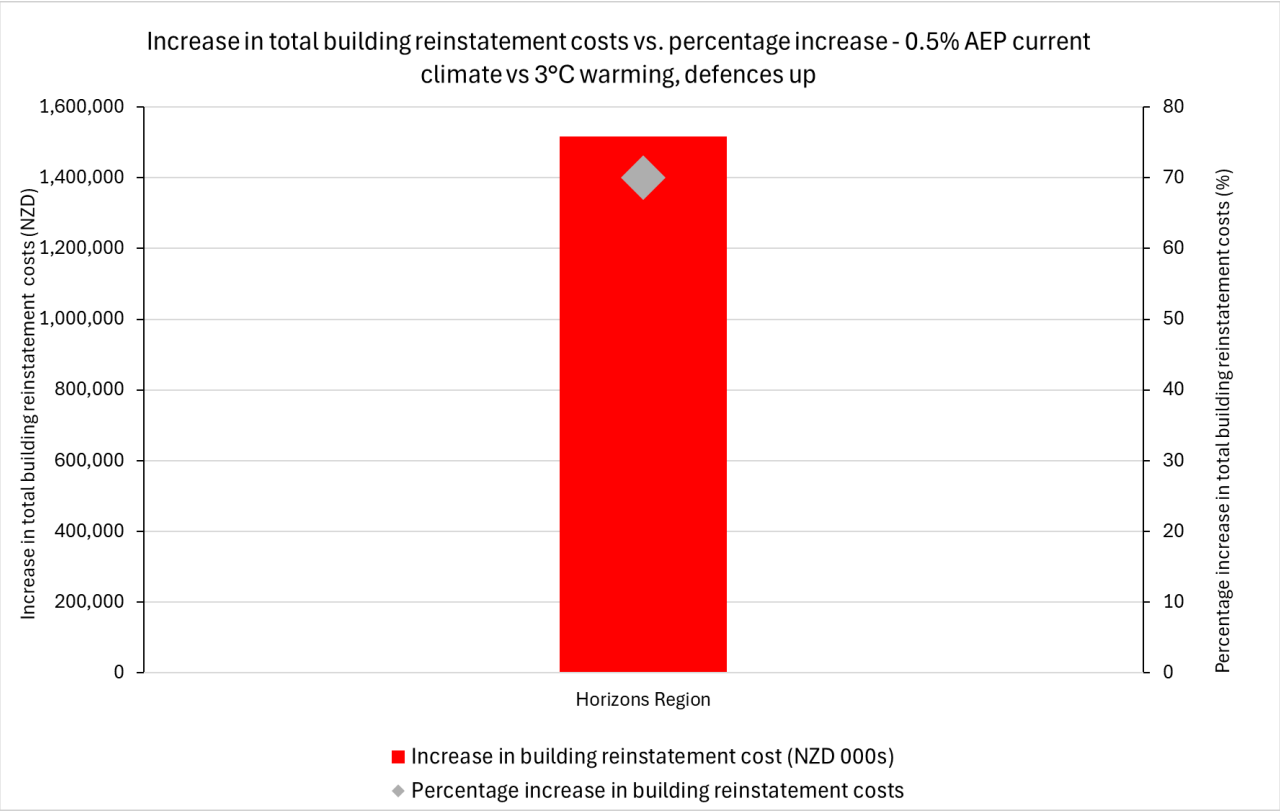


Figure 10: Percentage change in total building reinstatement costs for current climate vs 3 °C warming scenario (both 0.5% AEP events).

3.1.2.1 RESULTS COMPARISON FOR A 0.5% AEP FLOOD SCENARIO

Results below present a comparison of the 0.5% AEP vulnerability results in the current climate, against a 3°C warming scenario, and a 3°C warming scenario with sea level rise. While the results are presented for the entire region, it is important to note that we would not expect all areas to flood simultaneously. The modelling assumes a single large event occurring everywhere, which is a simplification for regional-scale analysis. The modelling also combines pluvial and fluvial flooding and excludes representation of the stormwater network, leading to overestimation of results (Refer to Section 1.3). Despite this, the comparison between the 0.5% AEP event in the current climate, with 3°C warming and 3°C warming with sea level rise events highlights a clear trend that as flood magnitude increases, exposure and impacts increase.

Figure 11 shows the total area of land inundated by flooding over 0.05 m within the Horizons Region for the 0.5% AEP events with current climate, in comparison to the 1°C, 2°C, and 3°C warming scenarios. Results show an increase in the area flooded as more severe climate scenarios are considered, the trend appears relatively stable between current climate, and the 2°C warming scenario. A sharp increase in area flooded is observed between the 2°C and 3°C warming scenarios.

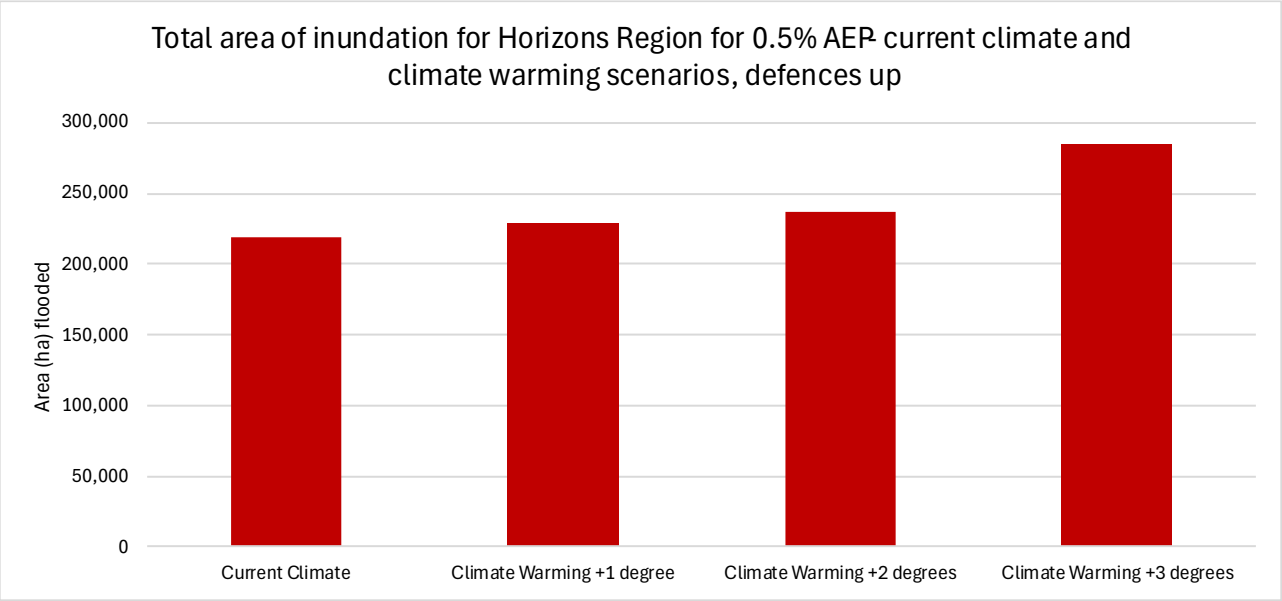


Figure 11: Total area of inundation within the Horizons Region in 0.5% AEP scenarios with defences up in current climate, compared to the 1°C, 2°C, and 3°C warming scenarios.

Building and population exposure

With current climate conditions, the region has 20% of buildings exposed (50,760 out of 247,914 total buildings throughout the region) and almost 22% of total people (almost 44,000 people out of a total of 194,665) are exposed. Under a 3°C warming scenario, exposure increases to 26% of total buildings (65,872) and 29% of total people (56,872). When considering a 3°C warming scenario with sea level rise, exposure increases further to nearly 27% of total buildings (66,126) and a little over 29% of total people (57,014). When comparing modelled results for estimated fatalities for these three events, the estimated number of fatalities increases from 70 under current climate conditions, to 388 with 3°C warming scenario and 390 under 3°C warming with sea level rise (Figure 12).

Residential buildings consistently dominate the total number of buildings exposed to flooding across all climate warming scenarios, both across the individual districts and at the regional scale. Rural buildings form the second largest impacted. A breakdown of the buildings by building type and their exposure to flooding under the climate change scenarios can be seen in Table 16.

Reinstatement costs and life costs

With current climate conditions, almost 10% of total buildings (25,000) throughout the entire region contribute to reinstatement costs of nearly $2.2B, with life costs from this event estimated at around $89M. Building reinstatement costs increase to $3.6B, contributed by more than 15% of total buildings (38,500), and life costs increase to almost $480M under a 3°C warming scenario. When sea level rise is added to the 3°C scenario, building reinstatement costs increase by approximately $27M while life costs increase by approximately $3M. These results highlight a notable increase in life costs, following a 29% increase in population exposure.

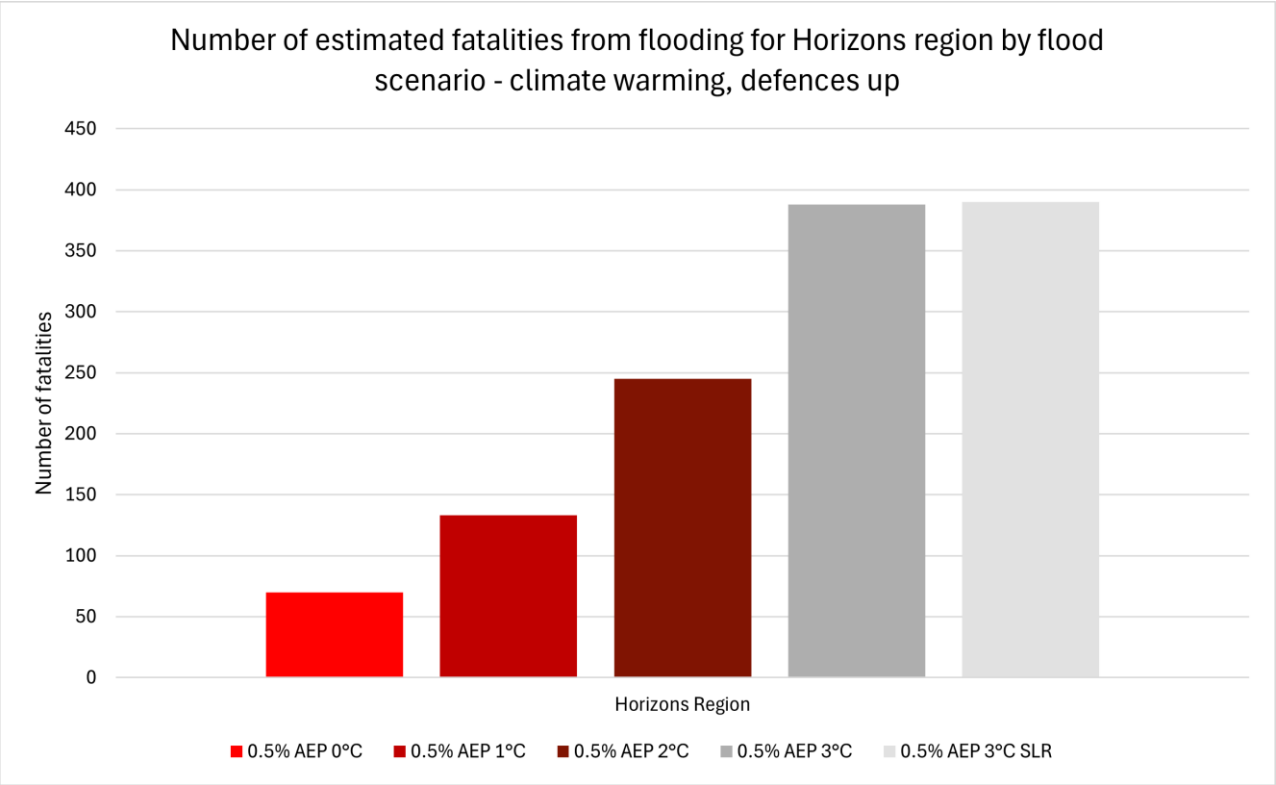


Figure 12: Comparison of number of fatalities resulting from flooding with defences up for 0.5% AEP flood events at different climate scenarios (0°C - 3°C + SLR) across the Horizons Region.

3.1.3 REGIONAL FLOOD VULNERABILITY: DEFENCES DOWN

Level A regional flood modelling has been used to understand and compare regional flood risk if flood protection assets are not in place (referred to as 'defences down'). The results can be used to understand the benefits of having flood protection assets in place or not. As detailed in Section 1.3, the results presented are based on a uniform flood event throughout the region which is unlikely in reality. Urban stormwater networks have been excluded from modelling, as has calibration against historic flood events. This means results are overstated, however can still be used to inform high level decision making.

The regional-scale results provide generalised patterns that may not reflect localised flooding behaviour when results are assessed for districts, towns or settlements only. Localised flooding behaviour may differ from these regional trends, meaning that outcomes for individual districts, towns or settlements may not align with the regional-level summary.

Comparing vulnerability results where flood protection assets are in place (defences up) against modelling scenarios where flood protection assets have been removed (defences down) can help to identify pinch points in flood protection asset performance and inform the prioritisation of asset renewals or maintenance, along with informing emergency planning and land use planning decision-making.

3.1.3.1 INTERPRETATION OF DEFENCES UP AND DOWN RESULTS

The comparison of reinstatement costs for the 5% AEP and 0.5% AEP flood events highlights the complex role of flood defences. For events with a higher frequency and are more common (5% AEP and 2% AEP), removing defences can, at a regional scale, lead to a reduction of exposure and vulnerability within the region as a whole. It is important to note that this regional-level pattern is not consistent across all districts or towns, where local topography, drainage behaviour, and the positioning of assets may influence outcomes. Several factors contribute to this complexity of results:

- **Redistribution of floodwaters:** flood defences, such as stopbanks, are designed to protect specific areas against specific design events. However, when overtopped or breached, they can cause sudden and concentrated flooding in areas that may have previously experienced more gradual inundation. In contrast, without defences, floodwaters may spread more evenly across the floodplain, potentially reducing peak depths in some high-value areas. This redistribution can lead to lower damage estimates and exposure in certain locations, particularly where densely built area are no longer the primary recipients of floodwater.
- **Model assumptions and simplifications:** hydrodynamic models used for flood risk assessments often make assumptions about how water behaves with and without defences. These assumptions can sometimes lead to artifices in the results, such as decreases in exposure and costs, particularly in areas where the model has flood protection features like watercourses that are not well-represented within the model.
- **Stormwater network:** the defences up and down flood models were both completed with Level A modelling which excludes the stormwater network from the model inputs. This may overstate results, particularly in dense urban areas, which may influence the results presented.
- **Local topography and flow paths:** in some districts, the presence of defences may alter the natural flow paths of water and inadvertently direct water towards other assets. When defences are removed, water may follow lateral routes or diffuse and bypass assets. This is relevant in areas with complex terrain or where urban development has occurred behind defences that now act as unintended channels or barriers.
- **Influence of pluvial flooding (Palmerston North):** in more frequent flooding events, pluvial flooding plays a crucial role. When flood defences such as stopbanks are in place, surface water from

rainfall cannot efficiently drain into rivers, because despite relatively low river levels flood defences act as barriers. This leads to increased local ponding and greater exposure of buildings and people. However, in these lower intensity events (5% and 2% AEP) when defences are removed, surface water is able to flow more freely into river channels that have the capacity to accommodate the additional water, thereby reducing ponding and exposure of buildings. In contrast, during large fluvial dominated flood events (such as 0.5% AEP) river levels are already high and the primary threat comes from the river overtopping its banks. Removal of defences during these events enables flood waters to spread widely across the floodplain, resulting in greater damages and exposure. This is relevant in districts like Palmerston North City where flood protection structures such as stopbanks are present to protect buildings, land and people.

3.1.3.2 DEFENCES DOWN RESULTS SUMMARY

The removal of flood defences within the Horizons Region shows complexities in flood vulnerability dependent on the scenario. As shown in Figure 13, for some flood events (5% to 0.1% AEP), results from the vulnerability assessment reveal that the removal of flood defences results in lower building exposure at a regional scale. For larger AEP events (0.5% AEP), the removal of defences results in building exposure increases when reviewing results at a regional scale. These results suggest 0.5% AEP defences down event has the most impact to increase flood exposure when compared to defences up. These regional patterns should not be interpreted as applying uniformly across districts, towns or settlements. Some local areas may experience increased exposure when in scenarios where the regional summary shows a decrease and vice versa.

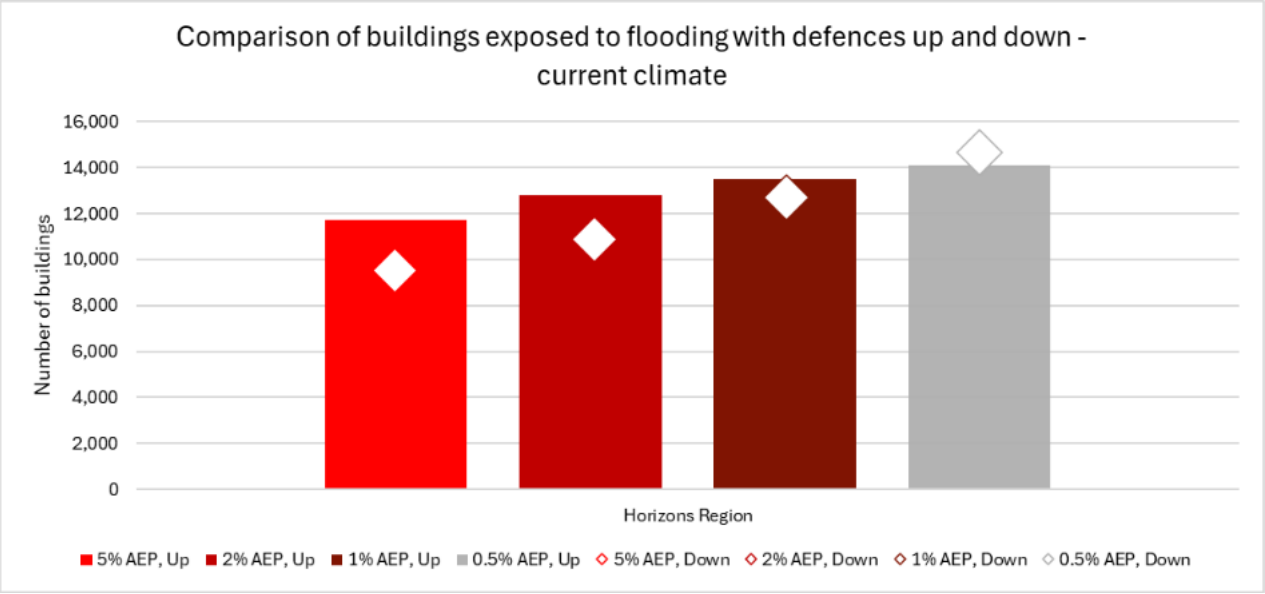


Figure 13: Comparison of number of buildings exposed to flooding with defences up and down for 5% to 0.5% AEP flood events (current climate) across the districts within the Horizons Region.

3.1.3.3 RESULTS COMPARISON FOR 5% TO 0.5% AEP DEFENCES DOWN SCENARIOS

Results below are based on uniform flood modelling that excludes the stormwater network and has not been calibrated against historic events. Explained in Section 1.3, results may be overstated, however can be used to provide an understanding of flood vulnerability and allow comparison across the Horizons Region. Results of defences down modelling can be used, from a regional perspective, to understand the benefit of having flood protection assets in place. The results below are also from a regional perspective, and trends across districts, towns or settlements may vary from those reported on from the region as a whole.

Similar trends are recorded from the modelling when comparing the defences up and down scenarios of both the 5% and 0.5% AEP events. For both, lower areas of inundation are recorded for the defences down scenario. For the 5% AEP modelling, the defences down scenario has over 550 hectares less flooding than the defences up scenario, while for the 0.5% event the difference is over 1,360 hectares. This can be seen in Figure 14. These results may be influenced by the low resolution of modelling (8 m), and by the exclusion of the stormwater network within the modelling. Further breakdowns of the area of inundation recorded can be viewed in Appendix D1. When looking at Figure 15 which provides a breakdown of flood depth ranges (above 0.05 m) and comparing between the defences up and down results, the total area of inundation reported is smaller overall, however, more flooding is reported at higher depths (for example 1 m). Interpretation of the comparison of defences up and down modelling can be found previously in Section 3.1.3.1.

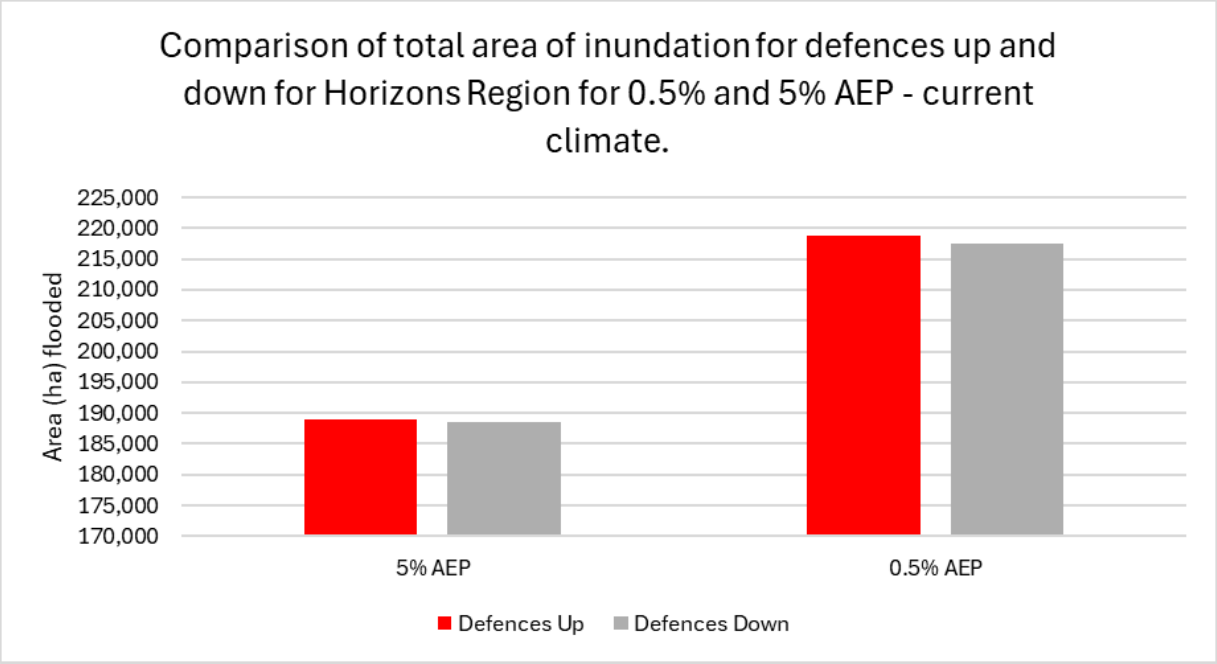


Figure 14: Comparison of area of land inundated from flooding in 5% AEP and 0.5% AEP for defences up and defences down.

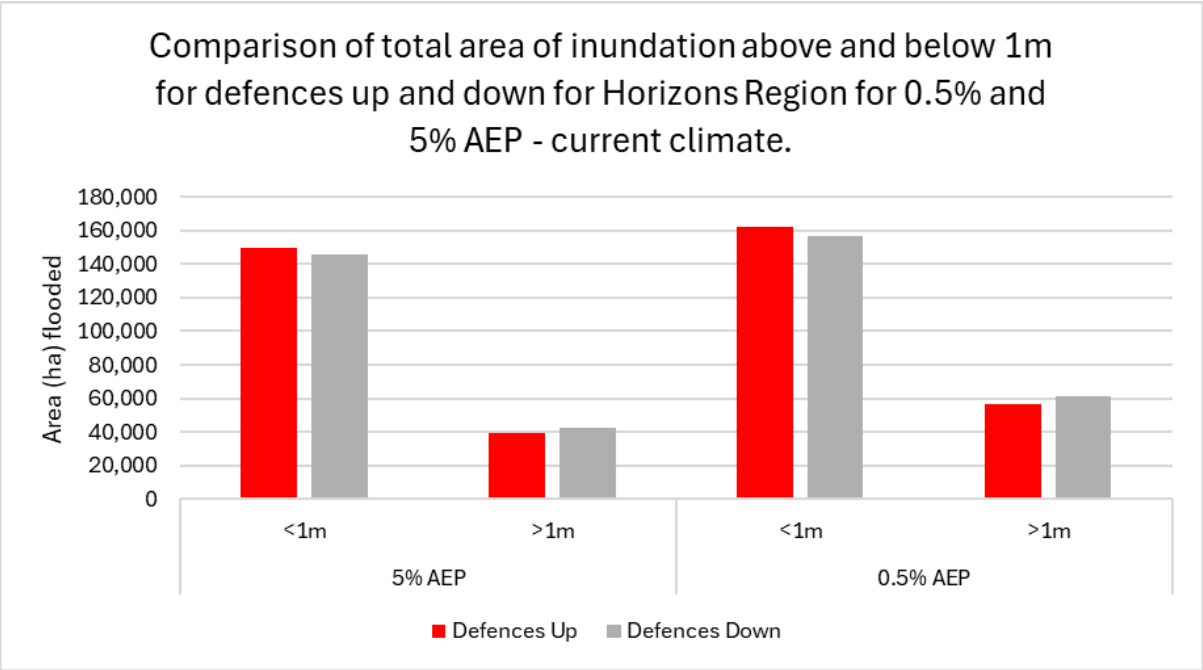


Figure 15: Comparison of area of land inundated above and below 1 m from flooding in 5% AEP and 0.5% AEP for defences up and down.

BUILDING AND POPULATION EXPOSURE

For the 5% AEP event under current climate conditions, exposure and vulnerability results show decreases throughout the region when defences are removed. The number of buildings across all building categories exposed to flooding changes from 16.5% of total buildings in the region (41,070) to 16.4% (40,757), a decrease of more than 300, and similar trends can be observed in exposure to people, decreasing from 18% (36,227) of the region total to 17% (34,375) exposed to flooding, almost 2,000 fewer people. For this event, an estimated 28 fatalities are reported from the vulnerability modelling.

Although the total area of inundation decreases slightly in the 0.5% AEP defences down scenario, overall vulnerability throughout the region still increases. This may be reflective of the redistribution of floodwaters across the floodplain (and other processes explained in Section 3.1.3.1). For the 0.5% AEP event with current climate, the removal of defences increases exposure throughout the region. The number of buildings exposed to flooding increases by almost 3,000, from 20% of total buildings in the region (50,760) to over 21% (53,426). Residential buildings dominate exposure for both scenarios. Removal of defences overall increases exposure moderately for all buildings; however, the largest proportional change is in rural buildings. Further detail on the number of buildings exposure can be seen in Table 21. Results show an additional 2,300 people, are exposed to flooding with the removal of defences for this event, increasing from 22% of total people (43,830) to 23% (46,159). The estimated number of fatalities increases from 28 in the 5% AEP event to 80.

When comparing the 0.5% AEP, 3°C warming defences down event against the same climate scenario with defences up, exposure increases. The number of buildings exposed throughout the region increases by over 9,000 buildings from 26% (65,872) of the region total to 30% (75,201). The steepest increase is in Palmerston North City where an additional 7,371 buildings are exposed, increasing from 9% (17,644) of the region total to nearly 12% (25,015). The estimated number of fatalities for the region increases to 470.

REINSTATEMENT COSTS AND LIFE COSTS

Building reinstatement costs decrease by approximately $53M (from $1.5B to $1.4B), for the 5% AEP event when defences are removed, and life costs decrease from $40.4M to $34.6M, by approximately $5.8M. For

the 0.5% AEP event with current climate, reinstatement costs rise by approximately $360M from $2.17B to around $2.53B, and life costs increase by around $12M from $88M to $100M. Detailed asset specific modelling would be required to better understand asset performance under different flood scenarios.

3.2 HORIZONS REGIONAL SUMMARY BY DISTRICT – CURRENT CLIMATE (0°C) WITH EXISTING DEFENCES UP

Table 5 to Table 10 show the total building reinstatement costs and total life costs estimated for all districts in the region for six flooding scenarios. These results for all six flooding scenarios assume current climate (0°C increase) and that existing flood defences are up. The number of buildings and the total population exposed per flooding scenario are provided for context. Figure 16 provides a graph comparing the building reinstatement costs for each district within the Horizons Region, while Figure 17 shows the relative percentage increases in building exposure and costs when comparing the 5% and 0.1% AEP events for each district. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

The flood vulnerability assessment highlights that from the 5% AEP to the 0.1% AEP regional flood exposure increases. Regional building exposure increases by approximately 45% from 41,070 to 59,955 between the 5% AEP and the 0.1% AEP scenarios. For these events, the building reinstatement costs increase by 105% from approximately $1.5B to over $3B. Population exposure and life costs also show consistent increases in exposure between events, rising from 36,227 to 50,887 people and from approximately $40.4M to around $245M respectively. The estimated number of fatalities also show consistent increases rising from 33 to 198. These results indicate the escalating human vulnerability with more severe flood scenarios. At the district level, Palmerston North City leads regional exposure across all flood scenarios, closely followed by Horowhenua District. However, when comparing the relative increase in building exposure and reinstatement costs between the 5% and 0.1% AEP events, Palmerston North shows the smallest increase. This result is likely influenced by the 5% AEP event results likely being overestimated, in combination with Palmerston North having flood protection up to a 0.2% AEP event which is higher than the level of flood protection within other districts. Whanganui shows the largest percentage increase in the number of buildings flooded and building reinstatement cost, suggesting high sensitivity to flood severity. Rangitīkei and Ruapehu Districts show high percentage increases in building reinstatement costs, suggesting disproportionate damage in these districts. Horowhenua District, despite having the second highest absolute numbers, shows the smallest percentage increases between flood events.

Table 5: Regional summary by district – Vulnerability metrics for Level A regional model results for a 5% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences up.

REGION/ DISTRICT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000S)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**41,070**	**17,543**	**1,487,582**	**180,389**	**36,227**	**33**	**40,407**
PALMERSTON NORTH CITY	55,246	11,703	6,600	675,595	66,586	14,336	15	18,040
WHANGANUI DISTRICT	35,020	6,905	3,364	272,136	33,444	6,201	5	6,029
HOROWHENUA DISTRICT	33,924	10,257	2,808	188,750	25,770	8,666	3	4,115
MANAWATŪ DISTRICT	28,012	4,410	1,380	99,879	22,106	2,874	1	1,445
TARARUA DISTRICT	23,114	3,410	1,528	142,249	13,563	1,889	3	3,770
RANGITĪKEI DISTRICT	19,038	2,390	963	54,825	11,386	1,402	1	1,212
RUAPEHU DISTRICT	14,317	1,995	900	54,149	7,534	859	5	5,797

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 6: Regional summary by district – Vulnerability metrics for Level A regional model results for a 2% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences up.

REGION/ DISTRICT[2]	2% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000S)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**44,732**	**20,145**	**1,742,119**	**180,389**	**39,204**	**48**	**58,573**
PALMERSTON NORTH CITY	55,246	12,779	7,445	775,444	66,586	15,599	17	21,276
WHANGANUI DISTRICT	35,020	7,437	3,731	313,541	33,444	6,646	6	6,793
HOROWHENUA DISTRICT	33,924	10,937	3,305	219,494	25,770	9,167	4	4,605
MANAWATŪ DISTRICT	28,012	4,955	1,664	121,736	22,106	3,193	1	1,790
TARARUA DISTRICT	23,114	3,784	1,827	175,790	13,563	2,104	5	5,755
RANGITĪKEI DISTRICT	19,038	2,637	1,127	67,347	11,386	1,556	1	1,487
RUAPEHU DISTRICT	14,317	2,203	1,046	68,769	7,534	939	14	16,867

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events, the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 7: Regional summary by district – Vulnerability metrics for Level A regional model results for a 1% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences up.

REGION/ DISTRICT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000S)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**47,720**	**22,380**	**1,911,613**	**180,389**	**41,605**	**59**	**72,135**
PALMERSTON NORTH CITY	55,246	13,485	7,957	794,946	66,586	16,382	19	23,064
WHANGANUI DISTRICT	35,020	8,007	4,140	354,095	33,444	7,195	8	9,590
HOROWHENUA DISTRICT	33,924	11,431	3,682	245,422	25,770	9,510	4	5,012
MANAWATŪ DISTRICT	28,012	5,467	2,007	149,010	22,106	3,491	2	2,267
TARARUA DISTRICT	23,114	4,055	2,077	207,794	13,563	2,285	6	7,726
RANGITĪKEI DISTRICT	19,038	2,895	1,323	82,763	11,386	1,720	5	5,803
RUAPEHU DISTRICT	14,317	2,380	1,194	77,584	7,534	1,022	15	18,674

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 8: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences up.

REGION /DISTRICT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000S)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**50,760**	**24,816**	**2,168,356**	**180,389**	**43,830**	**70**	**88,912**
PALMERSTON NORTH CITY	55,246	14,120	8,449	848,338	66,586	17,039	21	26,421
WHANGANUI DISTRICT	35,020	8,713	4,756	421,773	33,444	7,776	12	15,031
HOROWHENUA DISTRICT	33,924	11,833	3,924	265,399	25,770	9,778	4	5,396
MANAWATŪ DISTRICT	28,012	6,053	2,508	183,070	22,106	3,822	2	2,989
TARARUA DISTRICT	23,114	4,332	2,312	251,035	13,563	2,466	8	10,200
RANGITĪKEI DISTRICT	19,038	3,115	1,504	101,702	11,386	1,840	5	6,109
RUAPEHU DISTRICT	14,317	2,594	1,363	97,039	7,534	1,109	18	22,767

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 9: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.2% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences up.

REGION /DISTRICT[2]	0.2% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000S)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**56,446**	**30,334**	**2,674,586**	**180,389**	**48,124**	**137**	**168,752**
PALMERSTON NORTH CITY	55,246	14,681	8,893	899,976	66,586	17,645	23	28,155
WHANGANUI DISTRICT	35,020	11,186	7,478	669,352	33,444	9,931	40	49,746
HOROWHENUA DISTRICT	33,924	12,358	4,278	302,866	25,770	10,104	5	5,907
MANAWATŪ DISTRICT	28,012	6,692	3,048	223,456	22,106	4,141	3	3,980
TARARUA DISTRICT	23,114	4,692	2,631	283,164	13,563	2,690	22	27,542
RANGITĪKEI DISTRICT	19,038	3,845	2,311	167,765	11,386	2,246	10	11,734
RUAPEHU DISTRICT	14,317	2,992	1,695	128,005	7,534	1,367	34	41,689

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 10: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.1% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences up.

REGION /DISTRICT[2]	0.1% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000S)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**59,955**	**33,491**	**3,063,454**	**180,389**	**50,887**	**198**	**245,311**
PALMERSTON NORTH CITY	55,246	15,150	9,283	947,034	66,586	18,133	22	27,696
WHANGANUI DISTRICT	35,020	12,475	8,876	842,641	33,444	11,009	81	99,771
HOROWHENUA DISTRICT	33,924	12,699	4,460	335,905	25,770	10,325	5	6,197
MANAWATŪ DISTRICT	28,012	7,076	3,304	247,617	22,106	4,394	4	4,731
TARARUA DISTRICT	23,114	4,954	2,841	334,617	13,563	2,860	35	43,399
RANGITĪKEI DISTRICT	19,038	4,123	2,536	192,369	11,386	2,420	12	14,983
RUAPEHU DISTRICT	14,317	3,478	2,191	163,269	7,534	1,746	39	48,535

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

.

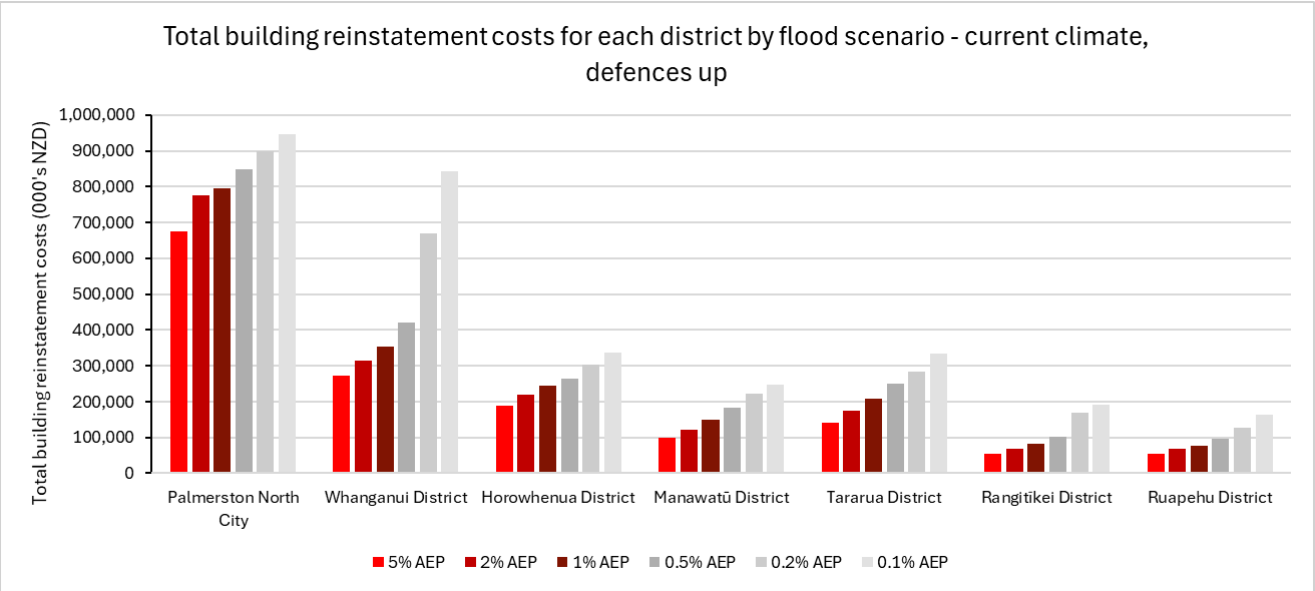


Figure 16: Total building reinstatement costs by district for current climate flood scenarios with defences up.

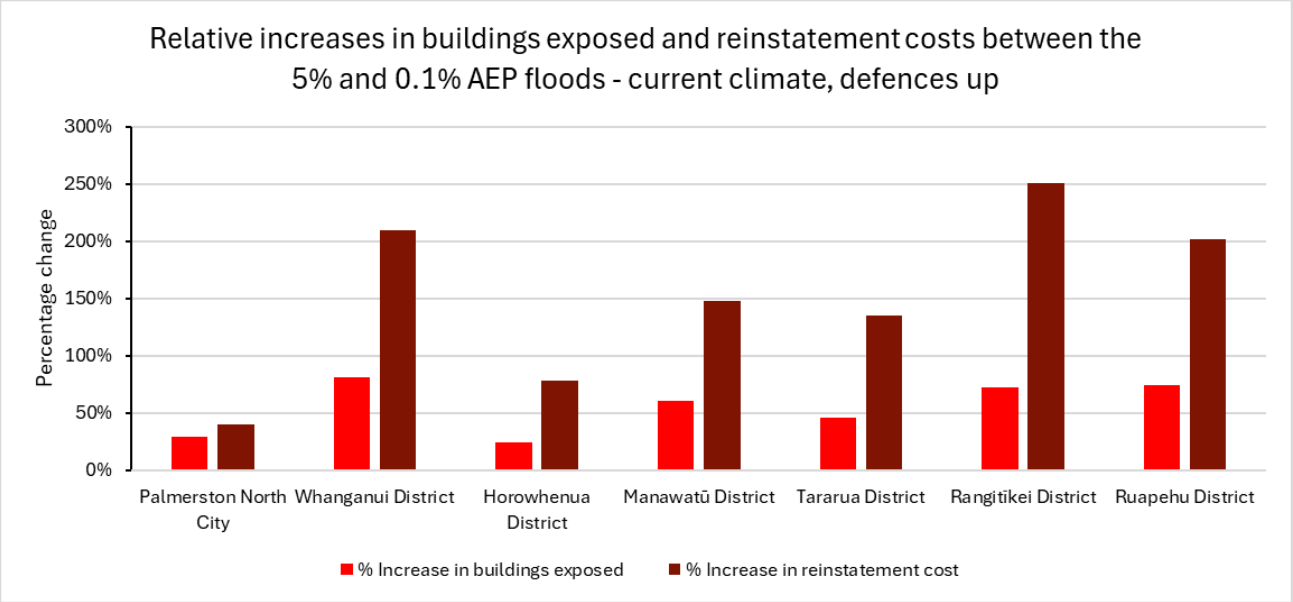


Figure 17: Changes to building exposure and building reinstatement costs between the 5% and 0.1% AEP flood events with current climate and defences up.

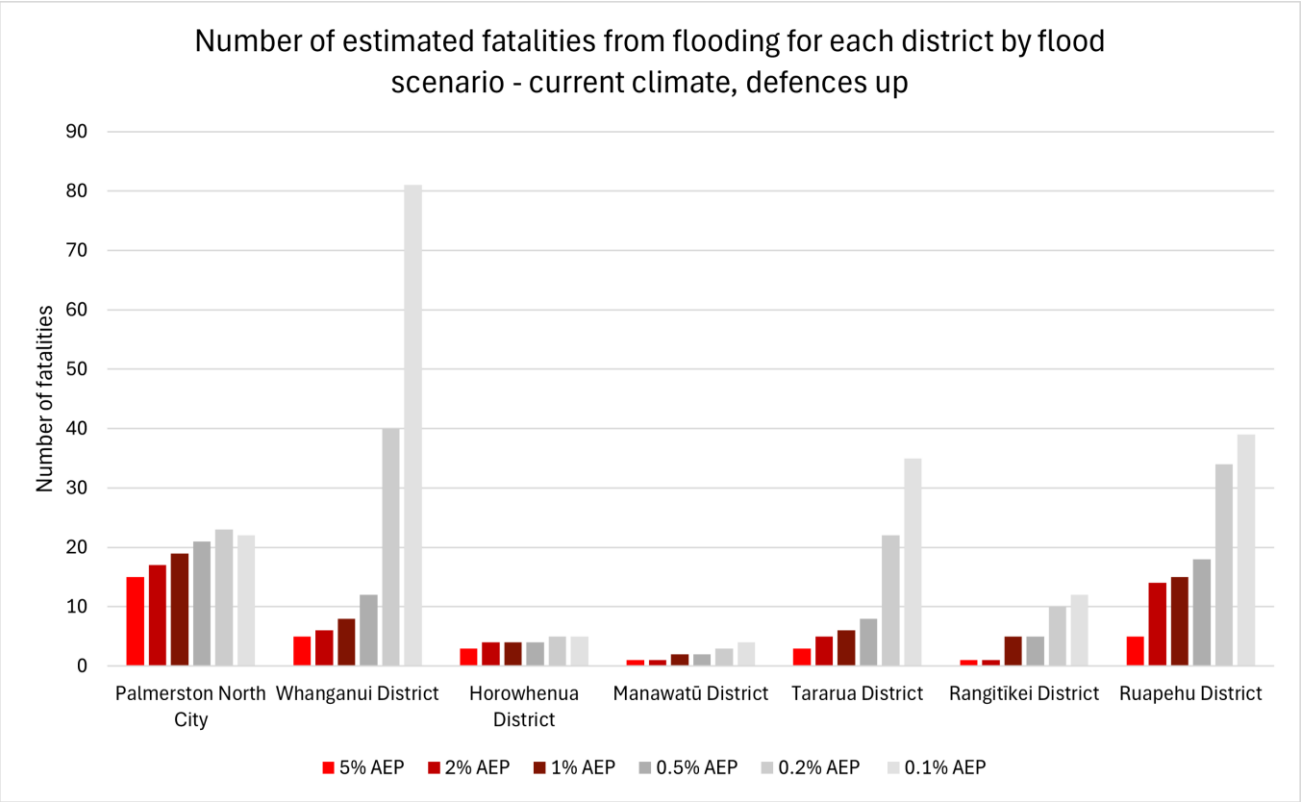


Figure 18: Total number of fatalities by district for current climate flood scenarios with defences up.

Table 11: Total number of buildings by type, and number of buildings impacted by flooding by type for 0.5% AEP flood scenario[1], current climate, defences up. Note that primary and secondary structures have been combined.

REGION/ DISTRICT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NO. OF RESIDENTIAL BUILDINGS[3]	NO. OF RESIDENTIAL BUILDINGS EXPOSED BY FLOODING	TOTAL NO. OF COMMERCIAL/ INDUSTRIAL BUILDINGS[3]	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS EXPOSED BY FLOODING	TOTAL NO. OF RURAL BUILDINGS[3]	NO. OF RURAL BUILDINGS EXPOSED BY FLOODING	TOTAL NO. OF OTHER BUILDINGS[3]	NO. OF OTHER BUILDINGS EXPOSED BY FLOODING
HORIZONS REGION TOTAL	**156,500**	**38,157**	**8,942**	**2,727**	**740,53**	**8,283**	**8,419**	**1,593**
PALMERSTON NORTH CITY	45,581	12,244	2,680	838	5,502	697	1,484	341
WHANGANUI DISTRICT	30,925	7,156	1,559	494	8,078	796	1,351	267
HOROWHENUA DISTRICT	27,380	9,530	1,108	617	8,098	1,359	964	327
MANAWATŪ DISTRICT	18,687	3,444	855	237	16,768	2,147	1,151	225
TARARUA DISTRICT	11,725	2,318	943	207	14,972	1,659	1,108	148
RANGITĪKEI DISTRICT	11,305	1,861	936	208	10,218	885	1,143	161
RUAPEHU DISTRICT	10,897	1,604	861	126	10,417	740	1,218	124

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

3.3 HORIZONS REGIONAL SUMMARY BY DISTRICT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP

Table 12 to Table 15 show the total building reinstatement costs and life costs estimated for all districts in the region for a 0.5% flood event for four climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase, along with a 3°C increase including sea level rise. The number of buildings and the total population exposed, the number of fatalities and the number of buildings contributing to reinstatement costs per flooding scenario are provided for context. The results assume that existing flood defences are up. Figure 19 shows the total building reinstatement costs for buildings across the districts within the Horizons Region, with Figure 20 presenting the relative percentage increases in building exposure and reinstatement costs when comparing the 1°C warming scenario with the 3°C warming scenarios (both with 0.5% AEP and defences up). The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

The flood vulnerability assessment highlights that with increasing climate warming, regional flood exposure increases. Regional building exposure increases by 19% from 55,232 buildings at 1°C warming to 65,872 buildings at 3°C warming, while building reinstatement costs increase by 46% from over $2.5B to over $3.7B. Population exposure and human fatality costs also show consistent increases in exposure between events, indicating escalating human vulnerability with climate warming. At the district level, Palmerston North City, Horowhenua District and Whanganui District have the highest regional exposure across climate change scenarios. Whanganui District shows the largest percentage increase in the number of buildings flooded and building reinstatement cost, suggesting high sensitivity to flood severity. Horowhenua, despite having the some of the highest absolute numbers, shows more moderate percentage increases between flood events.

Minimal differences in exposure and costs can be observed in Table 14 and Figure 19 between the 3°C climate warming scenario and the 3°C scenario with sea level rise. This is reflective of the riverine setting of the region.

Table 12: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenario[1] with climate warming (1°C) and with flood defences up.

REGION/DISTRICT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**55,232**	**28,718**	**2,517,377**	**180,389**	**47,424**	**133**	**163,741**
PALMERSTON NORTH CITY	55,246	14,919	9,053	921,489	66,586	17,884	22	26,799
WHANGANUI DISTRICT	35,020	10,472	6,659	586,805	33,444	9,264	42	52,094
HOROWHENUA DISTRICT	33,924	12,411	4,274	305,128	25,770	10,162	5	5,830
MANAWATŪ DISTRICT	28,012	6,558	2,881	218,314	22,106	4,187	3	3,885
TARARUA DISTRICT	23,114	4,449	2,364	230,904	13,563	2,541	22	27,474
RANGITĪKEI DISTRICT	19,038	3,368	1,713	121,933	11,386	1,961	5	5,703
RUAPEHU DISTRICT	14,317	3,055	1,774	132,801	7,534	1,425	34	41,956

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 13: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenarios[1] with climate warming (2°C) and with flood defences up.

REGION/DISTRICT[2]	0.5% AEP FLOOD – 2°C CLIMATE WARMING							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**60,501**	**33,526**	**3,065,655**	**180,389**	**51,767**	**245**	**304,216**
PALMERSTON NORTH CITY	55,246	15,950	9,907	1,025,127	66,586	19,039	26	32,242
WHANGANUI DISTRICT	35,020	12,209	8,519	799,015	33,444	10,768	109	135,038
HOROWHENUA DISTRICT	33,924	12,964	4,638	344,822	25,770	10,551	5	6,339
MANAWATŪ DISTRICT	28,012	7,087	3,280	257,222	22,106	4,517	4	5,042
TARARUA DISTRICT	23,114	5,021	2,869	318,000	13,563	2,923	50	61,994
RANGITĪKEI DISTRICT	19,038	3,578	1,903	139,941	11,386	2,063	10	12,444
RUAPEHU DISTRICT	14,317	3,692	2,410	181,528	7,534	1,906	41	51,118

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 14: Regional summary by district – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C) and with flood defences up.

REGION/ DISTRICT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**65,872**	**38,517**	**3,685,863**	**180,389**	**56,872**	**388**	**479,817**
PALMERSTON NORTH CITY	55,246	17,644	11,478	1,263,686	66,586	21,192	33	40,413
WHANGANUI DISTRICT	35,020	14,023	10,552	1,064,011	33,444	12,553	210	260,001
HOROWHENUA DISTRICT	33,924	13,516	4,995	379,412	25,770	11,002	6	6,855
MANAWATŪ DISTRICT	28,012	7,528	3,594	295,328	22,106	4,769	5	6,330
TARARUA DISTRICT	23,114	5,275	3,015	306,547	13,563	3,031	72	88,859
RANGITĪKEI DISTRICT	19,038	3,784	2,051	154,980	11,386	2,190	12	15,392
RUAPEHU DISTRICT	14,317	4,102	2,832	221,899	7,534	2,135	50	61,967

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 15: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenarios[1] with climate warming (3°C sea level rise) and with flood defences up.

REGION/ DISTRICT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**66,126**	**38,826**	**3,713,098**	**180,389**	**57,014**	**390**	**482,862**
PALMERSTON NORTH CITY	55,246	17,645	11,478	1,263,453	66,586	21,192	33	40,410
WHANGANUI DISTRICT	35,020	14,180	10,728	1,079,969	33,444	12,661	212	262,914
HOROWHENUA DISTRICT	33,924	13,592	5,104	388,914	25,770	11,032	6	6,949
MANAWATŪ DISTRICT	28,012	7,525	3,592	296,324	22,106	4,769	5	6,332
TARARUA DISTRICT	23,114	5,287	3,032	307,340	13,563	3,036	72	88,879
RANGITĪKEI DISTRICT	19,038	3,795	2,060	155,199	11,386	2,189	12	15,411
RUAPEHU DISTRICT	14,317	4,102	2,832	221,899	7,534	2,135	50	61,967

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

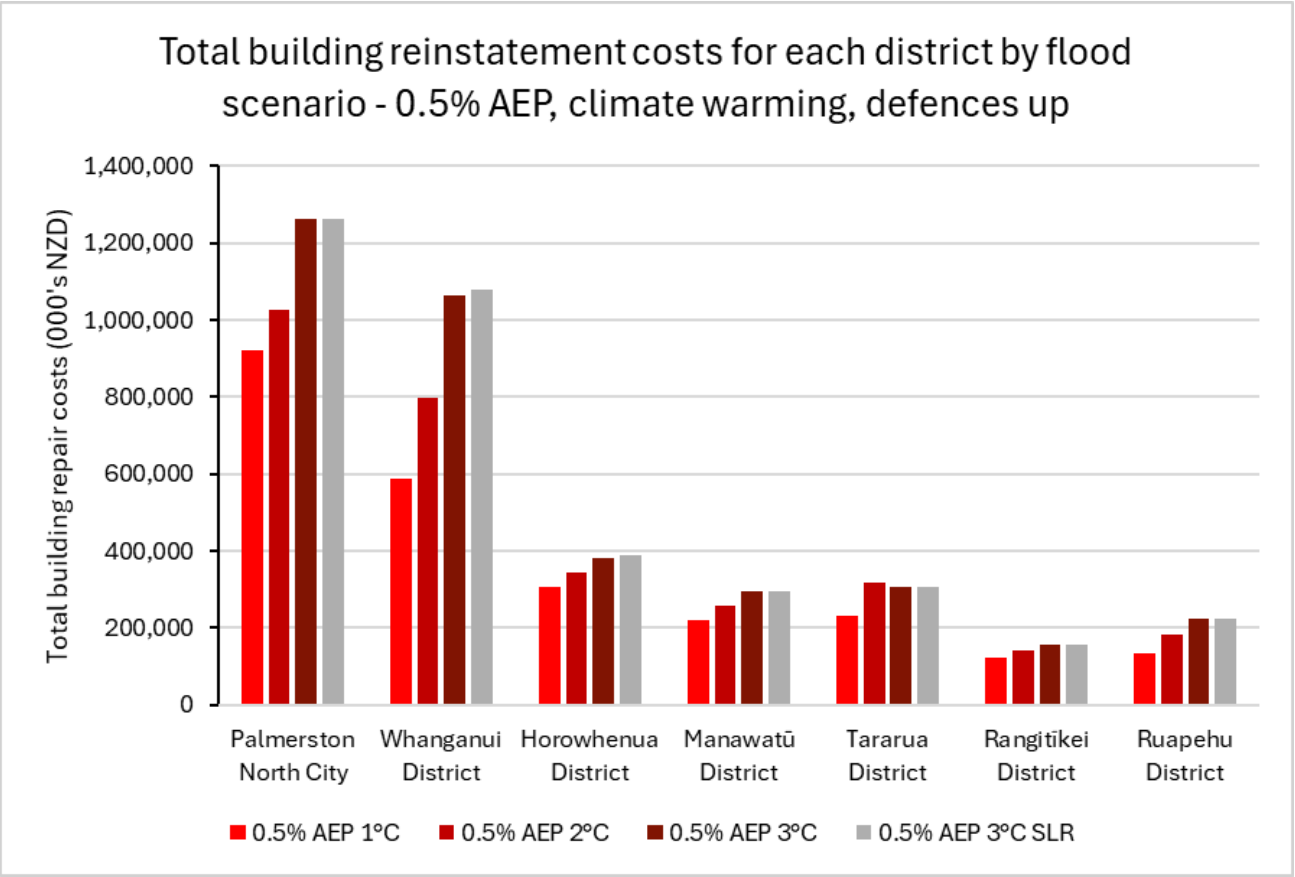


Figure 19: Total building reinstatement costs by district for 0.5% AEP, climate warming scenarios with defences up.

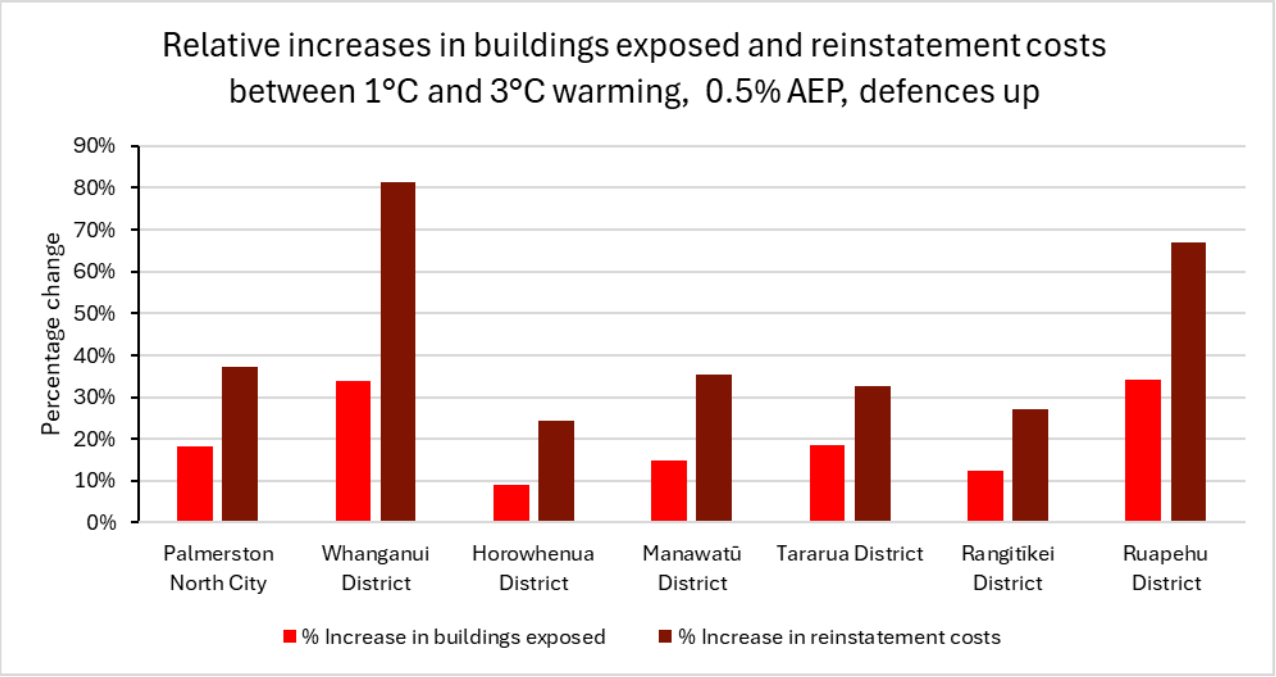


Figure 20: Changes to building exposure and building reinstatement costs between the 0.5% AEP flood events with 1°C and 3°C warming scenarios and defences up.

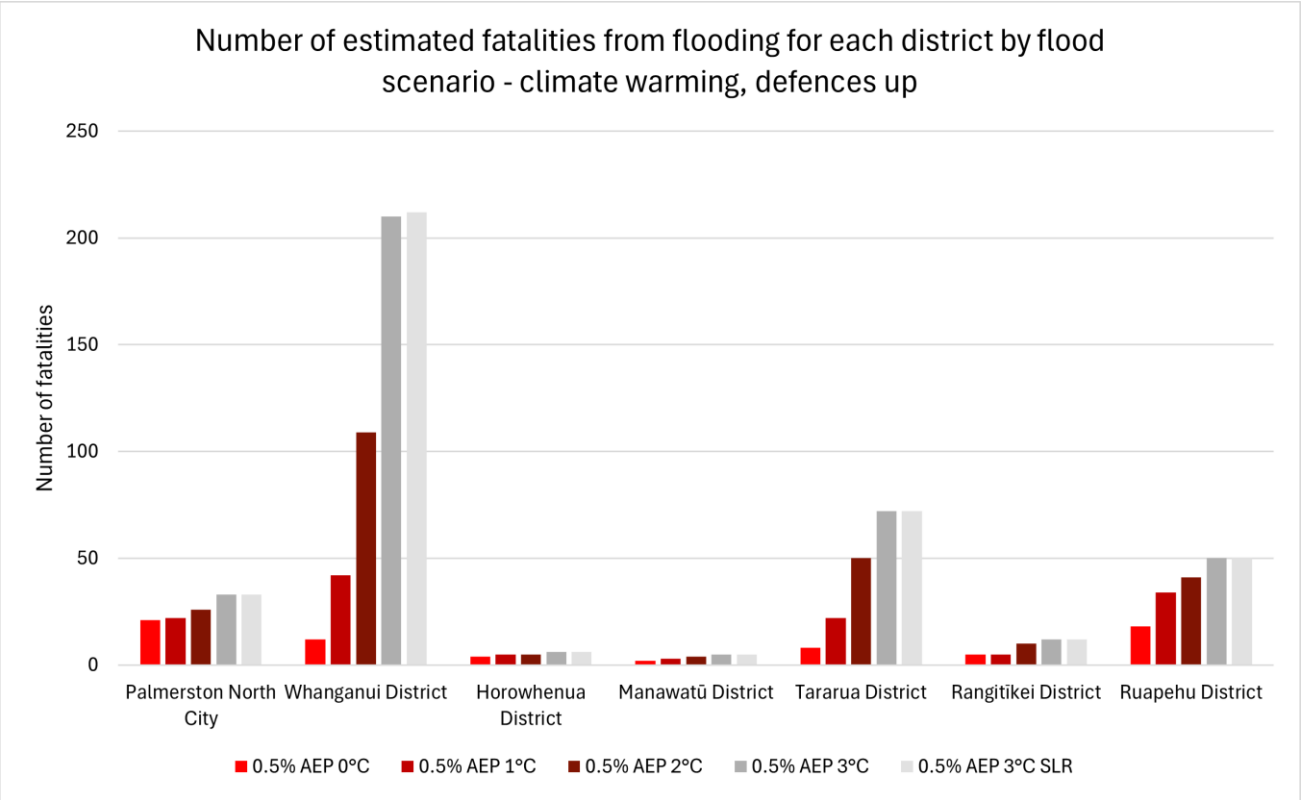


Figure 21: Total number of fatalities by district for 0.5% AEP, climate warming scenarios with defences up.

Table 16: Number of buildings impacted by type for a 0.5% AEP flood in 1°C, 2°C, 3°C AND 3°C +SLR climate warming scenarios[1]. Note that the primary and secondary structures have been combined.

REGION/ DISTRICT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING				0.5% AEP FLOOD – 2°C CLIMATE WARMING				0.5% AEP FLOOD – 3°C CLIMATE WARMING				0.5% AEP FLOOD – 3°C CLIMATE WARMING + SLR			
	NO. OF RESIDENTIAL BUILDINGS IMPACTED BY FLOODING	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS IMPACTED BY FLOODING	NO. OF RURAL BUILDINGS IMPACTED BY FLOODING	NO. OF OTHER BUILDINGS IMPACTED BY FLOODING	NO. OF RESIDENTIAL BUILDINGS IMPACTED BY FLOODING	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS IMPACTED BY FLOODING	NO. OF RURAL BUILDINGS IMPACTED BY FLOODING	NO. OF OTHER BUILDINGS IMPACTED BY FLOODING	NO. OF RESIDENTIAL BUILDINGS IMPACTED BY FLOODING	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS IMPACTED BY FLOODING	NO. OF RURAL BUILDINGS IMPACTED BY FLOODING	NO. OF OTHER BUILDINGS IMPACTED BY FLOODING	NO. OF RESIDENTIAL BUILDINGS IMPACTED BY FLOODING	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS IMPACTED BY FLOODING	NO. OF RURAL BUILDINGS IMPACTED BY FLOODING	NO. OF OTHER BUILDINGS IMPACTED BY FLOODING
HORIZONS REGION TOTAL	**41,528**	**2,941**	**9,049**	**1,714**	**45,402**	**3,202**	**10,013**	**1,884**	**49,621**	**3,465**	**10,766**	**2,020**	**49,854**	**3,488**	**10,758**	**2,025**
PALMERSTON NORTH CITY	12,887	869	803	360	13,713	934	916	387	15,157	1,019	1,049	419	15,158	1,019	1,049	417
WHANGANUI DISTRICT	8,653	574	934	311	10,129	665	1,045	370	11,737	737	1,127	422	11,867	757	1,131	425
HOROWHENUA DISTRICT	9,986	632	1,454	339	10,393	645	1,577	349	10,798	665	1,687	366	10,881	665	1,677	369
MANAWATŪ DISTRICT	3,732	251	2,341	234	3,954	276	2,604	253	4,188	309	2,772	259	4,185	309	2,772	259
TARARUA DISTRICT	2,349	213	1,734	153	2,689	240	1,921	171	2,787	257	2,050	181	2,798	259	2,048	182
RANGITĪKEI DISTRICT	1,979	257	961	171	2,071	281	1,044	182	2,197	295	1,105	187	2,208	295	1,105	187
RUAPEHU DISTRICT	1,942	145	822	146	2,453	161	906	172	2,757	183	976	186	2,757	184	976	186

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

3.4 HORIZONS REGIONAL SUMMARY BY DISTRICT – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 17 to Table 20 show the total building reinstatement costs and life costs estimated for all districts in the region for four flooding scenarios. These results for all four flooding scenarios assume current climate conditions (0°C increase) and that existing flood defences are down. The number of buildings and the total population exposed per flooding scenario are provided for context. Figure 22 provides an overview of the number of buildings exposed to flooding for each scenario for each district. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Similar to other scenarios, the removal of flood defences causes exposure and costs to increase across the region when comparing different AEP events for defences down scenarios. This trend is particularly pronounced in Palmerston North City (Figure 22), where the exposure of buildings and population increases when defences are removed. For example, under the 0.5% AEP event, the number of buildings exposed to flooding in Palmerston North increases by 33%, while population exposure increases by 22%.

When comparing the vulnerability assessment results of defences down against defences up, complex trends are revealed. For lower AEP events (5% AEP and 2% AEP) total regional exposure decreases when defences are removed, primarily due to a reduction in exposure in Palmerston North (explained in Section 3.1.3). However, for higher severity events (1% AEP and 0.5% AEP) exposure and costs increase across all districts. Generally, most districts experience an increase in exposure across all scenarios when defences are removed. For example, in Manawatū, building exposure increases by 1,390 and 1,575 for the 5% and 0.5% AEP events, respectively, when comparing defences-up to defences-down scenarios. These results show that the removal of flood defences generally leads to increased risk and costs, especially for more severe flood events. This highlights the critical role that flood defences play in reducing risk from major flood events, even though the relationship between defences and exposure can be district or flood magnitude (AEP) specific.

Table 17: Regional summary by district – Vulnerability metrics for Level A regional model results for a 5% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences down.

REGION/DISTRICT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6,7]
HORIZONS REGION TOTAL	**208,671**	**40,757**	**16,527**	**1,433,703**	**180,389**	**34,375**	**28**	**34,647**
PALMERSTON NORTH CITY	55,246	9,521	4,320	482,542	66,586	11,311	8	9,886
WHANGANUI DISTRICT	35,020	6,826	3,264	256,695	33,444	6,145	5	5,787
HOROWHENUA DISTRICT	33,924	10,649	3,203	241,164	25,770	8,828	4	5,129
MANAWATŪ DISTRICT	28,012	5,800	2,178	186,346	22,106	3,844	2	2,768
TARARUA DISTRICT	23,114	3,415	1,528	143,159	13,563	1,901	3	3,777
RANGITĪKEI DISTRICT	19,038	2,560	1,141	70,023	11,386	1,490	1	1,510
RUAPEHU DISTRICT	14,317	1,986	893	53,773	7,534	856	5	5,790

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 18: Regional summary by district – Vulnerability metrics for Level A regional model results for a 2% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences down.

REGION/DISTRICT[2]	2% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF EXPOSED BUILDINGS[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**45,036**	**19,713**	**1,733,064**	**180,389**	**37,993**	**43**	**54,816**
PALMERSTON NORTH CITY	55,246	10,890	5,319	576,412	66,586	12,945	11	13,980
WHANGANUI DISTRICT	35,020	7,388	3,670	298,465	33,444	6,626	5	6,756
HOROWHENUA DISTRICT	33,924	11,355	3,721	278,865	25,770	9,356	5	5,921
MANAWATŪ DISTRICT	28,012	6,609	2,822	238,015	22,106	4,358	3	3,771
TARARUA DISTRICT	23,114	3,785	1,824	184,958	13,563	2,132	5	5,761
RANGITĪKEI DISTRICT	19,038	2,824	1,324	88,327	11,386	1,648	1	1,776
RUAPEHU DISTRICT	14,317	2,185	1,033	68,021	7,534	928	13	16,851

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 19: Regional summary by district – Vulnerability metrics for Level A regional model results for a 1% AEP flood scenarios[1] with no climate warming (0°C) and with existing flood defences down.

REGION/DISTRICT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF EXPOSED BUILDINGS[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**49,130**	**23,020**	**2,084,102**	**180,389**	**41,909**	**60**	**74,268**
PALMERSTON NORTH CITY	55,246	12,693	6,826	762,657	66,586	15,209	17	20,940
WHANGANUI DISTRICT	35,020	7,966	4,083	340,196	33,444	7,181	8	9,587
HOROWHENUA DISTRICT	33,924	11,864	4,077	307,966	25,770	9,688	5	6,692
MANAWATŪ DISTRICT	28,012	7,135	3,292	280,737	22,106	4,724	4	4,617
TARARUA DISTRICT	23,114	4,055	2,063	215,190	13,563	2,309	6	7,735
RANGITĪKEI DISTRICT	19,038	3,062	1,501	100,660	11,386	1,790	5	6,043
RUAPEHU DISTRICT	14,317	2,355	1,178	76,699	7,534	1,008	15	18,655

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 20: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenario[1] with no climate warming (0°C) and with existing flood defences down.

REGION/DISTRICT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF EXPOSED BUILDINGS[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6,7]
HORIZONS REGION TOTAL	**208,671**	**53,426**	**26,772**	**2,528,939**	**180,389**	**46,159**	**80**	**100,997**
PALMERSTON NORTH CITY	55,246	14,666	8,706	1,002,650	66,586	17,901	27	33,932
WHANGANUI DISTRICT	35,020	8,699	4,730	416,933	33,444	7,776	12	15,061
HOROWHENUA DISTRICT	33,924	12,252	4,330	328,467	25,770	9,942	6	7,324
MANAWATŪ DISTRICT	28,012	7,628	3,695	318,525	22,106	5,049	4	5,415
TARARUA DISTRICT	23,114	4,329	2,296	244,747	13,563	2,485	8	10,211
RANGITĪKEI DISTRICT	19,038	3,288	1,676	122,072	11,386	1,915	5	6,311
RUAPEHU DISTRICT	14,317	2,564	1,339	95,547	7,534	1,091	18	22,742

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

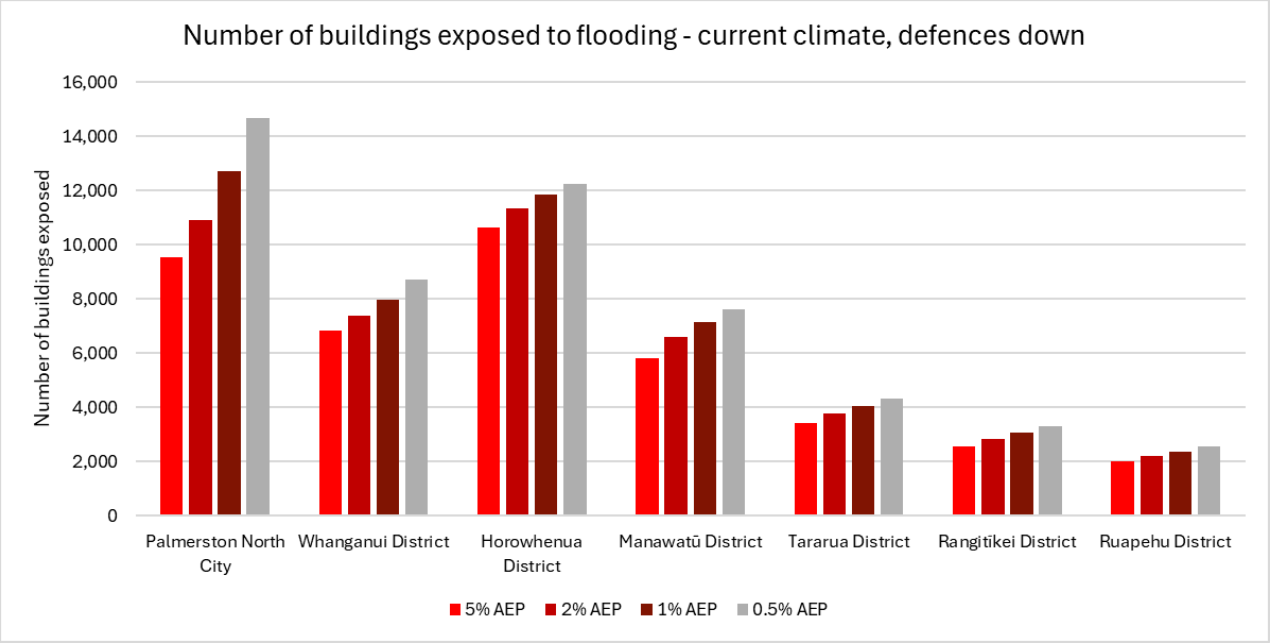


Figure 22: Number of buildings exposed for 5% to 0.5% AEP flood events with current climate and defences down.

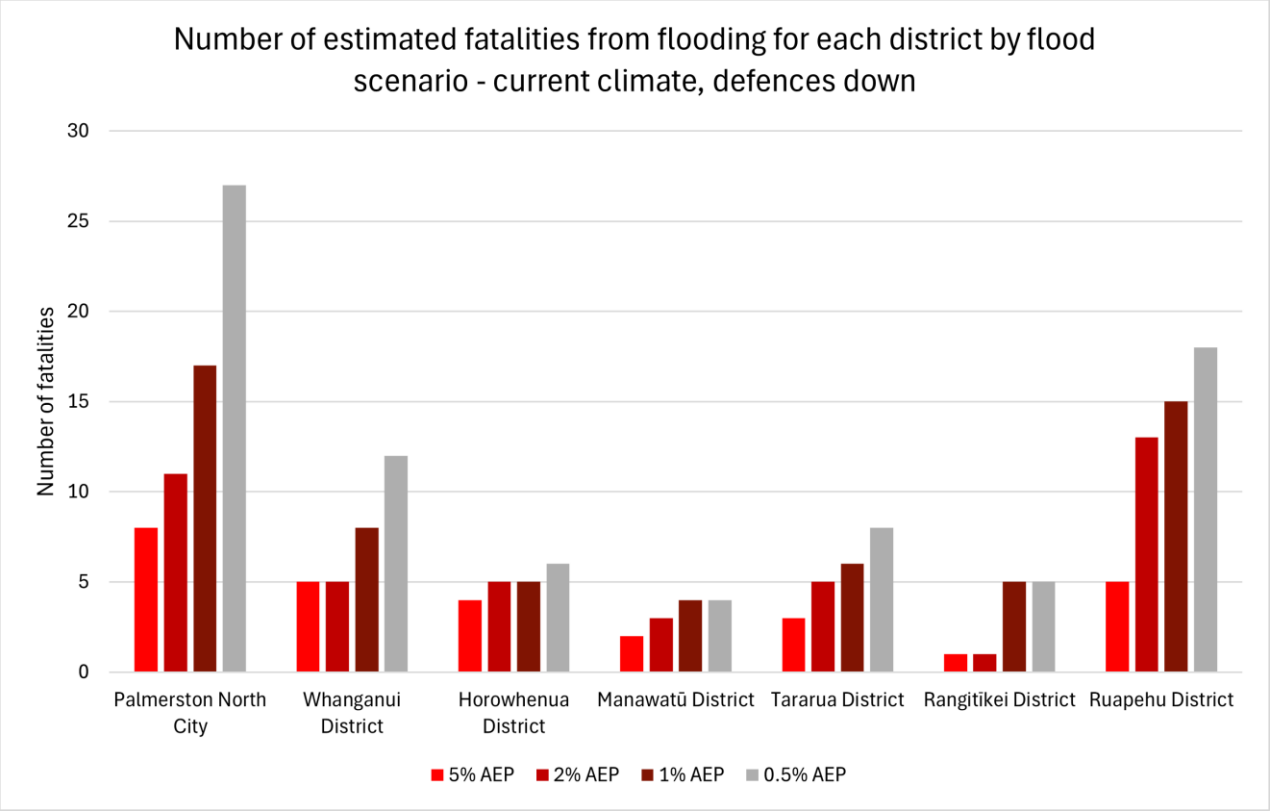


Figure 23: Number of fatalities for 5% to 0.5% AEP flood events with current climate and defences down.

Table 21: Number of buildings exposed to flooding by building type for a 0.5% AEP flood scenario[1] in current climate for defences up and defences down. Note that primary and secondary structures have been combined.

REGION/ DISTRICT[2]	TOTAL BUILDING NUMBERS				0.5% AEP FLOOD, CURRENT CLIMATE, DEFENCES UP				0.5% AEP FLOOD, CURRENT CLIMATE, DEFENCES DOWN			
	TOTAL NO. OF RESIDENTIAL BUILDINGS[3]	TOTAL NO. OF COMMERCIAL/ INDUSTRIAL BUILDINGS[3]	TOTAL NO. OF RURAL BUILDINGS[3]	TOTAL NO. OF OTHER BUILDINGS[3]	NO. OF RESIDENTIAL BUILDINGS IMPACTED BY FLOODING[4]	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS IMPACTED BY FLOODING[4]	NO. OF RURAL BUILDINGS IMPACTED BY FLOODING[4]	NO. OF OTHER BUILDINGS IMPACTED BY FLOODING[4]	NO. OF RESIDENTIAL BUILDINGS IMPACTED BY FLOODING[4]	NO. OF COMMERCIAL / INDUSTRIAL BUILDINGS IMPACTED BY FLOODING[4]	NO. OF RURAL BUILDINGS IMPACTED BY FLOODING[4]	NO. OF OTHER BUILDINGS IMPACTED BY FLOODING[4]
HORIZONS REGION TOTAL	**156,500**	**8,942**	**740,53**	**8,419**	**38,157**	**2,727**	**8,283**	**1,593**	**39,647**	**2,791**	**9,341**	**1,644**
PALMERSTON NORTH CITY	45,581	2,680	5,502	1,484	12,244	838	697	341	12,624	796	902	344
WHANGANUI DISTRICT	30,925	1,559	8,078	1,351	7,156	494	796	267	7,154	484	794	267
HOROWHENUA DISTRICT	27,380	1,108	8,098	964	9,530	617	1,359	327	9,663	621	1,639	329
MANAWATŪ DISTRICT	18,687	855	16,768	1,151	3,444	237	2,147	225	4,387	351	2,630	260
TARARUA DISTRICT	11,725	943	14,972	1,108	2,318	207	1,659	148	2,340	196	1,641	149
RANGITĪKEI DISTRICT	11,305	936	10,218	1,143	1,861	208	885	161	1,902	218	995	173
RUAPEHU DISTRICT	10,897	861	10,417	1,218	1,604	126	740	124	1,577	125	740	122

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

3.5 HORIZONS REGIONAL SUMMARY BY DISTRICT – CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 22 to Table 24 show the total reinstatement costs and life costs estimated for all districts in the region for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings and the total population exposed per flooding scenario are provided for context. Figure 24 provides a graph with the number of buildings exposed to each of the climate warming defences down scenarios for each district. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and can be used to understand the benefit of having flood structures in place. The results should not be used for site-specific analysis or compared to historic events.

The flood vulnerability assessment indicates that with increasing climate warming under a flood defences down scenario, regional flood exposure rises substantially. Between the 1°C and 3°C warming scenarios, the total number of buildings exposed to flooding across the Horizons Region increases by approximately 25%, while total building reinstatement costs rise by 56%. Population exposure, estimated fatalities and life costs also show consistent upward trends, reflecting escalating human vulnerability as the climate warms. At the district level, Palmerston North City, Whanganui, and Horowhenua districts experience the highest absolute exposure across all climate change scenarios. Palmerston North City records the highest percentage increase for buildings flooded, and the second highest percentage increase in building reinstatement costs. Shown in Figure 25, Palmerston North City also stands out for notable increases in all categories, particularly in human fatality costs and building reinstatement costs. These results highlight the compounding impact of climate warming on flood risk, especially in towns and settlements with high exposure and vulnerability.

Table 22: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenarios[1] with climate warming (1°C) and with existing flood defences down.

REGION /DISTRICT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF EXPOSED BUILDINGS[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**59,894**	**32,604**	**3,146,221**	**180,389**	**52,599**	**164**	**201,920**
PALMERSTON NORTH CITY	55,246	17,174	10,827	1,238,786	66,586	21,400	44	54,143
WHANGANUI DISTRICT	35,020	10,510	6,717	601,182	33,444	9,287	44	53,992
HOROWHENUA DISTRICT	33,924	12,801	4,675	375,223	25,770	10,311	7	8,102
MANAWATŪ DISTRICT	28,012	8,058	4,065	354,341	22,106	5,367	5	6,204
TARARUA DISTRICT	23,114	4,648	2,562	284,128	13,563	2,684	25	31,465
RANGITĪKEI DISTRICT	19,038	3,543	1,889	154,238	11,386	2,026	5	5,859
RUAPEHU DISTRICT	14,317	3,160	1,869	138,321	7,534	1,524	34	42,156

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 23: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenarios[1] with climate warming (2°C) and with existing flood defences down.

REGION /DISTRICT[2]	0.5% AEP FLOOD – 2°C CLIMATE WARMING							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF EXPOSED BUILDINGS[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s)[6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**68,359**	**40,426**	**4,042,891**	**180,389**	**61,863**	**298**	**368,768**
PALMERSTON NORTH CITY	55,246	21,833	15,065	1,747,946	66,586	27,713	73	89,845
WHANGANUI DISTRICT	35,020	12,204	8,525	809,837	33,444	10,766	111	137,110
HOROWHENUA DISTRICT	33,924	13,324	4,993	419,509	25,770	10,681	7	8,868
MANAWATŪ DISTRICT	28,012	8,451	4,417	391,627	22,106	5,668	6	7,066
TARARUA DISTRICT	23,114	5,033	2,858	316,184	13,563	2,953	50	62,046
RANGITĪKEI DISTRICT	19,038	3,755	2,094	172,841	11,386	2,134	10	12,603
RUAPEHU DISTRICT	14,317	3,759	2,474	184,949	7,534	1,948	41	51,230

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

Table 24: Regional summary by district – Vulnerability metrics for Level A regional model results for a 0.5% AEP flood scenarios[1] with climate warming (3°C) and with existing flood defences down.

REGION /DISTRICT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING							
	TOTAL NUMBER OF BUILDINGS[3]	NO. OF EXPOSED BUILDINGS[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000s) [6]	TOTAL POPULATION[3]	TOTAL POPULATION EXPOSED[3]	FATALITIES	TOTAL LIFE COST (NZD 000s)[6, 7]
HORIZONS REGION TOTAL	**208,671**	**75,201**	**47,624**	**4,923,415**	**180,389**	**69,189**	**470**	**582,224**
PALMERSTON NORTH CITY	55,246	25,015	18,758	2,217,133	66,586	32,038	108	134,362
WHANGANUI DISTRICT	35,020	14,012	10,552	1,068,643	33,444	12,551	211	261,195
HOROWHENUA DISTRICT	33,924	13,841	5,308	452,005	25,770	11,124	8	9,567
MANAWATŪ DISTRICT	28,012	8,788	4,680	412,694	22,106	5,883	6	7,889
TARARUA DISTRICT	23,114	5,472	3,238	358,595	13,563	3,158	74	91,373
RANGITĪKEI DISTRICT	19,038	3,951	2,231	189,399	11,386	2,275	13	15,533
RUAPEHU DISTRICT	14,317	4,122	2,857	224,946	7,534	2,160	50	62,307

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Districts are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6]Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7]The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

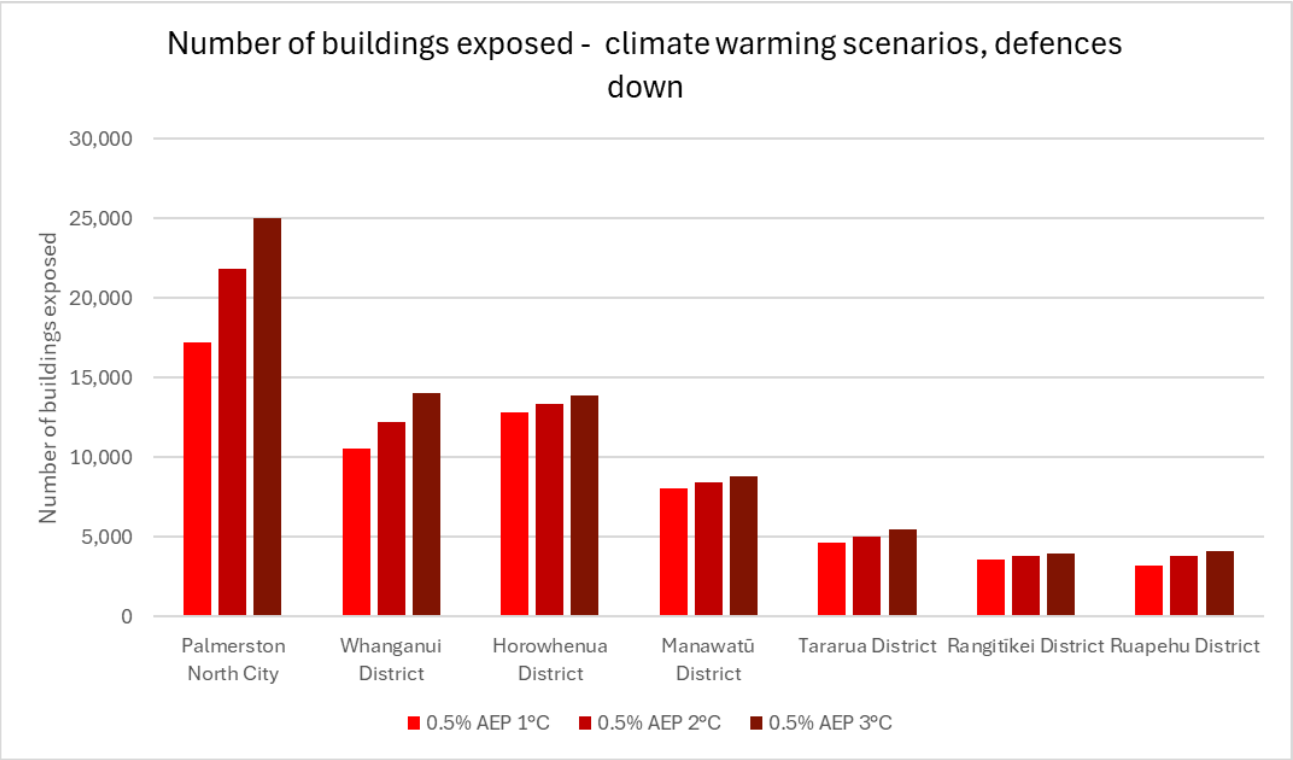


Figure 24: Total number of buildings exposed by district for climate warming scenarios with defences down.

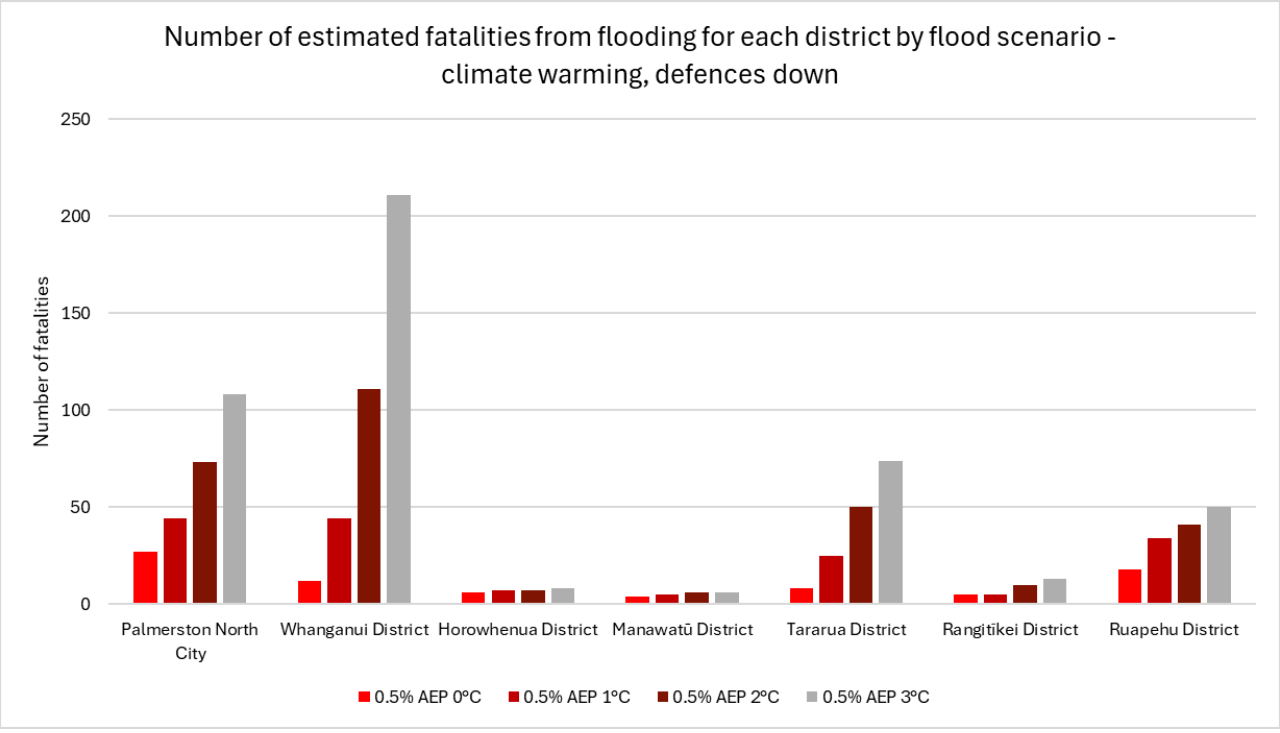


Figure 25: Total number of fatalities by district for climate warming scenarios with defences down

3.6 REGIONAL RESULTS: TOWNS AND SETTLEMENTS

This study has assessed the flood vulnerability of fifty-two towns and settlements (shown in Figure 3) across the Horizons Region. Table 25 presents a summary of each of these towns and settlements based on the flood vulnerability results for the 0.5% AEP event. This table presents the total number of buildings within each town and settlement, the total number of buildings exposed to flooding, the number of buildings that are contributing to reinstatement costs, and the total building reinstatement costs for that town or settlement. The number of buildings contributing to reinstatement costs (based on the total number of buildings within that town or settlement) is also provided. The building category and types (residential and secondary) have been combined within Table 25, however further detail on the breakdown of building categories across this flood scenario can be found in Appendix D1. The towns and settlements have been ranked by reinstatement value for buildings based on the 0.5% AEP flood event with current climate and defences up. Additional context is provided in Figure 26 and Figure 27, which present the number of buildings exposed to flooding against the number of buildings that contribute to reinstatement costs for each town and settlement.

The results presented below provide a relative understanding of flood risk throughout the region. In the development of a regional flood model, and using this to analyse vulnerability, a consistent methodology has been used to assess and understand risk. These results can help identify high-risk areas, inform funding allocation for flood protection assets, and enable comparison of mitigation costs against potential flood losses - supporting evidence-based investment decisions. They also provide valuable input for land-use planning and emergency management. Results from the ranking can also be combined or reviewed in conjunction with the results of the Current State Analysis to understand what areas are highly exposed to flooding, and where further high-resolution modelling may already exist or may need to be acquired. It should be noted that other flood models may produce different results and should not be compared to the results of this assessment. This includes the National Flood Report and other flood models that have been developed and reviewed as part of the Current State Analysis Report. This is because these models have been produced at different scales, for different purposes, and will have different levels of representation of the stormwater network or extents of calibration. These rankings are based on indicative regional modelling and should not be relied on for site-specific conclusions.

3.6.1 RANKING OF REGIONAL RESULTS

The results from the ranking of towns and settlements results show that the predominantly urban towns and settlements, consistently have high exposure for buildings for flooding. These urban centres are focal points for exposure and losses and highlight the importance of flood protection schemes to perform to their intended level of services to protect these areas. Exposure is not limited to the larger urban areas, with some smaller towns and settlements showing disproportionately high exposure to flooding. This shows that smaller towns and settlements can experience concentrated vulnerability to flooding which may be influenced by their location near rivers or coastlines, or limited flood protection.

Palmerston North has both the highest total number of buildings (47,822), along with the highest number of buildings contributing to reinstatement costs (8,103). In the 0.5% AEP, in the current climate with flood defences up flood event, 17% of all buildings within Palmerston North are exposed to flooding (Table 25). This predominantly consists of residential buildings. Palmerston North also has the highest building reinstatement costs throughout the region at over $804M (Table 25), showing the concentration of risk within this area. In addition to building exposure, Palmerston North's large population increases overall flood risk. This combination of high population density and building exposure underscores the need for flood risk management to protect people and buildings within this area. Understanding the relative influences of pluvial and fluvial flooding was investigated as a case study (See Appendix I). Results from the case study show that at the 0.5% AEP event with current climate conditions, and flood defences up pluvial and fluvial contributions

to flooding are similar. This gives insight to strategic asset management by indicating the most efficient and relative allocation of mitigation resources. Due to the high flood exposure of Palmerston North, we would recommend detailed modelling (Level B), including further investment in the Level B Lower Manawatū Model produced as part of this project to provide a more refined understanding on flooding within the Palmerston North City. Building on this, the high level of exposure means a risk-based approach to asset management (see Section 5.3) identifies Palmerston North as a priority area. These results can directly inform strategic decisions, emphasising the importance of this area for asset classification, funding allocation, and prioritisation of mitigation measures.

Whanganui shows high building exposure for the 0.5% AEP event in the current climate and defences up. Total building reinstatement costs exceed $390M for 4,319 buildings damaged by flooding (Table 25). Like Palmerston North, the building exposure is primarily residential buildings. Flood risk is also influenced by the large population number. To better understand sources of flood risk and inform strategic asset management decisions, the relative contributions of fluvial and pluvial flooding were investigated as a case study (See Appendix I). Results indicate that at the 0.5% AEP event with current climate conditions and flood defences up, pluvial flooding is the predominant type of flooding in Whanganui. This finding highlights the importance of urban drainage solutions and supports prioritisation of asset management strategies that address surface water risk. Incorporating these insights into a risk-based approach (see Section 5.3) will help target mitigation measures, guide funding allocation, and ensure resources are directed to the most critical areas.

Levin and **Feilding**, the third and fourth largest towns by total number of buildings (16,911 and 12,604 respectively), also show notable building exposure to flooding. In the 0.5% AEP event under current climate conditions with flood defences up, Levin has 7,445 buildings exposed, while Feilding has 2,217. Despite these high building exposure numbers, the proportion of buildings contributing to reinstatement costs is relatively low compared to other towns; 8% in Levin and 4% in Feilding (Table 25). This equates to reinstatement costs of approximately $106M for Levin (1,328 buildings) and $56M for Feilding (443 buildings). Case study investigations were undertaken to better understand the influence of pluvial versus fluvial flooding in these towns (See Appendix I). Results indicate that both are predominantly affected by pluvial flooding, similar to Whanganui. While this insight informs flood risk management decisions (see Section 5.3), the overall lower building exposure and reinstatement costs mean these towns would rank lower on a proposed asset management priority list compared to higher-risk areas.

Despite a lower total number of buildings (2,852) in **Woodville,** 40% of all buildings contribute to flood reinstatement costs for the 0.5% AEP event (Table 25). Shown in Figure 26 and Figure 27, Woodville also has a high proportion (83%) of buildings that are exposed contributing to reinstatement costs for this event. These two results reflect a greater proportional impact of flooding on property owners within this area. This results in total building reinstatement costs exceeding $135M, which is third highest within the region. Predominantly it is residential and rural buildings exposed to flooding. Results from this study may differ to modelling produced that has been reviewed as part of the Current State Analysis (WSP & NIWA, 2025b). This is because this modelling is produced for a different purpose, and is at a higher resolution. Enhanced vulnerability modelling could be completed with existing detailed modelling for Woodville, which would enhance understanding on where the exposure and risk is. This would guide decision making for flood protection assets or be used for informing emergency management.

Other smaller towns and settlements, such as **Tangimoana**, **Koitiata**, **Waitārere Beach** and **Mangatainoka** show similar trends to Woodville, where there is a high proportion (over 80%) of buildings that are exposed to flooding being damaged and contributing to reinstatement costs. This indicates that even in smaller towns and settlements with fewer buildings, the concentration of development in flood prone areas can create vulnerabilities. In Mangatainoka the average reinstatement cost per building is high ($203K), suggesting damage to high-value buildings is causing disproportionate monetary losses.

Mangamutu, straddling the Mangahao and **Mangatainoka** Rivers, has a small number of buildings (340), however, the town ranks 15th for total reinstatement costs (Table 25). Here, 40% of buildings that are exposed contribute to reinstatement costs of over $20M, with an average reinstatement cost of around $955k. This is the highest average reinstatement cost of all towns and settlements within the region. Commercial/industrial and rural buildings contribute over 75% of the building exposure. This is an example where additional detailed flood modelling (Level C) could be conducted to better understand the exposure of individual properties and inform decision making on flood risk management.

Buildings that are outside of a town or settlement extent have been categorised into a grouping called '**Other'**. These buildings are dispersed across the district. Results of the vulnerability assessment highlight the high exposure of these buildings and the population within them, with 12% of buildings exposed to flooding at the 0.5% AEP event, with total reinstatement costs of over $200M (Table 25).

Over 60% of the buildings exposed to flooding and outside of the towns and settlements boundaries are rural. This is important because these buildings may fall outside of the extents of existing flood protection schemes and may indicate a gap in current flood risk management strategies. This suggests the need for further detailed flood modelling (such as Level B or C) outside of the towns and settlements or detailed investigations to better understand the exposure and make informed flood risk management decisions.

Table 25: Town/settlement rankings for 0.5% AEP flood event in the current climate with flood defences up, showing total number of buildings, total number exposed, and the percent based on building type.

Rank	Town/ Settlement	Total number of buildings	Total number of buildings exposed to flooding	Total number of buildings contributing to reinstatement costs	% of total buildings contributing to reinstatement cost	Total building reinstatement cost (000s)
1	Palmerston North	47,822	12,968	8,103	17%	$804,798
2	Whanganui	34,005	8,017	4,319	13%	$394,391
3	Woodville	2,851	1,374	1,143	40%	$135,400
4	Levin	16,911	7,445	1,328	8%	$106,778
5	Foxton	4,357	1,394	868	20%	$62,703
6	Feilding	12,604	2,217	443	4%	$56,206
7	Pahiatua	5,071	1,108	488	10%	$34,660
8	Marton	8,099	1,269	501	6%	$33,140
9	Mangatainoka	581	147	129	22%	$26,240
10	Foxton Beach	3,241	933	519	16%	$25,257
11	Taumarunui	5,081	663	381	7%	$22,813
12	Kairanga	1,605	483	282	18%	$22,042

Rank	Town/ Settlement	Total number of buildings	Total number of buildings exposed to flooding	Total number of buildings contributing to reinstatement costs	% of total buildings contributing to reinstatement cost	Total building reinstatement cost (000s)
13	Ohakune	3,026	577	309	10%	$21,684
14	Longburn	931	259	131	14%	$20,863
15	Mangamutu	340	52	21	6%	$20,065
16	Waitārere Beach	1,708	464	391	23%	$17,825
17	Tangimoana	1,147	515	431	38%	$16,073
18	Bulls	2,798	565	227	8%	$16,003
19	Ashhurst	3,964	649	187	5%	$13,982
20	Dannevirke	8,602	753	161	2%	$10,397
21	Linton	2,230	222	49	2%	$10,304
22	Rongotea	2,537	354	175	7%	$10,137
23	Hunterville	2,423	254	158	7%	$9,660
24	Raetihi	1,900	249	119	6%	$6,350
25	Himatangi Beach	1,106	236	134	12%	$5,517
26	Bunnythorpe	2,670	248	84	3%	$4,674
27	Manakau	1,506	284	94	6%	$4,608
28	Ōhura	751	71	33	4%	$4,069
29	Waiouru	980	82	24	2%	$3,810
30	Hokio Beach	907	182	104	11%	$3,690
31	Eketāhuna	2,734	178	65	2%	$3,633
32	Shannon	2,247	165	60	3%	$3,389
33	Taihape	4,329	123	50	1%	$3,325
34	Koitiata	302	96	83	27%	$3,220
35	Halcombe	2,353	105	59	3%	$3,110

Rank	Town/ Settlement	Total number of buildings	Total number of buildings exposed to flooding	Total number of buildings contributing to reinstatement costs	% of total buildings contributing to reinstatement cost	Total building reinstatement cost (000s)
36	Ōhau	1,416	153	52	4%	$2,755
37	Pohangina	1,542	150	50	3%	$2,720
38	Ohakea	589	103	28	5%	$2,692
39	Tokomaru	1,070	71	32	3%	$2,668
40	Pongaroa	1,011	69	33	3%	$2,197
41	Sanson	1,296	108	47	4%	$2,187
42	Rātana	379	69	35	9%	$1,785
43	Waikawa Beach	565	82	49	9%	$1,415
44	Kimbolton	725	36	14	2%	$1,348
45	Kai Iwi	1,015	58	37	4%	$1,282
46	National Park	604	44	11	2%	$1,050
47	Mangaweka	971	39	14	1%	$1,040
48	Ōwhango	1,003	76	23	2%	$1,013
49	Norsewood	792	63	20	3%	$791
50	Ormondville	1,094	66	17	2%	$460
51	Rangataua	486	36	16	3%	$460
52	Raurimu	394	35	10	3%	$266
53	Other	39,243	4,801	2,675	7%	$201,411

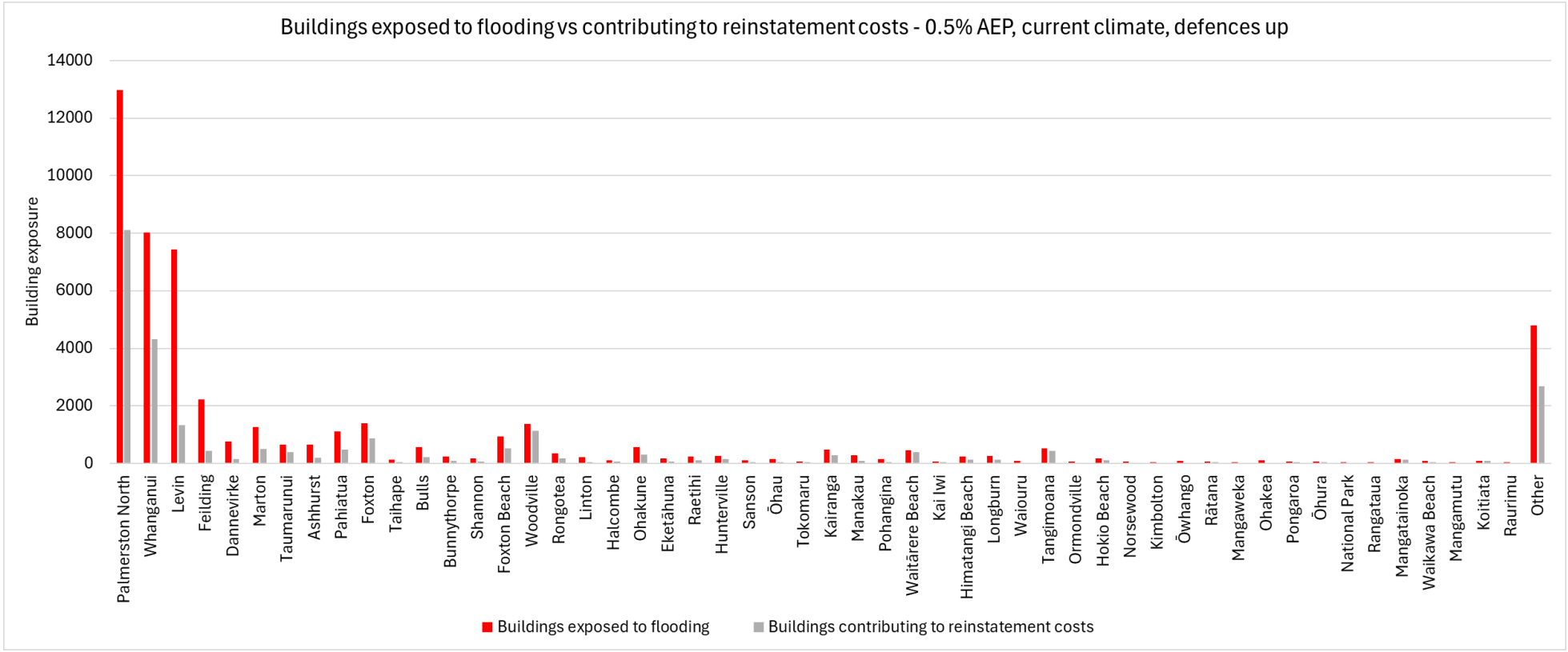


Figure 26: Total buildings exposed to flooding against total buildings contributing to reinstatement costs for each town/settlement for 0.5% AEP event with current climate and defences up. Towns and settlements have been ordered by population number.

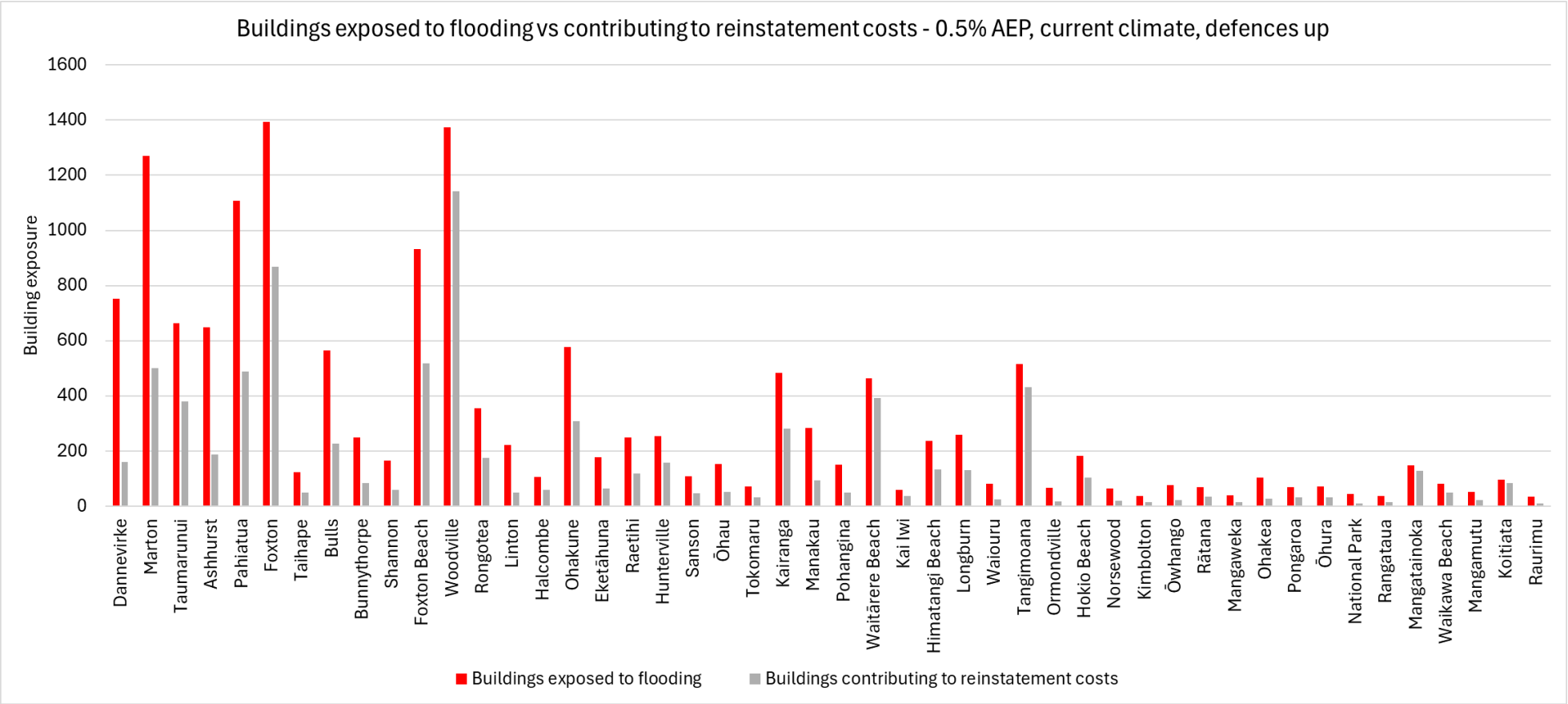


Figure 27: Total buildings exposed to flooding against total buildings contributing to reinstatement costs for each town/settlement for 0.5% AEP event with current climate and defences up. Towns and settlements have been filtered to exclude the four main urban centres and 'other'.

4 DISTRICT RESULTS

This section presents the results and describes some of the observations for the flood vulnerability of each district and city within the Horizons Region. It includes an overview of each area, detailing towns and settlements, population figures, and the existing flood management schemes that protect them. Results for current and future climate conditions are presented, as well as an assessment of the flood vulnerability with the removal of flood defences. As explained in Section 1.3, the results are derived from Level A scale flood modelling which provides a regional-scale vulnerability assessment and comparative risk analysis for the entire Horizons Region. The following should be considered when reviewing the results:

- The study methodology assumes a uniform flood event across the region incorporating multiple flood scenarios, with all rivers and pluvial areas flooding simultaneously. This means results may be overstated, and do not represent actual flood events.
- The results have not been calibrated against historic flood events.
- Urban stormwater networks have been excluded from the modelling methodology. This means results may be overestimated for dense urban areas where pluvial flooding has a greater influence.
- Due to the regional scale of modelling used for this assessment, the results are not suitable for site specific decision-making.

4.1 PALMERSTON NORTH CITY

4.1.1 CITY OVERVIEW

Palmerston North City is located on the eastern part of the Manawatū Plains in the lower west of Aotearoa New Zealand's North Island, about 140 km north of Wellington. The city's population is 87,090 (per the 2023 Census), with the official city limits comprising the main urban area and surrounding rural areas, extending to the Tararua Ranges, including the town of Ashhurst as well as the villages of Bunnythorpe and Longburn (Figure 28). Palmerston North is administered by a city council and serves as the seat of the Manawatū-Whanganui Region.

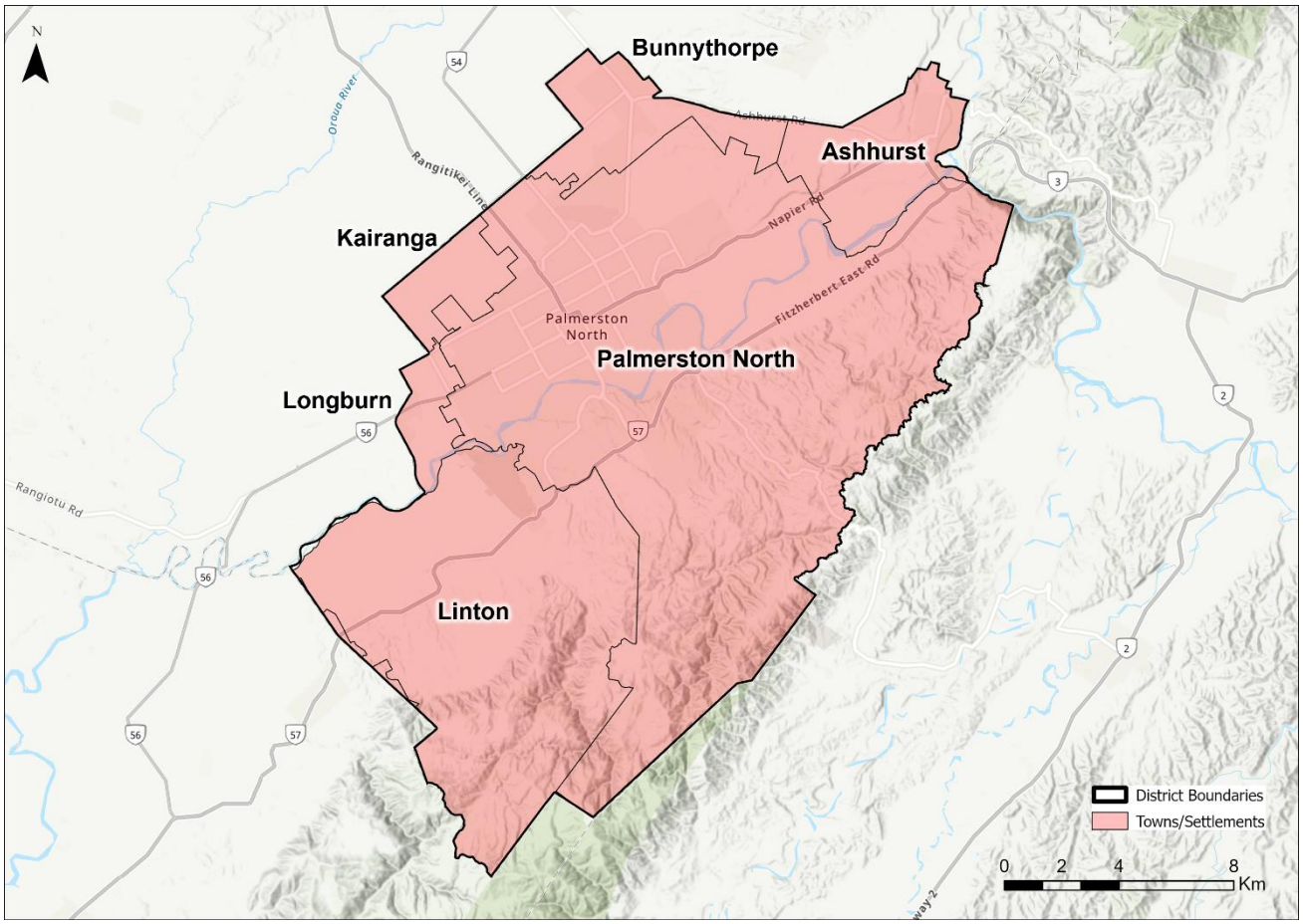


Figure 28: Map of Palmerston North City with town and settlement boundaries.

Palmerston North City has a relatively low median age of 35.7 years, compared to the national median of 38.1 (Stats NZ, 2025). The city has a lower proportion of older residents (15.7% aged 65+) than the national average, which slightly reduces vulnerability to flooding compared to areas with more elderly populations (Stats NZ, 2025). However, 20.9% of residents live in the most deprived quintile, and housing insecurity remains a concern, which can heighten vulnerability during flood events (Stats NZ, 2025).

Economically, Palmerston North's GDP is approximately $6.95 billion, supported by 8,457 businesses and 54,200 employees (Stats NZ, 2025). Key sectors include public administration and safety (11.3%), education and training (11%), and health care and social assistance (12%), reflecting its role as a regional service hub (Stats NZ, 2025). Retail trade (9.1%), manufacturing (7%), and construction (8.7%) also contribute significantly (Stats NZ, 2025). The city hosts major institutions like Massey University and Palmerston North Hospital, making it an important urban hub within the wider region (Palmerston North City Council, 2024). While agriculture is not a significant portion of the city's economy (2%), surrounding areas rely on agri-food industries, linking the urban economy to regional farming (Palmerston North City Council, 2024).

4.1.2 FLOOD MANAGEMENT SCHEMES

Palmerston North City is protected by five flood management schemes. Table 26 indicates that levels of service for flood protection schemes in the Palmerston North City range from containing a 20% AEP flood (Manawatū Drainage Scheme) up to a 1% AEP flood (Ashhurst, and Lower Manawatū) and up to 0.2% AEP for the Palmerston North urban area

Table 26: Flood management schemes protecting the Palmerston North City (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
ASHHURST	Provides drainage to rural land upstream of Ashhurst to Ulysses Road and flood protection to Ashhurst Township.	1% AEP.
LOWER MANAWATŪ	The Manawatū and specified tributaries protect 280 square km of pastoral, horticultural and urban land between the Manawatū Gorge and Foxton Beach.	1% AEP (0.2% AEP in Palmerston North).
MAKERUA	4,088 ha of rural land spanning between Horowhenua in the south to Levin (Palmerston North City) in the north.	1% AEP.
MANAWATŪ DRAINAGE	Provides land drainage to the rural land between the Manawatū and Ōroua Rivers downstream of Feilding. The Scheme also provides flood protection to a large section of the Taonui Basin.	20% AEP.
KAHUTERAWA	Channel maintenance scheme	Not assessed.

4.1.3 CITY FLOOD VULNERABILITY RESULTS

This section provides a summary of flood vulnerability in Palmerston North City under current and future climate conditions and compares scenarios with existing flood defences up and down.

The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.1.3.1 CITY FLOOD VULNERABILITY: CURRENT CLIMATE

Results from the regional flood vulnerability assessment show that vulnerability increases throughout the Palmerston North City as the flood severity increases. In the 5% AEP event, 11,703 buildings in total are exposed to flooding, with 56% (6,600) of them contributing to reinstatement costs more than $675M. For the 0.1% AEP event, these figures rise to 15,150 buildings exposed, with 61% (9,283) of these buildings contributing to over $947M in reinstatement costs. Population exposure increases by 3,797, the number of estimated fatalities increase from 15 to 22, while life costs increasing by more than $9M.

To further understand the drivers of flood risk in Palmerston North, a dedicated case study of the city was undertaken (see Appendix I). This focused on distinguishing the relative contributions of pluvial (surface water) and fluvial (river) flooding under the 0.5% AEP scenario. The analysis found that both sources contribute to building exposure and potential losses, highlighting the need for integrated flood risk management that addresses both riverine and surface water pathways. The case study also demonstrates the value of more detailed modelling with a higher resolution, representation of structures (Level C) to better represent the catchment processes and features which can inform targeted mitigation and investment decisions for Palmerston North's unique risk profile.

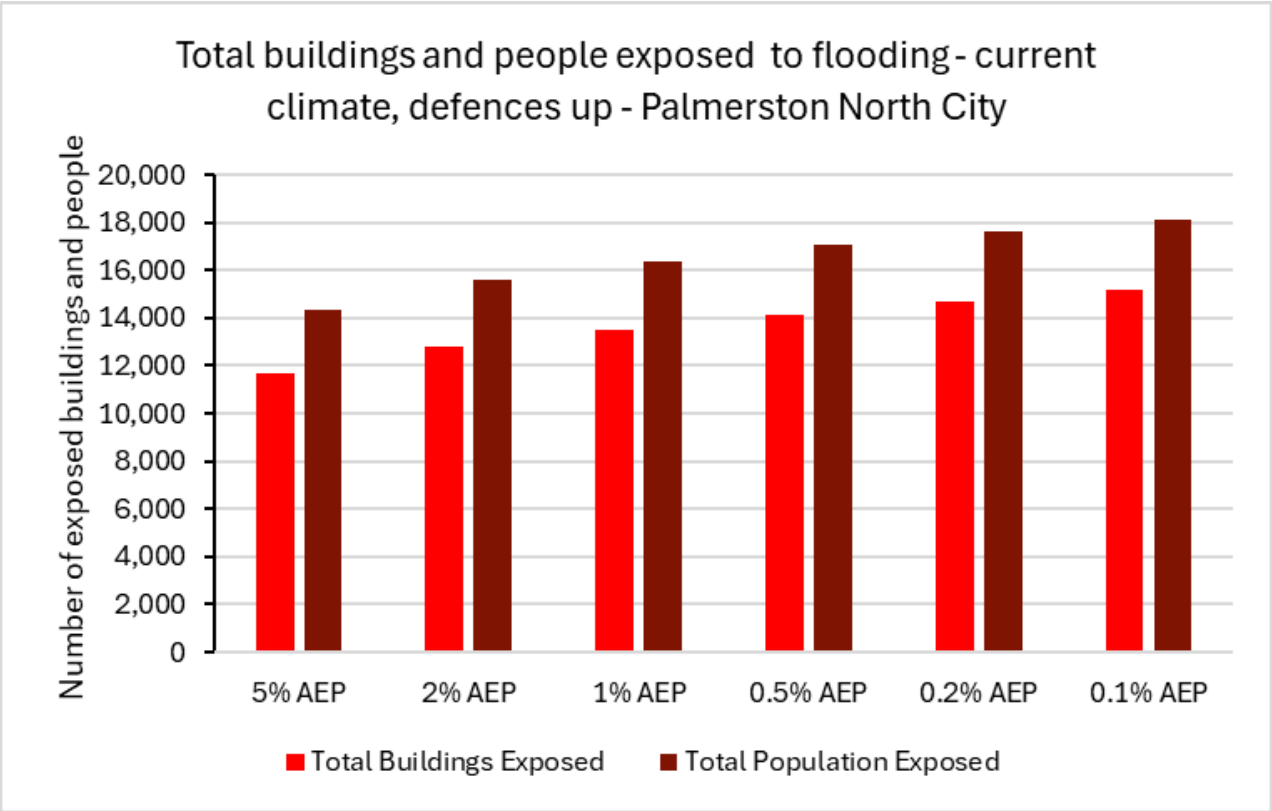


Figure 29: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Palmerston North City.

4.1.3.2 CITY FLOOD VULNERABILITY: WARMING SCENARIOS

Flood vulnerability increases within Palmerston North City under climate warming scenarios. Results in Table 27 reflect a 53% increase in life costs and a 41% increase in reinstatement costs between the current climate and 3°C scenarios, demonstrating Palmerston North City vulnerability to climate change.

Table 27: Palmerston North City– Vulnerability metrics for 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood defences up.

CLIMATE SCENARIO	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALITIES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	14,120	8,449	848,338	17,039	21	26,421
1°C CLIMATE WARMING	14,919	9,053	921,490	17,884	22	26,798
2°C CLIMATE WARMING	15,950	9,907	1,025,126	19,039	26	32,242
3°C CLIMATE WARMING	17,644	11,478	1,263,685	21,192	33	40,411
3°C CLIMATE WARMING with SEA LEVEL RISE	17,645	11,478	1,263,452	21,192	33	40,409

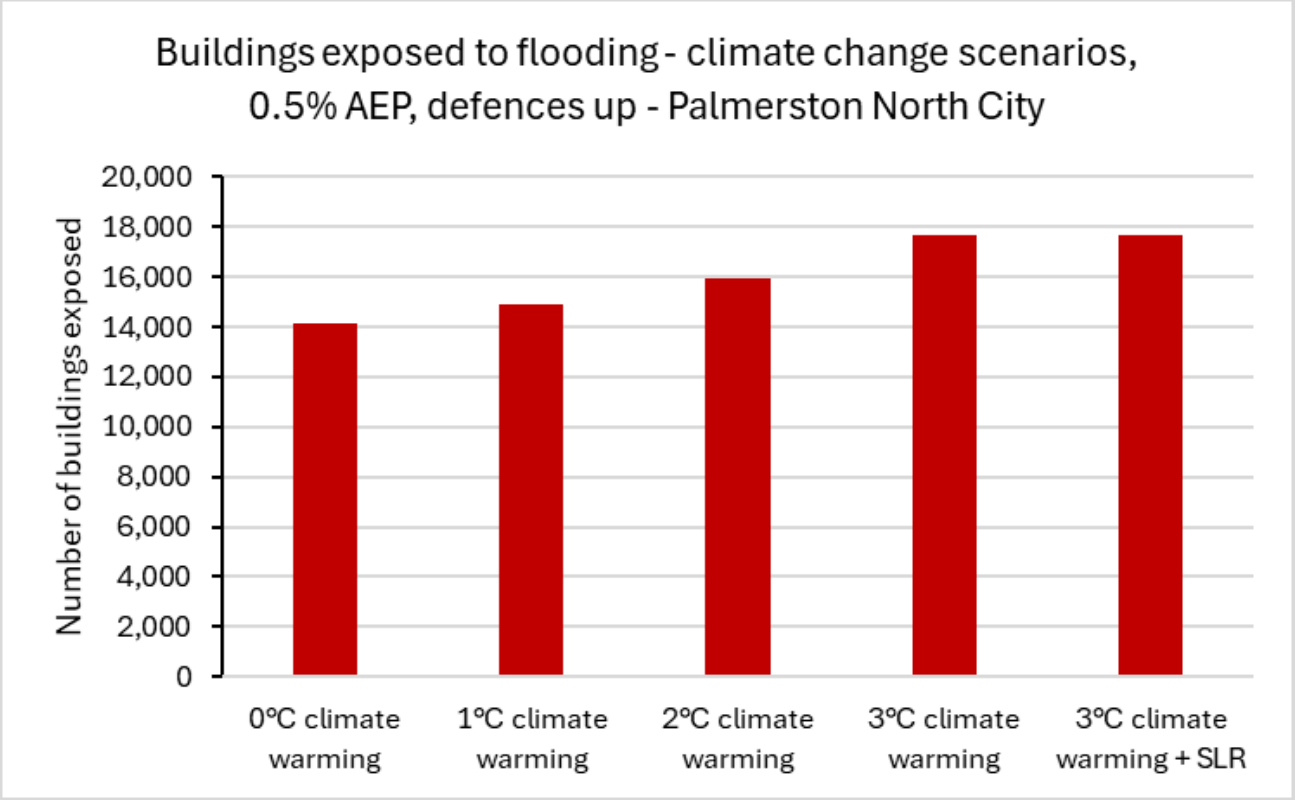


Figure 30: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C warming including with sea level rise) for the 0.5% AEP flood event with defences down for Palmerston North City.

The Palmerston North City case study (see Appendix I) investigated the effects of 1°C, 2°C and 3°C climate warming scenarios. Under the current climate, fluvial and pluvial flooding contribute similarly to exposure and building reinstatement costs. As warming increases, the fluvial influence strengthens and, in the 3°C warming scenario, becomes the dominant driver of exposure and building reinstatement costs.

4.1.3.3 CITY FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

Palmerston North City shows complex results when comparing vulnerability between defences up versus defences down. For the lower magnitude flood events (5%, 2% and 1% AEP), vulnerability assessment results for Palmerston North and Ashhurst show that the removal of flood defences reduces risk within the district (Figure 33 and Figure 34). In these areas, the exposed number of buildings and population decreases, along with reinstatement and life costs Figure 31 and Figure 32).

Exposure in Palmerston North increases when defences such as the Lower Manawatū Scheme are removed for the 0.5% AEP event. Here, building exposure increases by 546 buildings (Figure 33), with reinstatement costs increasing by more than $154M, and the number of buildings contributing to reinstatement costs increases by 47% (257 buildings). The Lower Manawatū Scheme includes stopbanks along the Manawatū River and provides protection for the Palmerston North area.

The vulnerability assessment results show that the implication of removing the scheme changes the floodwater distribution patterns, and reduces risk for frequent smaller events but amplifies damage for infrequent larger events. For these larger events, losses are concentrated in fewer but more vulnerable areas. Further analysis for the implications of removing defences around Palmerston North could include removing portions of the scheme such as the stopbanks, to better understand the spatial pattern of risk and highlight the most vulnerable areas, to enable more targeted investment.

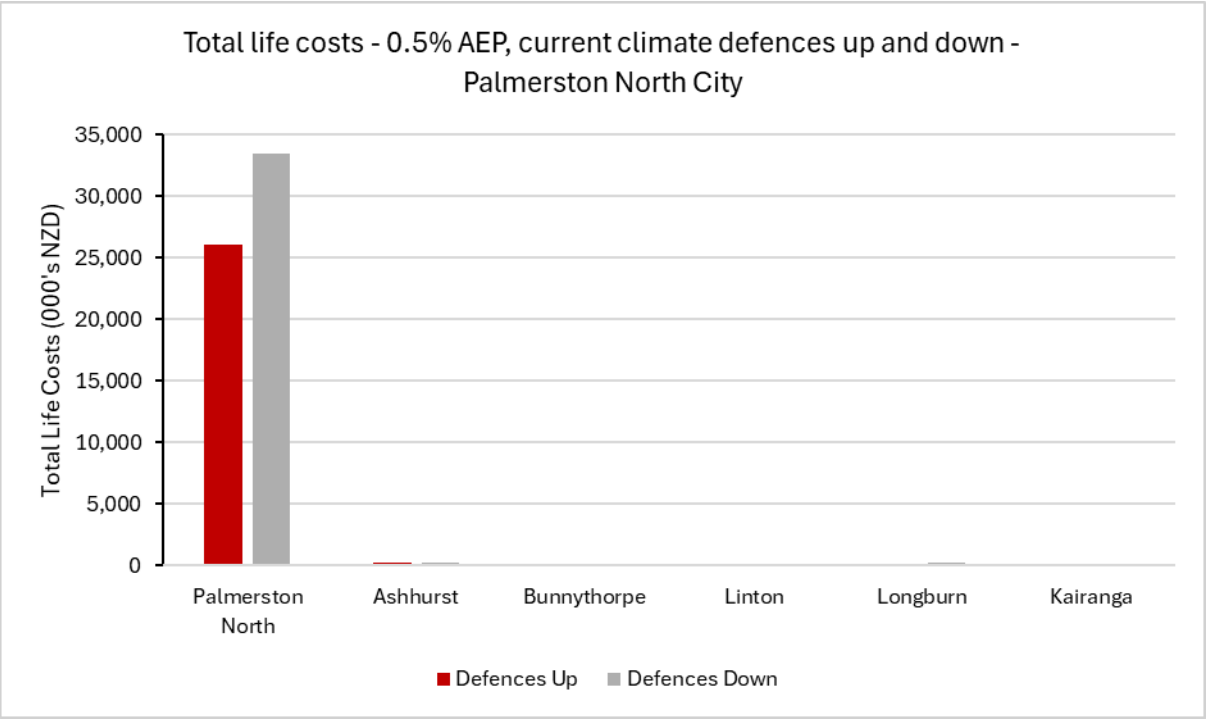


Figure 31: Total life costs for the 0.5% AEP event under today's climate with and without flood defences for Palmerston North City.

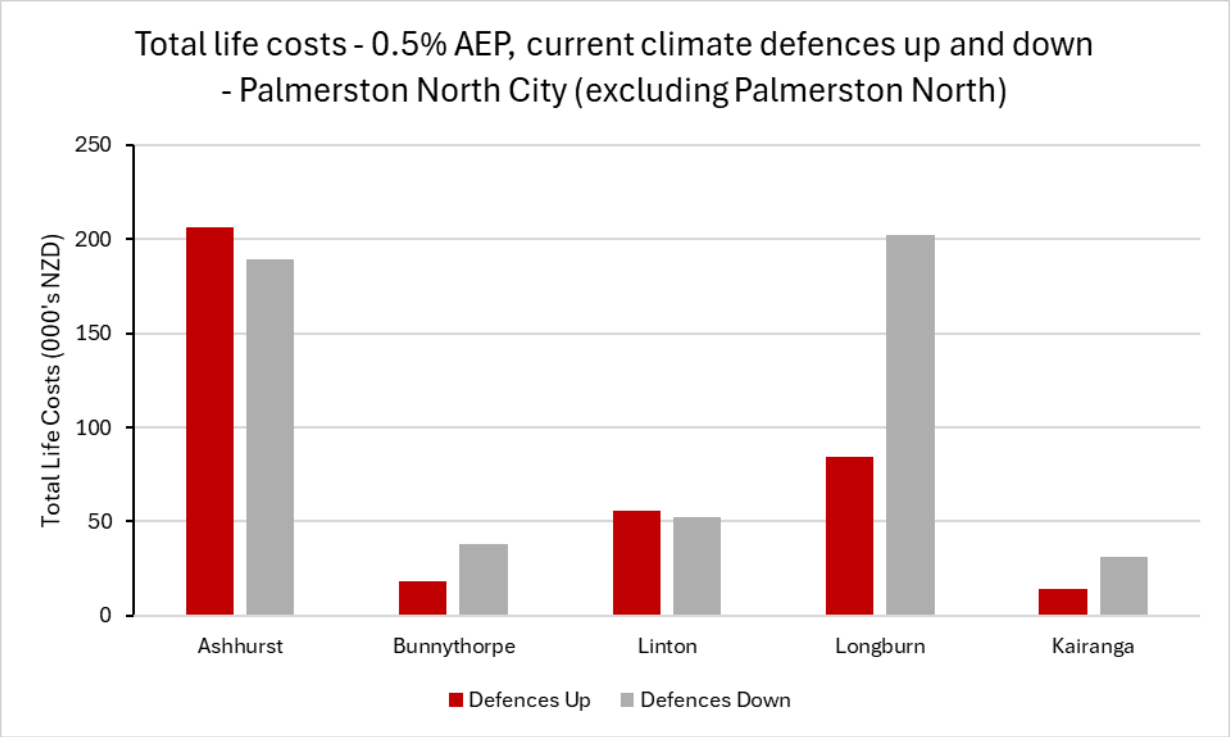


Figure 32: Total life costs for the 0.5% AEP event under today's climate with and without flood defences for Palmerston North City (excluding Palmerston North).

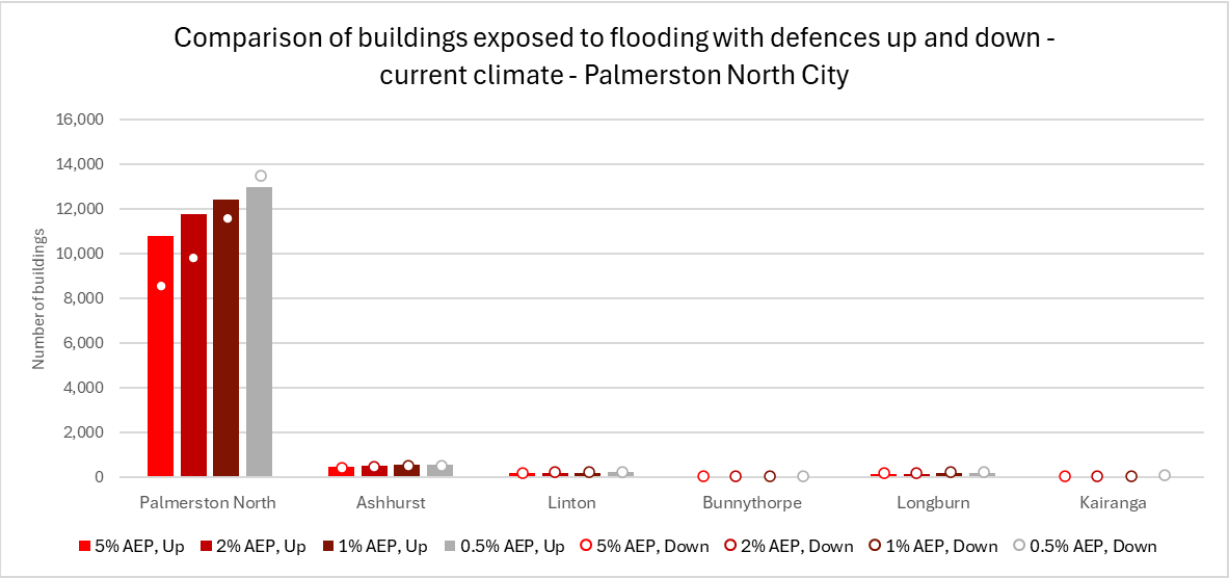


Figure 33: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Palmerston North City.

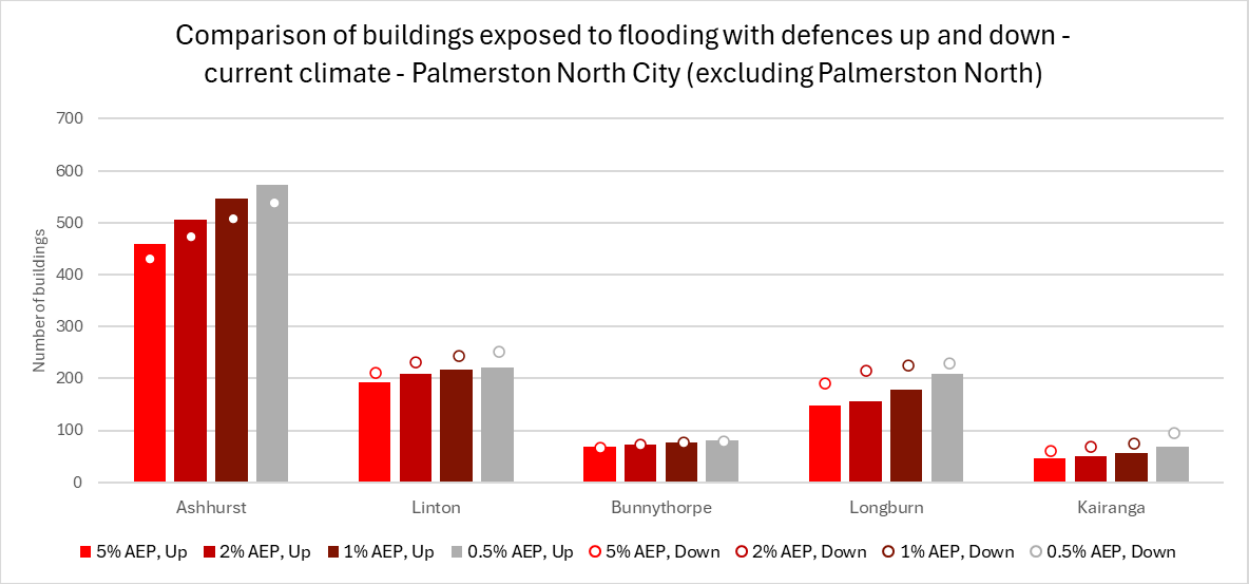


Figure 34: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Palmerston North City (excluding Palmerston North).

4.1.3.4 PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 28 and Table 29 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Palmerston North City for six flooding scenarios. The results for these scenarios assume no climate warming (0°C increase) and that existing flood defences are up. The number of buildings exposed, and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 28: Palmerston North City – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
PALMERSTON NORTH CITY	**11,703**	**6,600**	**675,593**	**14,336**	**18,041**	**12,779**	**7,445**	**775,442**	**15,599**	**21,276**	**13,485**	**7,957**	**794,946**	**16,382**	**23,063**
PALMERSTON NORTH[8]	10,792	6,391	648,873	13,698	17,782	11,785	7,195	745,580	14,892	20,984	12,410	7,667	762,190	15,617	22,742
ASHHURST[8]	458	98	8,273	457	153	505	121	8,823	503	174	547	138	10,022	537	186
LINTON	192	38	8,171	45	13	208	42	9,559	51	15	216	44	9,336	56	16
BUNNYTHORPE[8]	68	20	921	45	46	73	22	919	51	50	77	24	1,078	52	53
LONGBURN[8]	147	46	7,697	67	40	157	54	9,102	72	43	178	71	10,535	82	54
KAIRANGA[8]	46	7	1,658	24	7	51	11	1,459	30	10	57	13	1,785	38	12

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 29: Palmerston North City – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6,7]
PALMERSTON NORTH CITY	**14,120**	**8,449**	**848,339**	**17,039**	**26,421**	**14,681**	**8,893**	**899,975**	**17,645**	**28,155**	**15,150**	**9,283**	**947,034**	**18,133**	**27,695**
PALMERSTON NORTH[8]	12,968	8,103	804,798	16,236	26,043	13,455	8,511	855,269	16,774	27,754	13,884	8,862	897,027	17,239	27,262
ASHHURST[8]	573	158	11,827	564	206	611	159	11,540	604	231	620	171	12,429	619	245
LINTON	222	49	10,304	58	18	233	55	11,363	61	19	238	56	11,277	68	20
BUNNYTHORPE[8]	80	26	1,106	52	56	84	28	1,196	48	54	86	28	1,212	49	56
LONGBURN[8]	208	99	18,440	90	84	212	114	17,929	108	75	233	136	21,612	108	88
KAIRANGA[8]	69	14	1,864	39	14	86	26	2,678	50	22	89	30	3,477	50	24

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.1.3.5 PALMERSTON NORTH CITY – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) & EXISTING FLOOD DEFENCES UP

Table 30 and Table 31 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Palmerston North City for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 30: Palmerston North City – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C and 2°C) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
PALMERSTON NORTH CITY	**14,919**	**9,053**	**921,490**	**17,884**	**26,798**	**15,950**	**9,907**	**1,025,126**	**19,039**	**32,242**
PALMERSTON NORTH[8]	13,683	8,656	869,375	17,005	26,322	14,655	9,472	969,353	18,121	31,668
ASHHURST[8]	615	169	12,835	610	238	651	183	14,457	641	264
LINTON	241	59	11,849	70	20	254	68	12,378	75	27
BUNNYTHORPE[8]	82	29	1,243	52	58	87	29	1,254	53	61
LONGBURN[8]	227	120	23,656	108	144	229	134	25,035	108	204
KAIRANGA[8]	71	20	2,532	39	16	74	21	2,649	41	18

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 31: Palmerston North City – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
PALMERSTON NORTH CITY	**17,644**	**11,478**	**1,263,685**	**21,192**	**40,411**	**17,645**	**11,478**	**1,263,452**	**21,192**	**40,409**
PALMERSTON NORTH[8]	16,287	11,012	1,203,642	20,238	39,736	16,287	11,012	1,203,694	20,238	39,734
ASHHURST[8]	680	196	15,330	673	291	680	196	15,330	673	291
LINTON	268	74	12,784	77	25	268	74	12,784	77	25
BUNNYTHORPE[8]	92	31	1,304	56	64	93	31	1,304	56	64
LONGBURN[8]	231	134	27,341	104	272	231	134	27,056	104	272
KAIRANGA[8]	86	31	3,284	44	23	86	31	3,284	44	23

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.1.3.6 PALMERSTON NORTH CITY – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 32 and Table 33 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Palmerston North City for four flooding scenarios. The results for all four flooding scenarios no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 32: Palmerston North City – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS5	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
PALMERSTON NORTH CITY	**9,521**	**4,320**	**482,542**	**11,311**	**9,886**	**10,890**	**5,319**	**576,412**	**12,945**	**13,979**
PALMERSTON NORTH[8]	8,562	4,052	446,618	10,672	9,610	9,831	5,011	534,946	12,217	13,633
ASHHURST[8]	430	83	6,068	435	140	473	92	6,695	480	155
LINTON	211	57	9,819	49	17	232	63	11,495	62	23
BUNNYTHORPE[8]	67	19	866	45	45	72	22	882	51	48
LONGBURN[8]	190	91	17,061	76	60	214	108	20,012	94	102
KAIRANGA[8]	61	18	2,110	34	14	68	23	2,382	41	18

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 33: Palmerston North City – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[4]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
PALMERSTON NORTH CITY	**12,693**	**6,826**	**762,657**	**15,209**	**20,941**	**14,666**	**8,706**	**1,002,650**	**17,901**	**33,932**
PALMERSTON NORTH[8]	11,566	6,459	715,300	14,433	20,514	13,473	8,292	943,890	17,091	33,420
ASHHURST[8]	507	113	7,901	502	168	539	133	10,136	529	189
LINTON	244	69	11,568	72	32	251	78	13,021	75	38
BUNNYTHORPE[8]	76	24	1,038	52	51	79	26	1,062	52	52
LONGBURN[8]	226	132	24,491	106	154	229	133	31,097	104	202
KAIRANGA[8]	74	29	2,359	44	22	95	44	3,444	50	31

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

.

4.1.3.7 PALMERSTON NORTH CITY – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 34 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Palmerston North City for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 34: Palmerston North City – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
PALMERSTON NORTH CITY	**17,174**	**10,827**	**1,238,786**	**21,400**	**54,144**	**21,833**	**15,065**	**1,747,946**	**27,713**	**89,845**	**25,015**	**18,758**	**2,217,133**	**32,038**	**134,361**
PALMERSTON NORTH[8]	15,909	10,376	1,182,392	20,530	53,546	20,513	14,580	1,689,473	26,805	89,162	23,632	18,243	2,154,759	31,087	133,597
ASHHURST[8]	592	149	11,367	579	217	627	173	13,140	612	250	670	192	14,667	648	288
LINTON	264	84	14,464	85	43	274	92	15,159	87	47	283	97	15,577	87	45
BUNNYTHORPE[8]	81	29	1,189	52	54	85	29	1,202	53	55	90	31	1,264	56	57
LONGBURN[8]	230	136	24,973	104	249	230	136	24,510	104	291	232	136	26,398	108	329
KAIRANGA[8]	98	53	4,401	50	35	104	55	4,462	52	40	108	59	4,468	52	45

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.1.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

Flood exposure within Palmerston North City is concentrated in Palmerston North, the largest city in the region and home to the majority of the district's population. It represents more than 90% of building and population exposure, as well as life and building reinstatement costs. Palmerston North also stands out from a regional perspective, accounting for the highest building and people exposure. Building exposure increases from 10,792 to 13,884 from the 5% AEP to the 0.1% AEP events, while population exposure increases from 13,698 to 17,239. By the 0.1% AEP event, building reinstatement costs increase to almost $900M, and life costs to almost $28M. This high exposure is due to the city's large urban footprint, dense residential development, and proximity to flood-prone waterways. The dominance of Palmerston North in both regional and district flood risk highlights the importance of continued investment in the flood protection schemes protecting the city, such as the Lower Manawatū.

The smaller towns and settlements throughout Palmerston North City generally show incremental increases in exposure to flooding; however, the combined impacts remain much smaller than that in Palmerston North. This reflects the low building count and populations within these smaller towns relative to Palmerston North. Ashhurst shows consistent increases in exposure across all scenarios. The number of buildings exposed to flooding increases from 458 in the 5% AEP event to 620 in the 0.1% AEP event. Residential and rural buildings make up the majority of buildings exposed.

The exposure profile of other settlements within Palmerston North City changes, with lower exposure and risk to residential buildings, and a higher portion of building exposure from rural buildings. In Linton over 25% of buildings exposed to flooding at the 0.5% AEP event are classified as 'other' and may be military buildings.

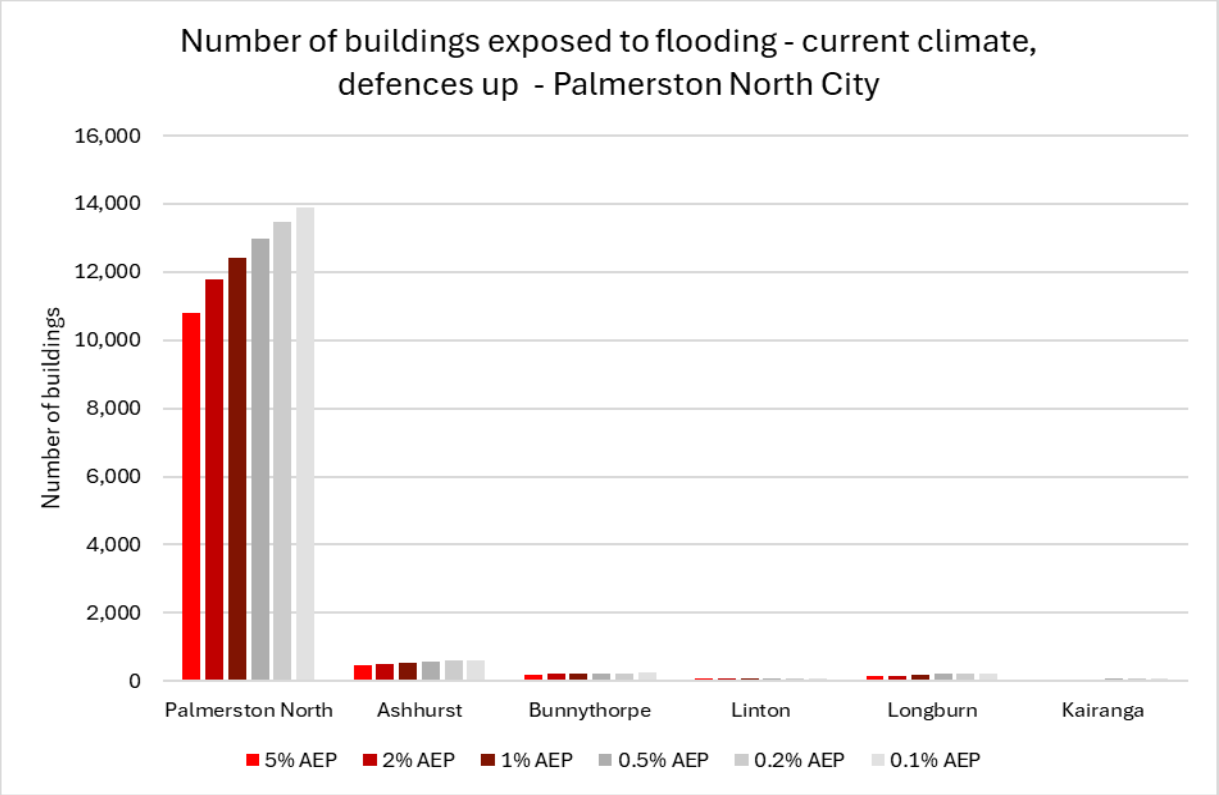


Figure 35: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Palmerston North City.

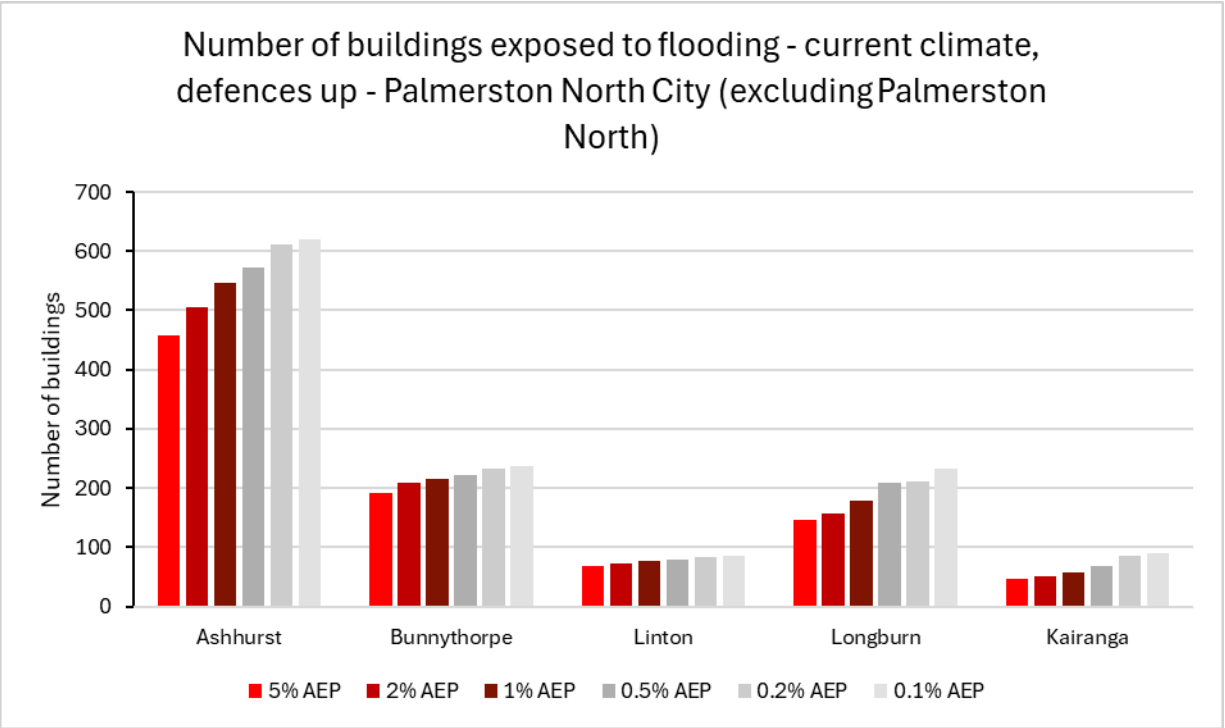


Figure 36: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for town/settlement within the Palmerston North City (excluding Palmerston North).

4.2 WHANGANUI DISTRICT

4.2.1 DISTRICT OVERVIEW

Whanganui District comprises the city of Whanganui and surrounding areas on the lower west coast of the North Island. The district is bounded by the Ruapehu District to the north, the Rangitīkei District in the east, the Tasman Sea in the south, and the South Taranaki and Stratford District in the west. A large proportion of the district is located within Whanganui National Park, bordering the Whanganui River which at 290 km is the longest navigable river in Aotearoa.

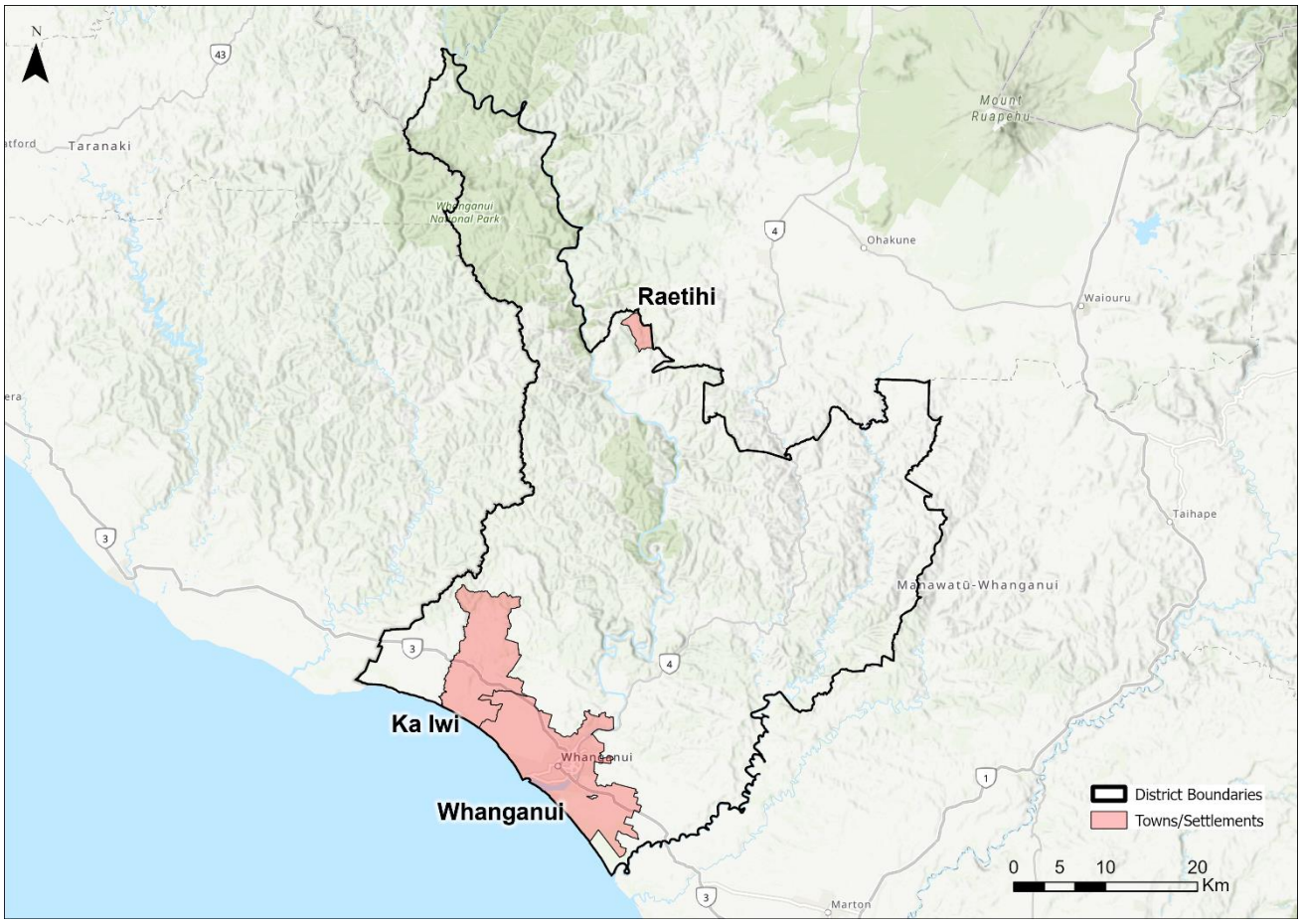


Figure 37: Map of Whanganui District with town and settlement boundaries. Note Raetihi extends into Whanganui District; however, there are no buildings within this extent so has been excluded from the list vulnerability result reporting for Whanganui District. For the purpose of reporting, any buildings outside of a town or settlement boundary have been categorised as 'Other'.

Whanganui District's population is 47,619 (according to the 2023 Census). The district has a high dependency ratio (70.3%) with 22% aged 65+ and only 58.7% of working age, indicating an ageing population and heightened vulnerability during emergencies (Whanganui District Council, 2023). A high proportion of residents (62.5%) live in high deprivation areas, which can limit access to quality housing, transport, and resources for flood preparedness (Whanganui District Council, 2023). Housing shortages persist, with over 300 families on the social housing register, and many homes report dampness and mould issues, potentially compounding health risks during flood events (Whanganui District Council, 2023).

Economically, Whanganui's GDP reached $2.28 billion in 2022, growing faster than the national average. Key industries include manufacturing, health care and social assistance, agriculture/forestry/fishing, public administration, and retail trade (Whanganui District Council, 2023). Tourism is expanding, with visitor spending up 2.5% in 2022, though accommodation shortages remain during peak periods (Whanganui District Council, 2023). Employment growth is steady, but 36.7% of jobs are low-skilled, and household incomes ($95,934) are well below the national average, ranking 45th out of 66 territorial authorities (Whanganui District Council, 2023). Agriculture remains significant but faces future challenges from climate impacts, which may shift economic reliance toward professional services and tourism (Whanganui District Council, 2023).

4.2.2 FLOOD MANAGEMENT SCHEMES

Whanganui District is protected by three flood management schemes. Table 35 indicates that levels of service for flood management schemes in the Whanganui District range from containing a 5% AEP flood (Matarawa) up to a 1% AEP flood (Lower Whanganui).

Table 35: Flood management schemes in the Whanganui District (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
LOWER WHANGANUI	Provide flood protection to selected Whanganui urban areas and bank protection to erosion areas, primarily through the use of vegetation management.	0.5-1% AEP.
MATARAWA	Protects rural land from river flooding.	5% AEP.
WHANGAEHU - MANGAWHERO	Channel maintenance scheme.	Not assessed.

4.2.3 DISTRICT FLOOD VULNERABILITY RESULTS

This section provides a summary of flood vulnerability in Whanganui District under current and future climate conditions and compares scenarios with existing flood defences up and down.

The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.2.3.1 DISTRICT FLOOD VULNERABILITY: CURRENT CLIMATE

Across the Whanganui district, flood vulnerability increases with the magnitude of flood events. At the 5% AEP level, 6,905 buildings are exposed to flooding, with 49% (3,364) of these incurring reinstatement costs totalling approximately $272M. These figures rise to 12,475 buildings exposed with 71% (8,876) of these incurring $843M in reinstatement costs at the 0.1% AEP level. Population exposure increases by 77.5% (6,201-11,009). The number of estimated fatalities increases from 5 to 81 while costs to live increase from approximately $6M to nearly $100M between the 5% and 0.5% AEP scenarios. These trends underscore the notable exposure of people and buildings to flooding in Whanganui District, even with flood protection structures up.

The Whanganui City case study (see Appendix I) was developed to clarify the dominant sources of flood risk in the urban area. Results indicate that pluvial flooding is the primary driver of building exposure and reinstatement costs at the 0.5% AEP event, with fluvial flooding becoming more significant under climate warming scenarios. This finding underscores the importance of urban drainage and stormwater management in Whanganui, as well as the need for ongoing investment in both river and surface water infrastructure. The case study provides a practical example of how localised analysis can inform asset management and prioritisation.

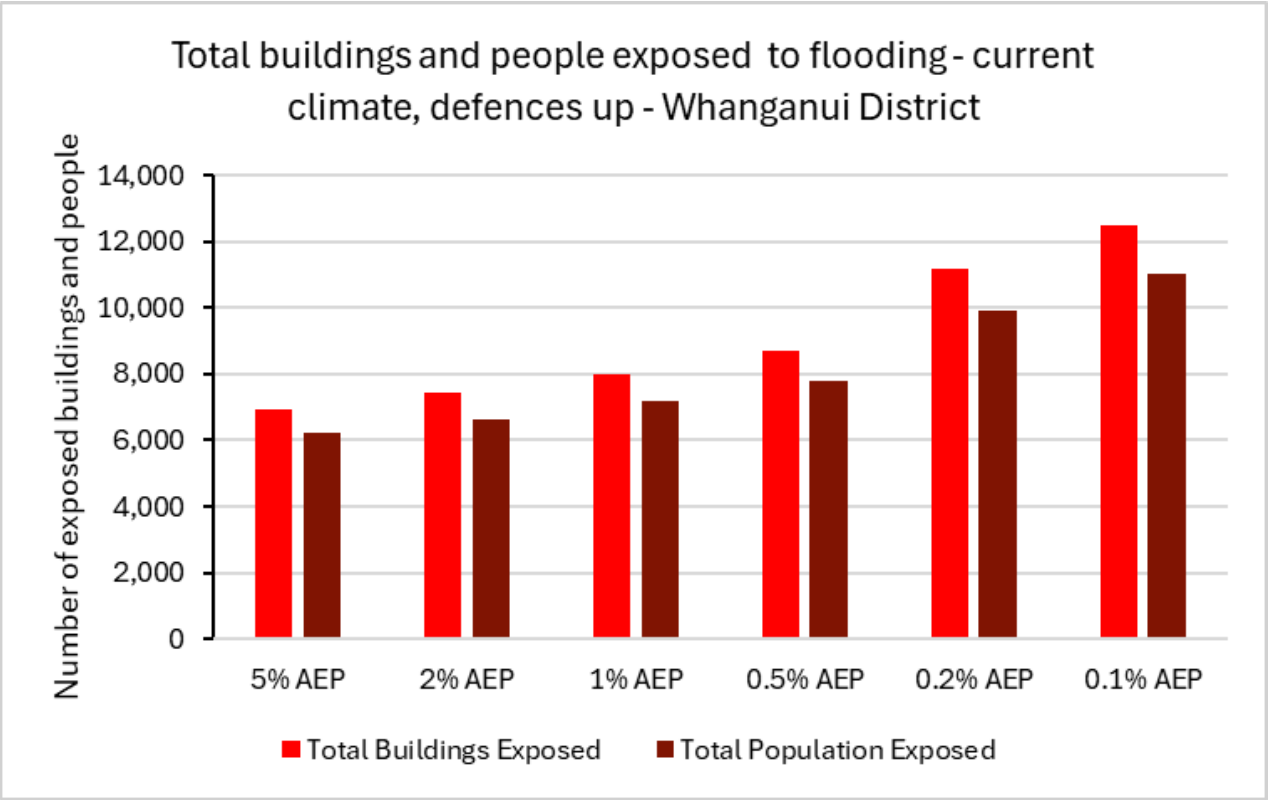


Figure 38: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Whanganui.

4.2.3.2 DISTRICT FLOOD VULNERABILITY: WARMING SCENARIOS

Climate warming increases flood vulnerability in Whanganui District. The progression shown in Table 36 reflects a significant increase in life costs and a 152% increase in reinstatement costs between the current climate and 3°C warming scenarios. Results from the pluvial-fluvial case study also highlight that with climate warming, the contribution of fluvial flooding for Whanganui City rises. The data clearly demonstrates the sensitivity of Whanganui District's flood vulnerability to climate change.

Table 36: Whanganui District – Vulnerability metrics for 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood Defences up.

CLIMATE SCENARIO	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALITIES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	8,713	4,756	421,773	7,776	12	15,031
1°C CLIMATE WARMING	10,472	6,659	586,805	9,264	42	52,094
2°C CLIMATE WARMING	12,209	8,519	799,015	10,768	109	135,038
3°C CLIMATE WARMING	14,023	10,552	1,064,011	12,553	210	260,001
3°C CLIMATE WARMING with SEA LEVEL RISE	14,180	10,728	1,079,969	12,661	212	262,914

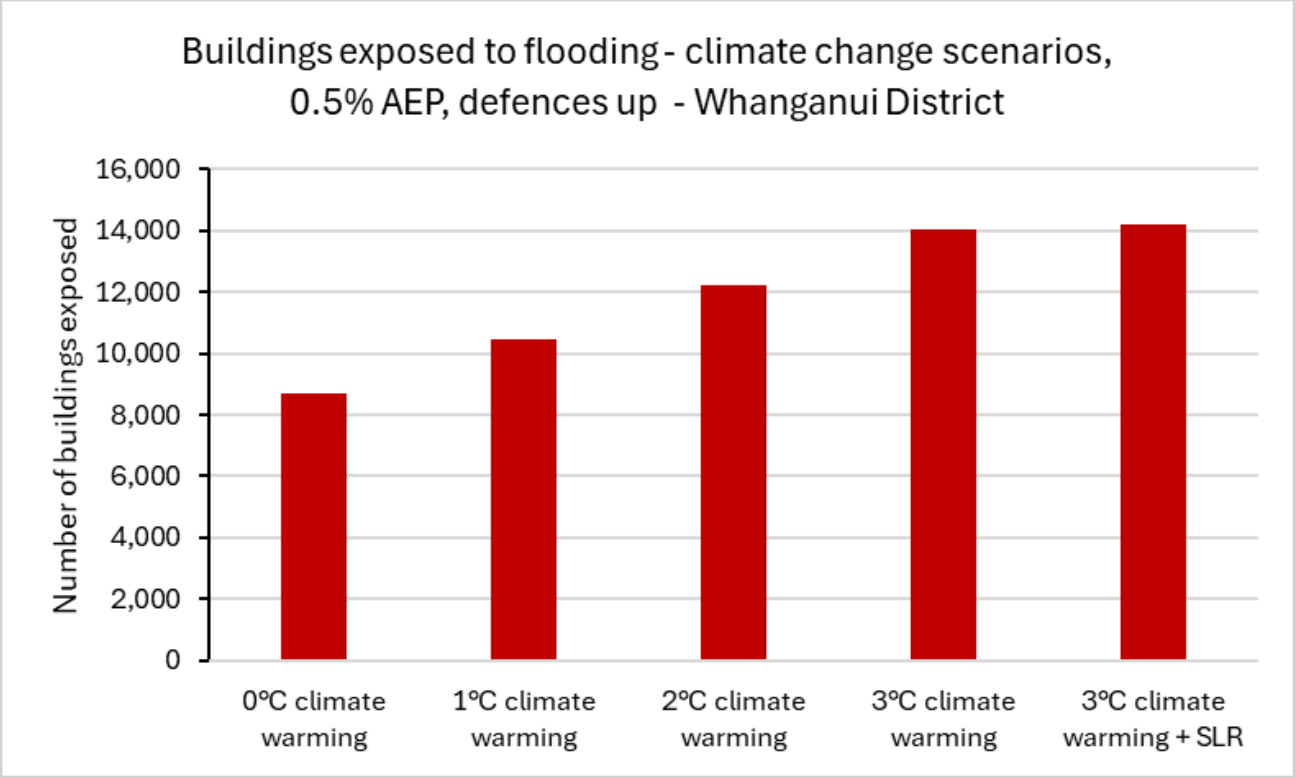


Figure 39: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C warming including with sea level rise) for the 0.5% AEP flood event with defences down for Whanganui.

The Whanganui City case study (see Appendix I) investigated the effects of 1°C, 2°C and 3°C climate warming scenarios. Under the current climate, pluvial flooding is the dominant driver of exposure and impacts. As warming increases, the fluvial contribution grows and, in the 3°C warming scenario, becomes the dominant driver of exposure and impacts.

4.2.3.3 DISTRICT FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

The results of the combined pluvial fluvial modelling show that the removal of flood defences in Whanganui District has minimal changes to the district's flood exposure. In Whanganui City there is a small increase life costs (Figure 40) and building exposure (Figure 41 and Figure 42) in the results for the defences down scenarios. Results from the Pluvial Fluvial Case Study (Appendix I) highlight the influence of pluvial flooding when defences are down in Whanganui. For example, the combined pluvial fluvial modelling estimates 8,188 buildings exposed to flooding under the 0.5% AEP event, however decreases by 93% (676) when reviewing fluvial modelling results. This reflects the higher proportion of pluvial flooding in this area along with the absence of stormwater network from the Level A regional model used for this vulnerability assessment. Improved detailed modelling, such as Level C modelling, incorporating the stormwater network and defence performance, will allow decision makers to better understand the performance of assets. For example, the modelling can suggest if stormwater network upgrades are required or support the use of alternate methods such as investment in flood protection assets to increase the level of service they provide.

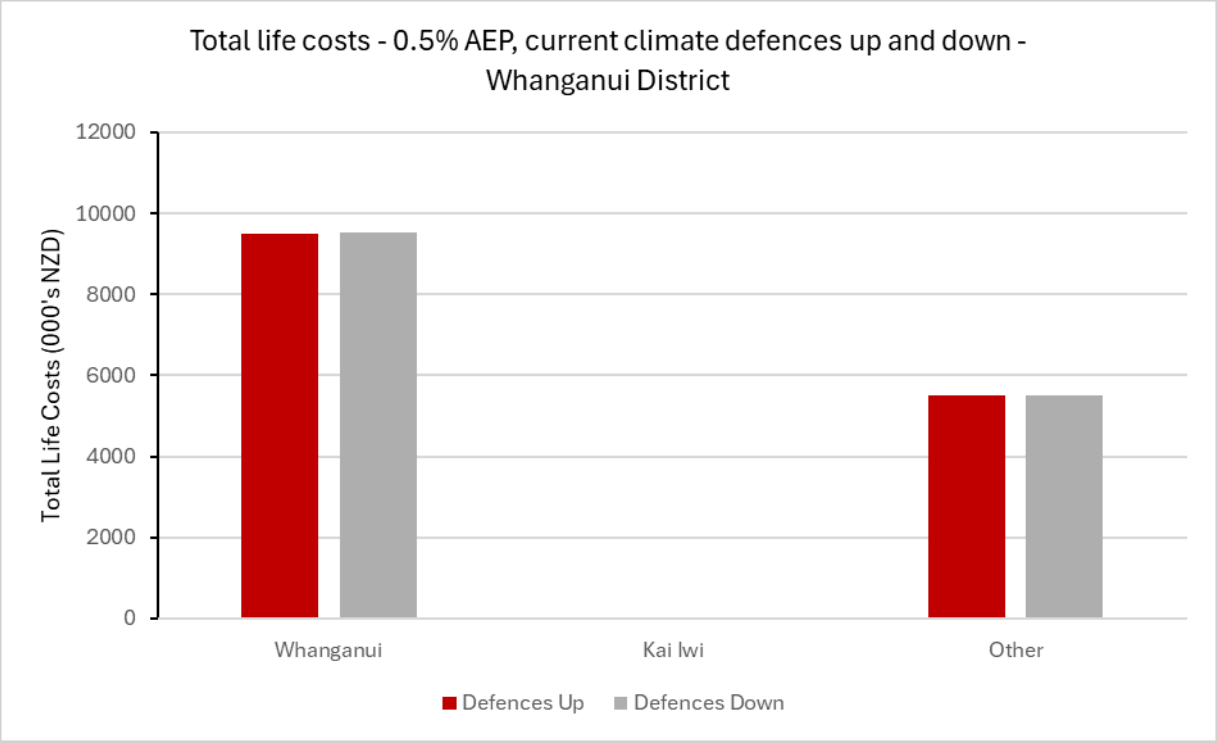


Figure 40: Total life costs for the 0.5% AEP event under current climate conditions with and without flood defences for Whanganui District.

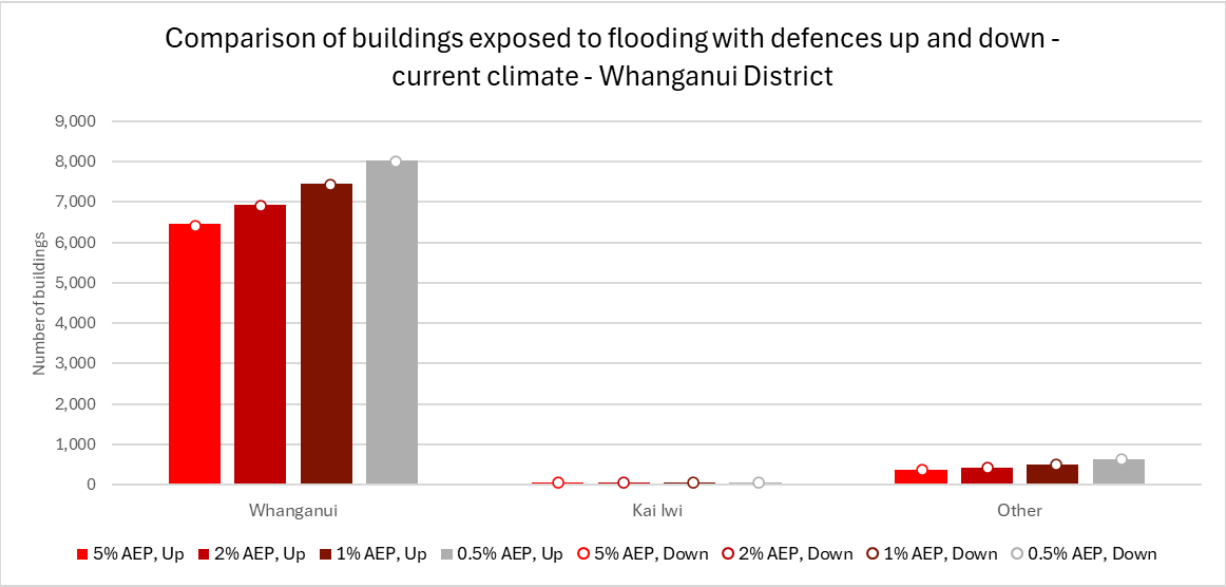


Figure 41: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Whanganui District.

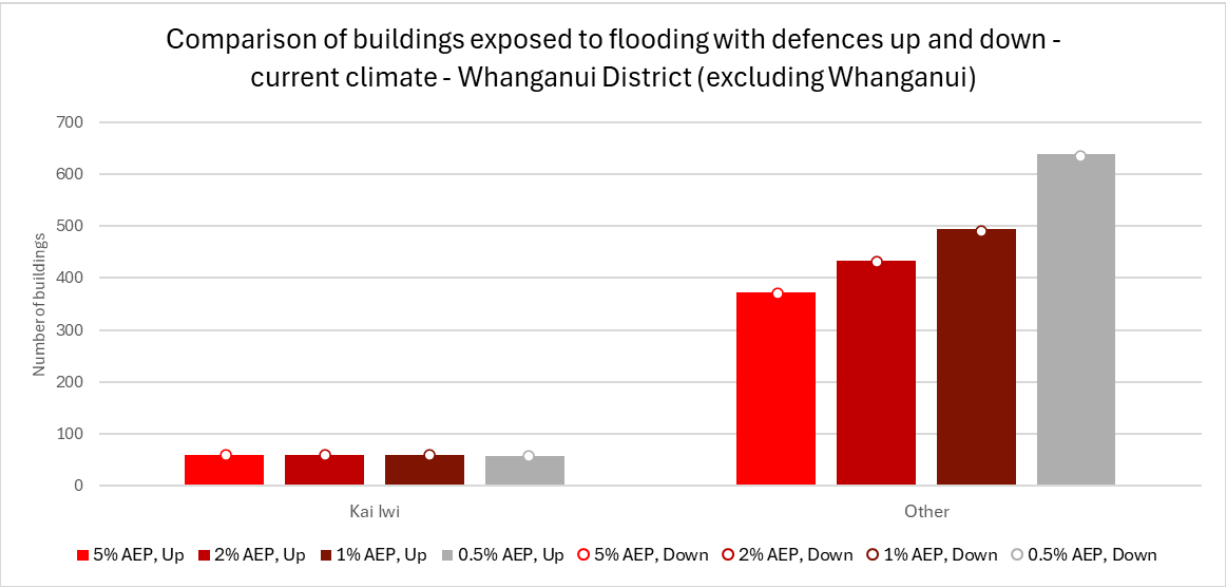


Figure 42: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Whanganui District (excluding Whanganui).

4.2.3.4 WHANGANUI DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 37 and Table 38 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Whanganui District for six flooding scenarios. The results for these scenarios assume no climate warming (0°C increase) and that existing flood defences are up. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 37: Whanganui District – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**6,905**	**3,364**	**272,136**	**6,201**	**6,028**	**7,437**	**3,731**	**313,542**	**6,646**	**6,793**	**8,007**	**4,140**	**354,094**	**7,195**	**9,590**
WHANGANUI	6,474	3,173	263,031	6,069	5,884	6,944	3,491	301,077	6,498	6,578	7,453	3,839	337,106	7,003	7,787
KAI IWI	59	35	1,242	23	24	59	35	1,252	23	25	59	35	1,262	23	25
OTHER	372	156	7,863	109	120	434	205	11,213	125	190	495	266	15,726	169	1,778

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 38: Whanganui District – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**8,713**	**4,756**	**421,773**	**7,776**	**15,030**	**11,186**	**7,478**	**669,352**	**9,931**	**49,746**	**12,475**	**8,876**	**842,641**	**11,009**	**99,771**
WHANGANUI	8,017	4,319	394,392	7,505	9,495	10,186	6,762	620,415	9,548	19,636	11,257	7,939	768,464	10,522	36,325
KAI IWI	58	37	1,282	23	25	60	37	1,265	21	26	60	37	1,247	21	28
OTHER	638	400	26,099	248	5,510	940	679	47,672	362	30,084	1,158	900	72,930	466	63,418

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.2.3.5 WHANGANUI DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) & EXISTING FLOOD DEFENCES UP

Table 39 and Table 40 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Whanganui District for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 39: Whanganui District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C and 2°C) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[5]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**10,472**	**6,659**	**586,805**	**9,264**	**52,094**	**12,209**	**8,519**	**799,016**	**10,768**	**135,038**
WHANGANUI	9,547	6,004	542,310	8,905	31,930	11,035	7,632	730,844	10,312	76,708
KAI IWI	60	37	1,246	25	26	61	37	1,292	21	26
OTHER	865	618	43,249	334	20,138	1,113	850	66,880	435	58,304

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 40: Whanganui District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**14,023**	**10,552**	**1,064,011**	**12,553**	**260,000**	**14,180**	**10,728**	**1,079,969**	**12,661**	**262,913**
WHANGANUI	12,706	9,522	976,153	12,027	156,170	12,861	9,696	992,159	12,135	158,863
KAI IWI	62	38	1,261	21	28	62	39	1,410	21	28
OTHER	1,255	992	86,597	505	103,802	1,257	993	86,400	505	104,022

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.2.3.6 WHANGANUI DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 41 and Table 42 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Whanganui District for four flooding scenarios. The results for all four flooding scenarios assume no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 41: Whanganui District – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[5]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**6,826**	**3,264**	**256,696**	**6,145**	**5,787**	**7,388**	**3,670**	**298,466**	**6,626**	**6,756**
WHANGANUI	6,397	3,077	247,643	6,013	5,643	6,898	3,434	285,964	6,478	6,541
KAI IWI	59	35	1,242	23	24	59	35	1,252	23	25
OTHER	370	152	7,810	109	120	431	201	11,250	125	190

[1] This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[4] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[5] Population values are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele et al. (2021).

[6] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[7] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 42: Whanganui District – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**7,966**	**4,083**	**340,196**	**7,181**	**9,587**	**8,699**	**4,730**	**416,933**	**7,776**	**15,061**
WHANGANUI	7,416	3,786	323,374	6,991	7,794	8,007	4,297	389,702	7,507	9,528
KAI IWI	59	35	1,262	23	25	58	37	1,282	23	25
OTHER	491	262	15,560	167	1,768	634	396	25,949	246	5,508

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.2.3.7 WHANGANUI DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 43 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Whanganui District for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 43: Whanganui District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6,7]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
WHANGANUI DISTRICT	**10,510**	**6,717**	**601,182**	**9,287**	**53,992**	**12,204**	**8,525**	**809,837**	**10,766**	**137,110**	**14,012**	**10,552**	**1,068,643**	**12,551**	**261,195**
WHANGANUI	9,589	6,066	556,869	8,928	33,861	11,036	7,643	742,267	10,312	78,820	12,696	9,524	981,132	12,027	157,277
KAI IWI	60	37	1,245	25	26	61	37	1,292	21	26	62	38	1,261	21	28
OTHER	861	614	43,068	334	20,105	1,107	845	66,278	433	58,264	1,254	990	86,250	503	103,890

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[4] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[5] Population values are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele et al. (2021).

[6] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[7] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.2.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

Whanganui City makes up most of the district's flood exposure, representing >90% of the buildings exposed, reinstatement costs, and life-related impacts across all modelled scenarios. Its concentration of residential development along flood-prone waterways contributes to this level of vulnerability when compared to the rest of the district. High exposure of buildings and population is also linked to an influence of pluvial dominated flooding within the area.

The results of the vulnerability assessment show a steep increase in exposure for Whanganui between the 0.5% and 0.2% AEP events, where an additional 2,400 buildings are exposed. This may indicate the overtopping of assets at this level. The dominance of pluvial flooding in this area, however, suggests that further detailed Level C modelling is required to better understand the influence of pluvial flooding for more severe floods. This further modelling could better inform decision making and form the basis for considering the performance of stormwater systems.

The low exposure for other towns and settlements, such as Kai Iwi, is likely due to low overall building count and population numbers in those towns and settlements, resulting in low exposure. Kai Iwi, however, still show notable vulnerability for rural land.

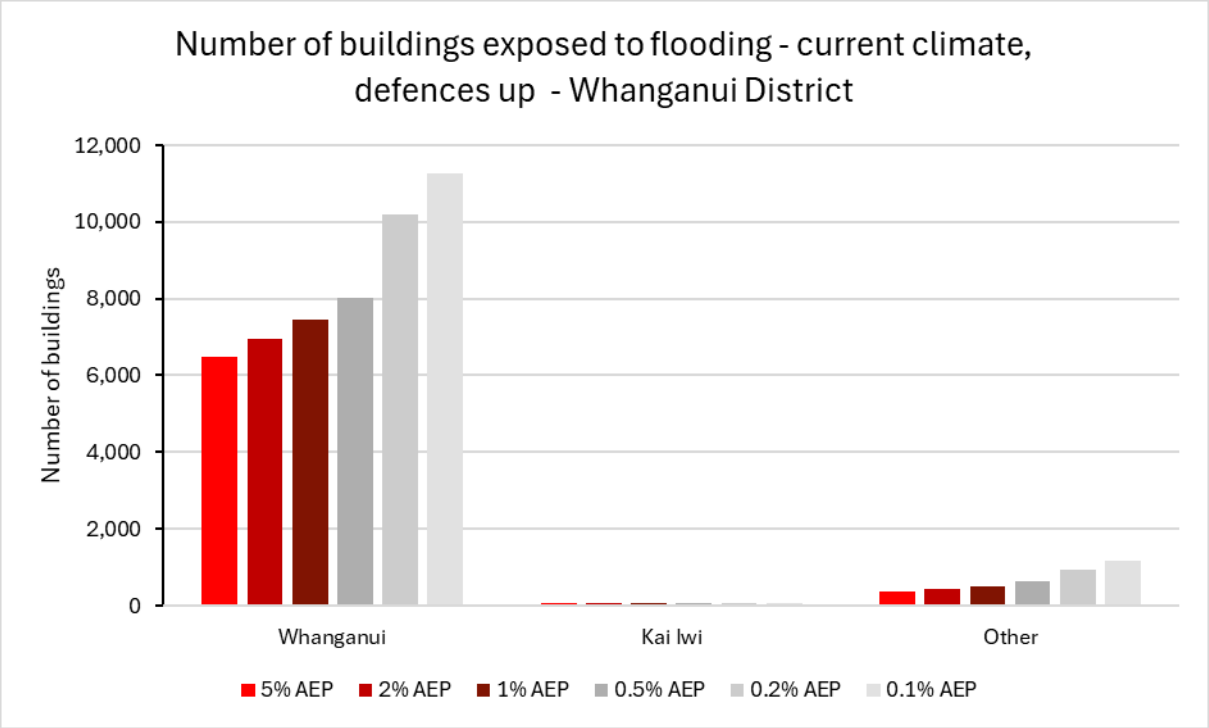


Figure 43: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Whanganui District.

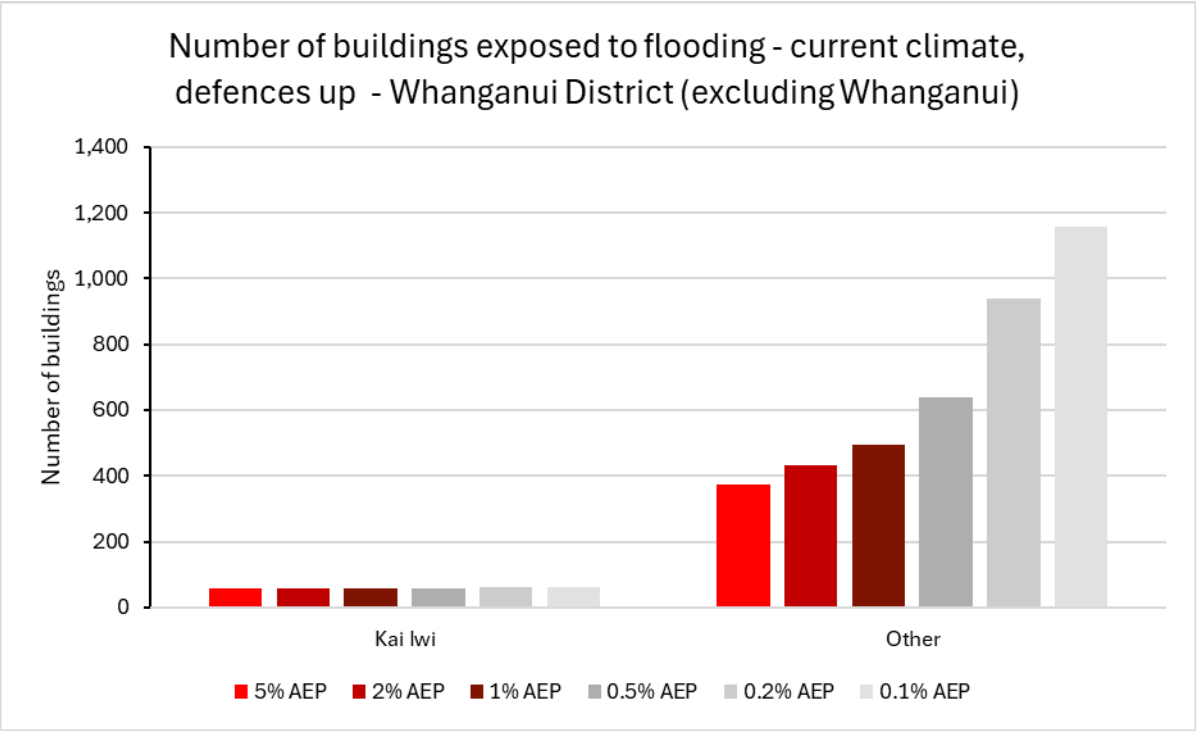


Figure 44: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Whanganui District (excluding Whanganui).

4.3 HOROWHENUA DISTRICT

4.3.1 DISTRICT OVERVIEW – HOROWHENUA

Horowhenua District is located on the lower west coast of Aotearoa New Zealand's North Island. The district stretches from just north of Ōtaki in the south to just south of Himatangi in the north. Horowhenua's total population is 36,693 (according to the 2023 Census). Levin is the seat of the District Council and the district's main town (Figure 45).

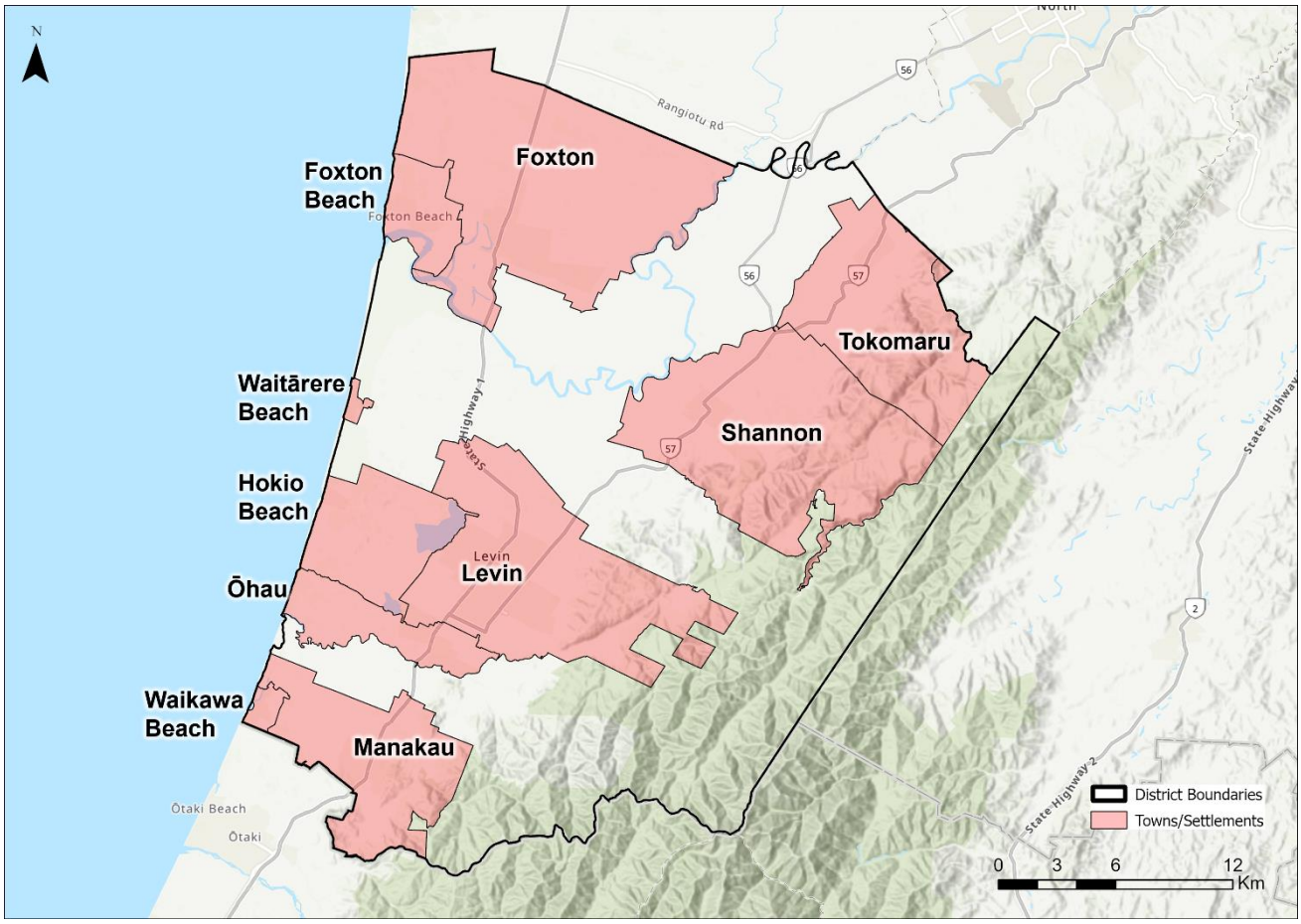


Figure 45: Map of Horowhenua District with town and settlement boundaries. For the purpose of reporting, any buildings outside of a town or settlement boundary has been categorised as 'Other'.

The district's median age is 45.5 years, much older than the national median (38.1), and 24.9% of residents are aged 65+, indicating an ageing population and heightened vulnerability during emergencies (Stats NZ, 2025). Household ownership is high (71.3%), but median personal income ($31,700) is well below the national average, and weekly rents rose by 5.6% in 2024, adding cost pressures for residents (Horowhenua District Council, 2024). Public housing stock increased 25% in the past year, yet NEET rates (21.8 % of people 15-24 years old not in employment, education or training) and low school attendance signal persistent socio-economic challenges (Horowhenua District Council, 2024).

Economically, Horowhenua recorded zero GDP growth in 2024 (national decline: -0.5%), with construction and manufacturing subdued (Horowhenua District Council, 2024). Unemployment remains at 5.4%, above regional and national averages, and 13,872 residents are employed, down 0.2% (Horowhenua District Council, 2024). Agriculture is a key driver, contributing 14% of district output, buoyed by strong dairy and meat returns, including a Fonterra record high milk payout of approximately $184M in 2024 (Horowhenua District Council, 2024). Retail spending grew slightly in 2024 (0.7%), but leakage to Palmerston North remains high. Tourism expenditure rose 2% in 2024, though accommodation capacity is limited (Horowhenua District Council, 2024).

Horowhenua's low-lying areas and coastal settlements face increased storm intensity, sea-level rise, and erosion pressures. During the 2024-2025 period, Horowhenua District Council has invested in stormwater upgrades, wetland restoration, and LiDAR mapping to improve flood modelling and resilience (Horowhenua District Council, 2025).

4.3.2 FLOOD MANAGEMENT SCHEMES

Horowhenua District is protected by nine flood management schemes. Table 44 above indicates that levels of service for River, Flood and Drainage Schemes in the Horowhenua District range from containing a 10% AEP flood (Foxton East, Koputaroa, and Ōhau Manakau) up to a 1% AEP flood (Makerua and Lower Manawatū).

Table 44: Summary of Horizons Regional Council rivers management schemes in the Horowhenua District (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
FOXTON EAST	Approximately 80 ha of farmland to the east of Foxton Township.	10% AEP.
MAKERUA	4,088 ha of rural land spanning between Horowhenua in the south to Levin (Palmerston North City) in the north.	1% AEP.
LOWER MANAWATŪ	The Manawatū and specified tributaries protect 280 square km of pastoral, horticultural and urban land between the Manawatū Gorge and Foxton Beach.	1% AEP.
MOUTOA	5,012 ha of dairy, cropping, and horticultural land between the Manawatū River and the Foxton Township.	1% AEP.
KOPUTAROA	8,500 ha extending from the foothills of the Tararua Ranges to the Manawatū River, providing protection to the rural land between Levin and Shannon.	10% AEP.
HŌKIO	350 ha of low-lying land north and south of Lake Horowhenua and 600 ha of land south of Levin.	Not assessed.
HIMATANGI	A network of community drainage channels that provide outlets for 4,088 ha of rural land.	5% AEP.
WHIROKINO	A network of community drainage channels, pumping stations and flood protection assets between the Manawatū River and Foxton providing drainage to dairy, cropping and horticultural land.	4% AEP
ŌHAU MANAKAU	Rural land south of Levin to the region's boundary, at the edge of the Manakau Stream Catchment south of Manakau.	10% AEP.

4.3.3 DISTRICT FLOOD VULNERABILITY RESULTS

This section provides a summary of flood vulnerability in Horowhenua District under current and future climate conditions and compares scenarios with flood defences up and down.

The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.3.3.1 DISTRICT FLOOD VULNERABILITY: CURRENT CLIMATE

Under current climate conditions with existing flood defences up, increases can be seen in flood exposure within the Horowhenua District. At the 5% AEP event, 10,257 buildings are exposed to flooding, with 27% (2,808) of these incurring building reinstatement costs of approximately $189M. By the 0.1% AEP event this increases by 24% to 12,699 buildings exposed, and 35% (4,460) of these associated with more than $335M in building reinstatement costs. The total exposed population increases by 19% from 8,666 to 10,325 for these events. The number of estimated fatalities increases from 3 to 5.

Levin was selected as a case study area to investigate the sources of flood risk in detail (see Appendix I). The analysis confirmed that pluvial flooding is the predominant risk in Levin, with surface water ponding driving the majority of building exposure and costs. This is particularly relevant given the under-representation of the stormwater network in the regional model. The case study highlights the need for detailed rain-on-grid hydraulic modelling that incorporates the full stormwater system, to better inform future flood mitigation and emergency planning for Levin.

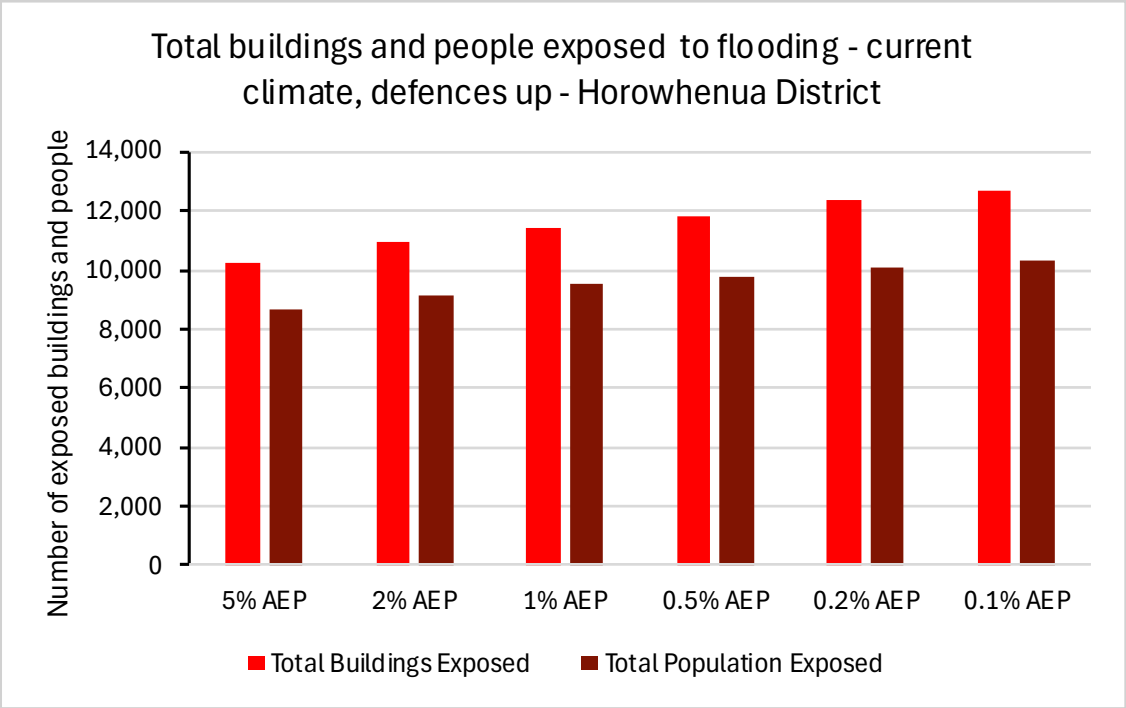


Figure 46: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Horowhenua.

4.3.3.2 DISTRICT FLOOD VULNERABILITY: WARMING SCENARIOS

Climate warming increases flood vulnerability in the Horowhenua District. The progression shown in Table 45 reflect a 27% increase in total life costs and a 42% increase in total building reinstatement costs between the current climate and 3°C warming scenarios. Results from the pluvial-fluvial and fluvial case study comparison show that flood risk in Levin remains dominated by pluvial flooding even when considering climate change.

Table 45: Horowhenua District – Vulnerability metrics for 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood Defences up.

CLIMATE SCENARIO	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALITIES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	11,833	3,924	265,399	9,778	4	5,396
1°C CLIMATE WARMING	12,411	4,274	305,128	10,162	5	5,830
2°C CLIMATE WARMING	12,964	4,638	344,822	10,551	5	6,339
3°C CLIMATE WARMING	13,516	4,995	379,412	11,002	6	6,855
3°C CLIMATE WARMING with SEA LEVEL RISE	13,592	5,104	388,914	11,032	6	6,949

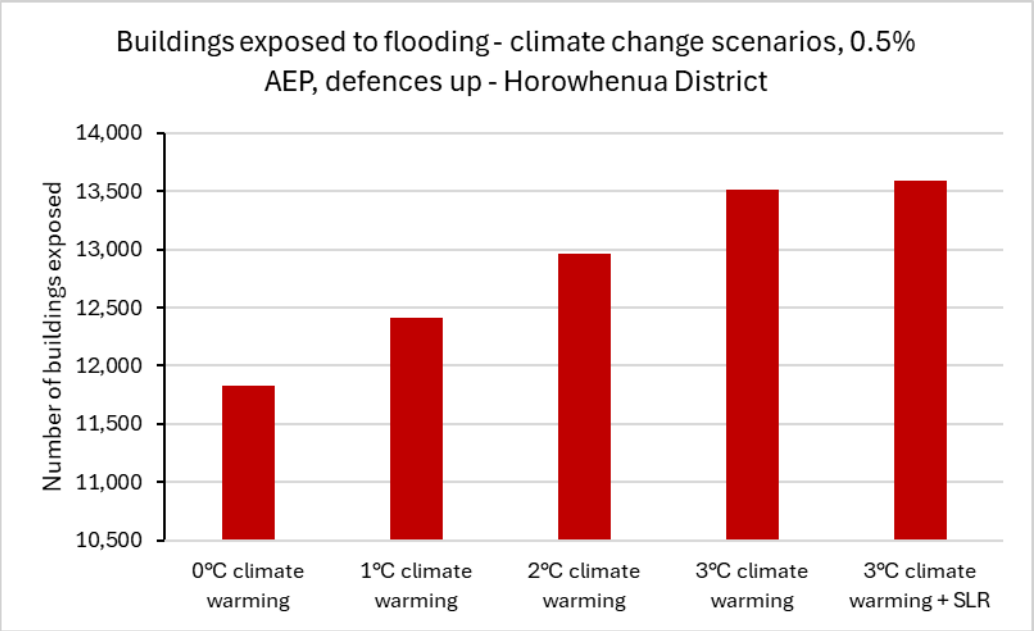


Figure 47: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C warming including with sea level rise) for the 0.5% AEP flood event with defences down for Horowhenua.

The Levin City case study (see Appendix I) assessed 1°C, 2°C, and 3°C warming scenarios. Under the current climate, pluvial flooding is the dominant driver of exposure and impacts, and in the 3°C warming scenario the relative fluvial-pluvial contribution remains similar, with pluvial processes continuing to dominate.

4.3.3.3 DISTRICT FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

Throughout the Horowhenua District, results for the defences down scenarios show variation in relation to exposure. In some towns and settlements such as Levin, Foxton Beach and Ōhau, the change in life costs shows minimal to low decreases when flood defences are removed. This can be seen in Figure 48 and Figure 49 showing the 0.5% AEP event. An increased in life costs can be observed in other towns and settlements, such as in Shannon and Foxton.

The increase in life costs is most notable within the Horowhenua District for populations that are outside of a town or settlement extent (Other).The extent of these areas can be seen within Figure 45 where buildings not within the highlighted town and settlement boundaries are assigned the category of 'Other'. When comparing the results of the 0.5% AEP events for defences up with defences down for this group of population and buildings, life costs increase by 475%, while the number of buildings contributing to reinstatement costs almost doubles, causing reinstatement costs to increase by 170%. These trends can also be seen when viewing the change in building exposure between defences up and down modelling (Figure 50 and Figure 51). Further detailed (Level C) modelling outside of the town and settlement areas may be required for the Horowhenua District to better understand the distribution of flooding within the district if defences were to fail. Decision makers could use this Level C modelling to inform emergency management planning and flood protection asset strategies.

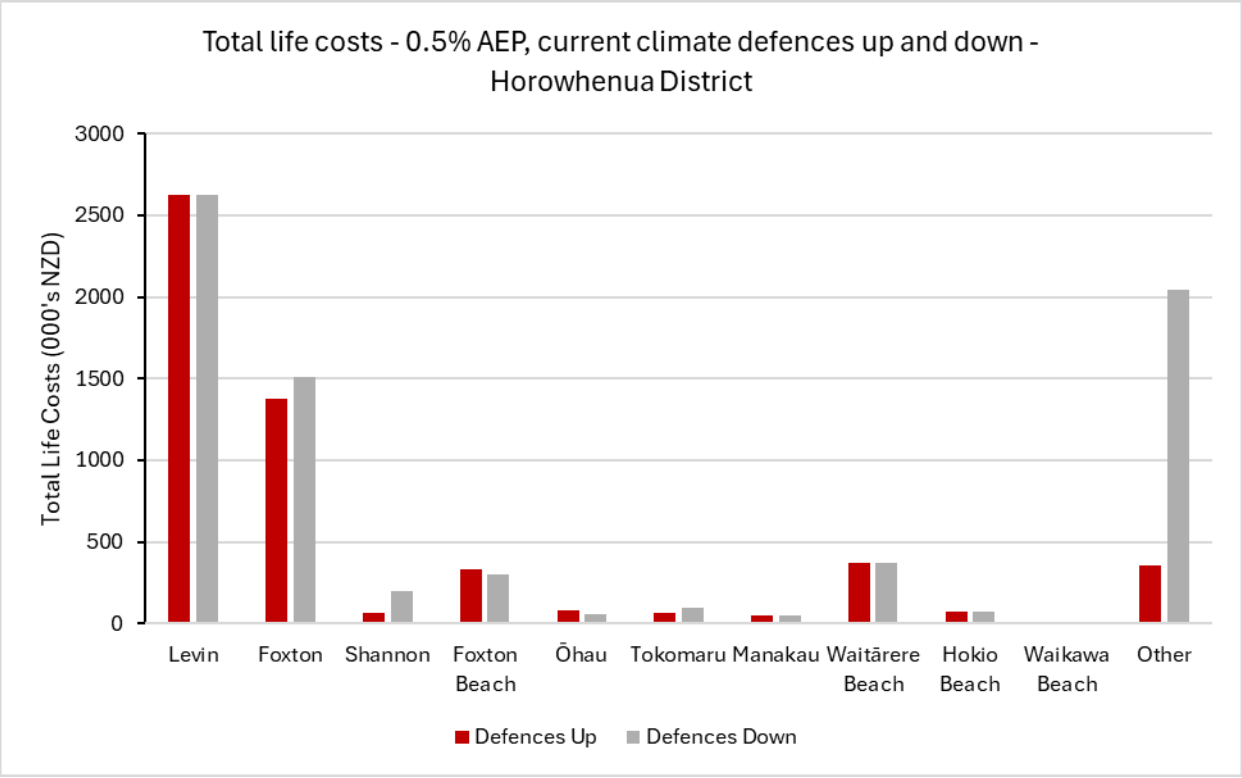


Figure 48: Total life costs for the 0.5% AEP event under current climate comparing defences up and down for the Horowhenua District.

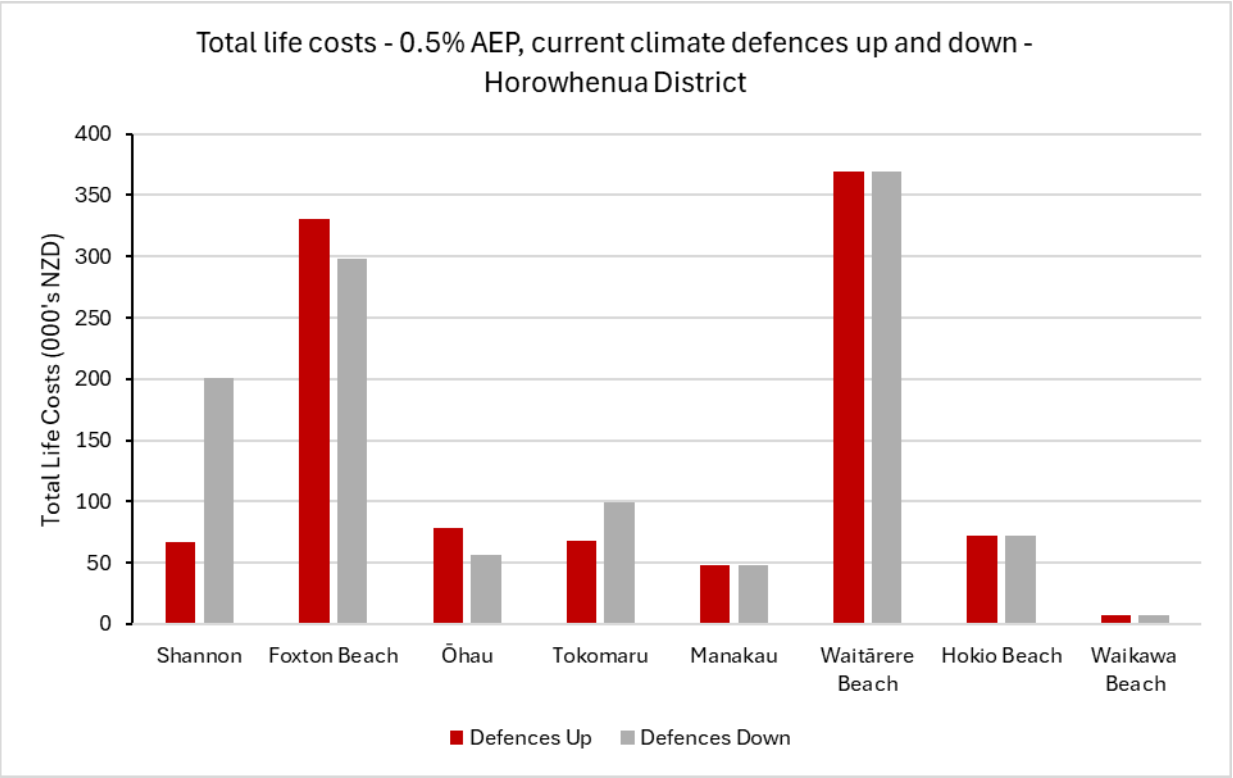


Figure 49: Total life costs for the 0.5% AEP event under current climate comparing defences up and down for the Horowhenua District (excluding Levin, Foxton and 'Other').

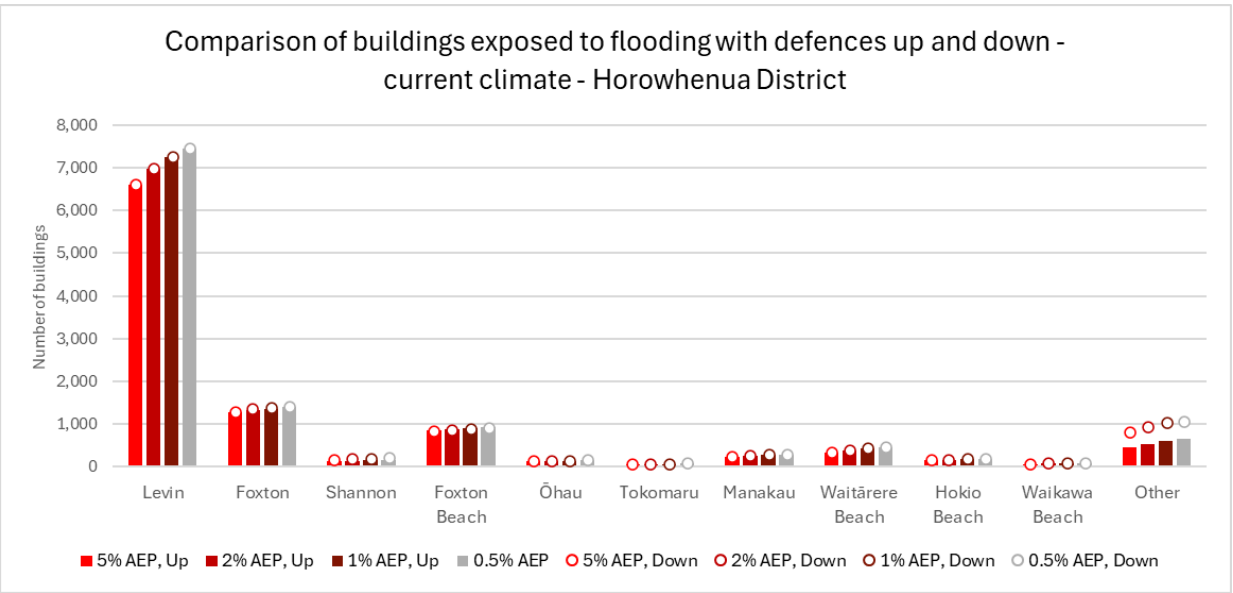


Figure 50: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Horowhenua District.

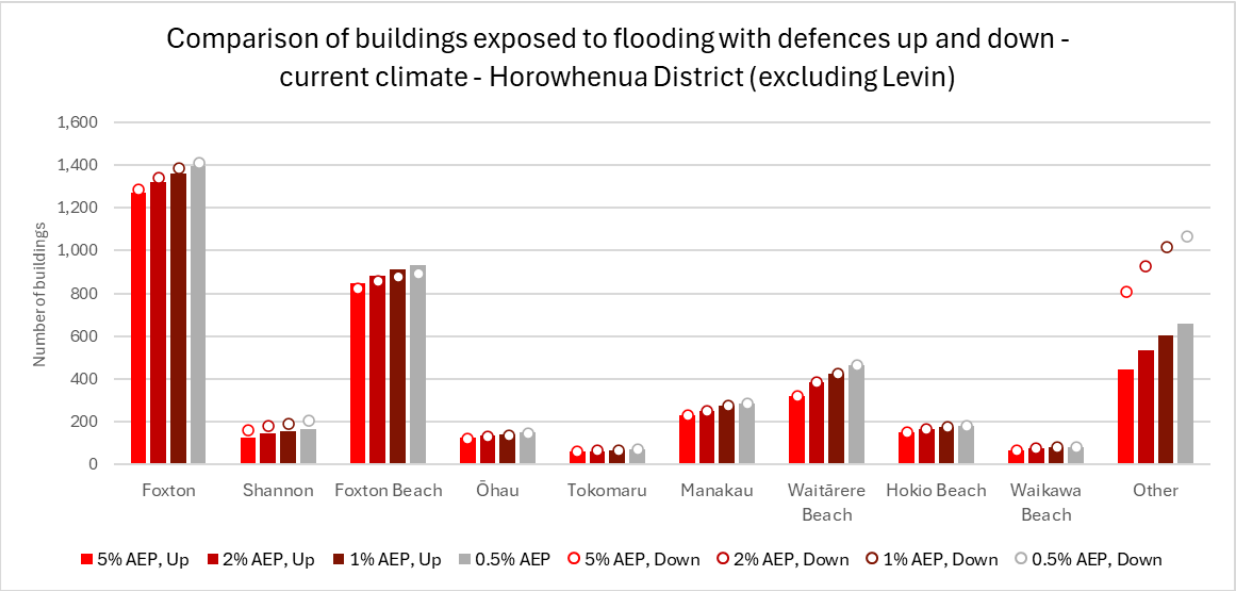


Figure 51: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Horowhenua District (excluding Levin).

4.3.3.4 HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 46 and Table 47 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Horowhenua District for six flooding scenarios. The results for all these scenarios assume no climate warming (0°C increase) and that existing flood defences are up. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 46: Horowhenua District – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**10,257**	**2,808**	**188,749**	**8,666**	**4,116**	**10,937**	**3,305**	**219,495**	**9,167**	**4,606**	**11,431**	**3,682**	**245,421**	**9,510**	**5,011**
LEVIN	6,612	869	73,872	6,646	2,078	6,975	1,087	88,660	7,019	2,308	7,239	1,241	99,993	7,253	2,464
FOXTON	1,270	768	56,183	976	1,196	1,322	810	58,143	1,011	1,266	1,363	848	61,156	1,042	1,331
SHANNON	124	29	1,793	114	37	144	43	2,655	122	48	156	56	3,175	122	58
FOXTON BEACH	848	441	21,466	368	274	885	472	22,594	384	300	912	491	23,514	394	316
ŌHAU	124	29	1,498	69	44	135	40	2,094	76	52	141	45	2,343	76	64
TOKOMARU[8]	60	20	1,898	53	63	63	23	1,958	57	66	66	27	2,201	57	67
MANAKAU	233	53	2,014	97	34	252	66	2,869	101	38	274	80	3,595	108	40
WAITĀRERE BEACH	320	239	9,724	108	162	384	311	13,605	129	239	425	357	16,034	138	310
HOKIO BEACH	152	73	2,483	38	45	168	89	3,032	49	54	174	97	3,274	51	62
WAIKAWA BEACH	68	31	834	9	4	75	39	1,087	9	5	79	45	1,324	13	6
OTHER	446	256	16,984	188	179	534	325	22,798	210	230	602	395	28,812	256	293

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 47: Horowhenua District – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**11,833**	**3,924**	**265,398**	**9,778**	**5,395**	**12,358**	**4,278**	**302,866**	**10,104**	**5,907**	**12,699**	**4,460**	**335,904**	**10,325**	**6,196**
LEVIN	7,445	1,328	106,778	7,419	2,621	7,700	1,454	123,097	7,622	2,867	7,872	1,498	144,606	7,764	2,995
FOXTON	1,394	868	62,703	1,057	1,379	1,463	940	74,990	1,112	1,480	1,490	952	76,812	1,131	1,524
SHANNON	165	60	3,389	133	67	183	65	3,792	142	79	192	73	4,467	148	93
FOXTON BEACH	933	519	25,257	402	331	991	559	27,896	422	364	1,023	605	30,249	444	401
ŌHAU	153	52	2,755	83	78	166	54	2,839	91	86	176	58	2,971	97	86
TOKOMARU[8]	71	32	2,668	57	68	75	32	2,590	57	70	76	32	2,705	57	70
MANAKAU	284	94	4,608	119	48	295	104	5,217	123	54	313	115	5,846	129	59
WAITĀRERE BEACH	464	391	17,825	147	369	526	442	19,838	171	445	535	450	20,123	171	458
HOKIO BEACH	182	104	3,690	59	72	197	118	4,320	66	82	201	123	4,549	66	88
WAIKAWA BEACH	82	49	1,415	13	7	88	55	1,653	16	16	94	58	1,791	16	17
OTHER	660	427	34,310	289	355	674	455	36,634	282	364	727	496	41,785	302	405

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.3.3.5 HOROWHENUA DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP

Table 48 and Table 49 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Horowhenua District for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 48: Horowhenua District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C and 2°C) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**12,411**	**4,274**	**305,128**	**10,162**	**5,831**	**12,964**	**4,638**	**344,823**	**10,551**	**6,339**
LEVIN	7,765	1,468	122,075	7,677	2,813	8,045	1,596	143,938	7,936	3,016
FOXTON	1,440	902	72,688	1,098	1,440	1,481	937	74,813	1,121	1,510
SHANNON	187	68	4,344	145	79	204	76	4,725	162	98
FOXTON BEACH	967	555	28,232	415	355	1,008	605	30,484	448	401
ŌHAU	166	55	2,816	91	87	179	58	3,044	97	94
TOKOMARU[8]	76	33	2,648	57	70	77	33	2,753	57	71
MANAKAU	298	106	5,342	123	54	322	127	6,414	136	63
WAITĀRERE BEACH	497	425	19,107	164	400	521	448	19,905	171	436
HOKIO BEACH	195	115	4,081	66	80	203	120	4,393	66	85
WAIKAWA BEACH	88	55	1,665	16	16	96	60	1,830	16	17
OTHER	732	492	42,130	310	437	828	578	52,524	341	548

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 49: Horowhenua District Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**13,516**	**4,995**	**379,411**	**11,002**	**6,855**	**13,592**	**5,104**	**388,913**	**11,032**	**6,948**
LEVIN	8,347	1,734	156,906	8,255	3,215	8,347	1,734	156,906	8,255	3,215
FOXTON	1,514	971	76,082	1,148	1,582	1,509	963	75,272	1,144	1,557
SHANNON	226	88	5,561	172	112	225	89	5,690	169	112
FOXTON BEACH	1,054	658	33,875	477	445	1,148	774	45,274	523	576
ŌHAU	203	68	4,008	110	104	203	68	4,008	110	104
TOKOMARU[8]	78	33	2,966	57	72	78	33	2,966	57	72
MANAKAU	338	137	6,738	143	70	339	137	6,739	143	70
WAITĀRERE BEACH	540	453	20,363	182	460	536	461	20,426	173	454
HOKIO BEACH	211	128	4,800	75	96	211	128	4,801	75	96
WAIKAWA BEACH	104	71	2,466	21	27	104	72	2,498	21	27
OTHER	901	654	65,646	362	672	892	645	64,333	362	665

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.3.3.6 HOROWHENUA DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 50 and Table 51 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Horowhenua District for four flooding scenarios. The results for all four flooding scenarios assume no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 50: Horowhenua District – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**10,649**	**3,203**	**241,165**	**8,828**	**5,129**	**11,355**	**3,721**	**278,866**	**9,356**	**5,921**
LEVIN	6,612	869	73,872	6,646	2,078	6,975	1,087	88,660	7,019	2,308
FOXTON	1,288	784	56,399	985	1,284	1,340	833	58,702	1,027	1,376
SHANNON	162	68	5,500	120	84	180	77	8,345	130	118
FOXTON BEACH	822	404	18,400	361	250	857	435	19,557	377	271
ŌHAU	123	26	1,210	68	38	132	33	1,860	76	47
TOKOMARU[8]	59	24	2,407	57	87	65	28	2,468	57	93
MANAKAU	233	53	2,014	97	34	252	66	2,869	101	38
WAITĀRERE BEACH	320	239	9,724	108	162	384	311	13,606	129	239
HOKIO BEACH	152	73	2,483	38	45	168	89	3,032	49	54
WAIKAWA BEACH	68	31	834	9	4	75	39	1,087	9	5
OTHER	810	632	68,322	339	1,063	927	723	78,680	382	1,372

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 51: Horowhenua District – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°c) and with existing flood defences down.

TOWN/SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**11,864**	**4,077**	**307,966**	**9,688**	**6,690**	**12,252**	**4,330**	**328,467**	**9,942**	**7,324**
LEVIN	7,239	1,241	99,993	7,253	2,464	7,445	1,328	106,778	7,419	2,621
FOXTON	1,384	869	61,865	1,058	1,459	1,412	887	63,229	1,075	1,509
SHANNON	192	87	11,490	133	166	205	99	11,407	143	201
FOXTON BEACH	876	450	20,050	386	285	895	469	21,510	393	298
ŌHAU	137	39	2,137	76	51	147	43	2,252	82	56
TOKOMARU[8]	67	29	2,465	57	96	71	33	3,075	57	99
MANAKAU	274	80	3,595	108	40	284	94	4,608	119	48
WAITĀRERE BEACH	425	357	16,035	138	310	464	391	17,818	147	369
HOKIO BEACH	174	97	3,274	51	62	182	104	3,690	59	72
WAIKAWA BEACH	79	45	1,324	13	6	82	49	1,413	13	7
OTHER	1,017	783	85,738	415	1,751	1,065	833	92,687	435	2,044

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.3.3.7 HOROWHENUA DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 52 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Horowhenua District for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 52: Horowhenua District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
HOROWHENUA DISTRICT TOTAL	**12,801**	**4,675**	**375,223**	**10,311**	**8,103**	**13,324**	**4,993**	**419,509**	**10,681**	**8,867**	**13,841**	**5,308**	**452,004**	**11,124**	**9,568**
LEVIN	7,765	1,468	122,075	7,677	2,813	8,045	1,596	143,938	7,936	3,016	8,347	1,734	156,906	8,255	3,215
FOXTON	1,452	917	73,104	1,109	1,569	1,487	944	74,622	1,128	1,629	1,520	970	75,664	1,161	1,684
SHANNON	236	115	12,488	160	269	251	128	13,912	177	336	263	135	16,411	184	386
FOXTON BEACH	907	489	22,806	399	313	922	502	23,641	416	329	934	517	24,684	424	343
ŌHAU	161	47	2,408	90	61	174	50	2,632	96	66	199	62	3,674	109	76
TOKOMARU[8]	77	35	3,314	57	104	81	37	3,650	58	111	86	41	4,303	58	119
MANAKAU	298	106	5,342	123	54	322	127	6,414	136	63	338	137	6,737	143	70
WAITĀRERE BEACH	497	425	19,107	164	400	521	448	19,905	171	436	540	453	20,377	182	460
HOKIO BEACH	195	115	4,081	66	80	203	120	4,393	66	85	211	128	4,800	75	96
WAIKAWA BEACH	88	55	1,665	16	16	96	60	1,827	16	17	103	69	2,386	21	27
OTHER	1,125	903	108,833	450	2,424	1,222	981	124,575	481	2,779	1,300	1,062	136,062	512	3,092

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.3.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

Flood risk within Horowhenua District is heavily concentrated in Levin, which accounts for the vast majority of buildings exposed to flooding under all scenarios. Levin is the district's largest town/settlement, with flood exposure spread predominately across residential buildings. Results from the pluvial fluvial case study show that the high level of exposure and costs for Levin are driven mainly by pluvial flooding and under-representation of the stormwater network within the Level A regional model.

Foxton and Foxton Beach are secondary hotspots with nearly 1,000 buildings exposed by the 0.1% AEP events. Other towns/settlements such as Shannon, Ōhau, Tokomaru, and coastal settlements like Waitārere and Hokio Beach show lower exposure; however, this is likely influenced by the lower populations and number of buildings within these towns and settlements. Exposure is predominately residential buildings but also includes a moderate to high portion of rural buildings. The town and settlement level results for the Horowhenua District highlight the importance of flood protection infrastructure within Levin to protect the high concentration of people and assets.

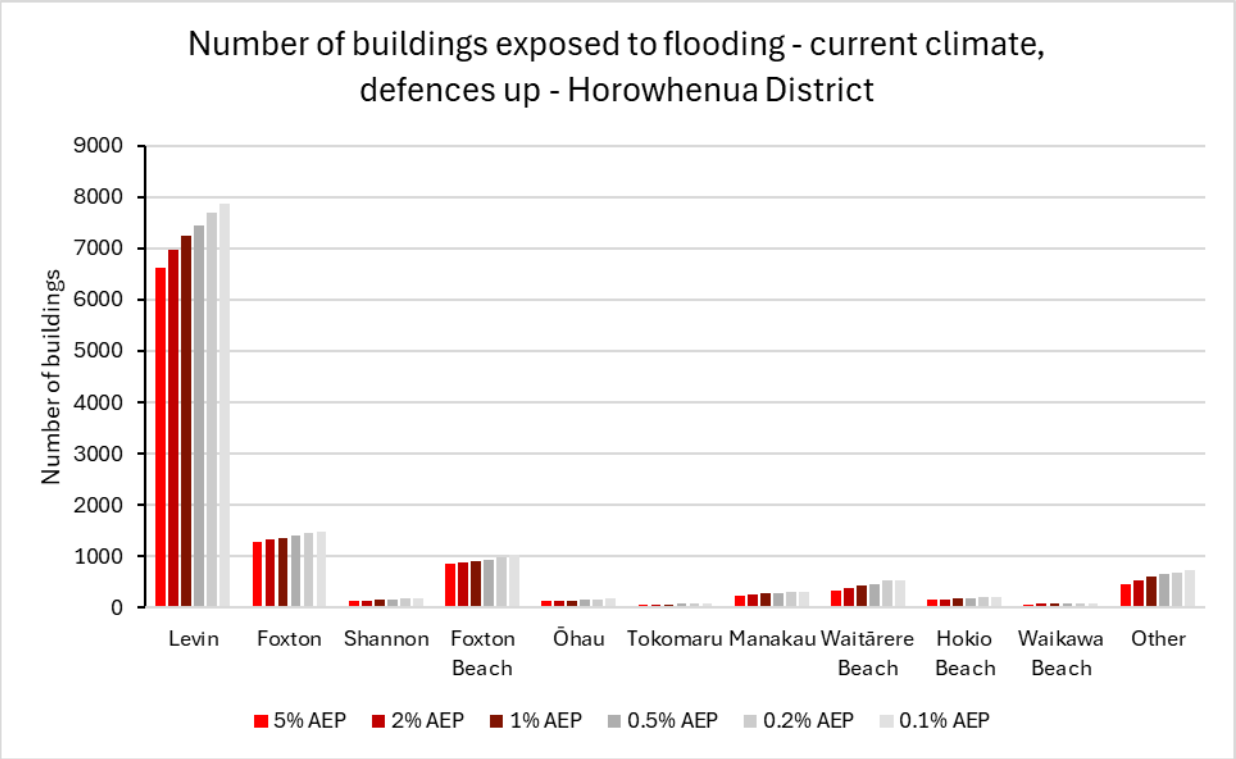


Figure 52: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Horowhenua District.

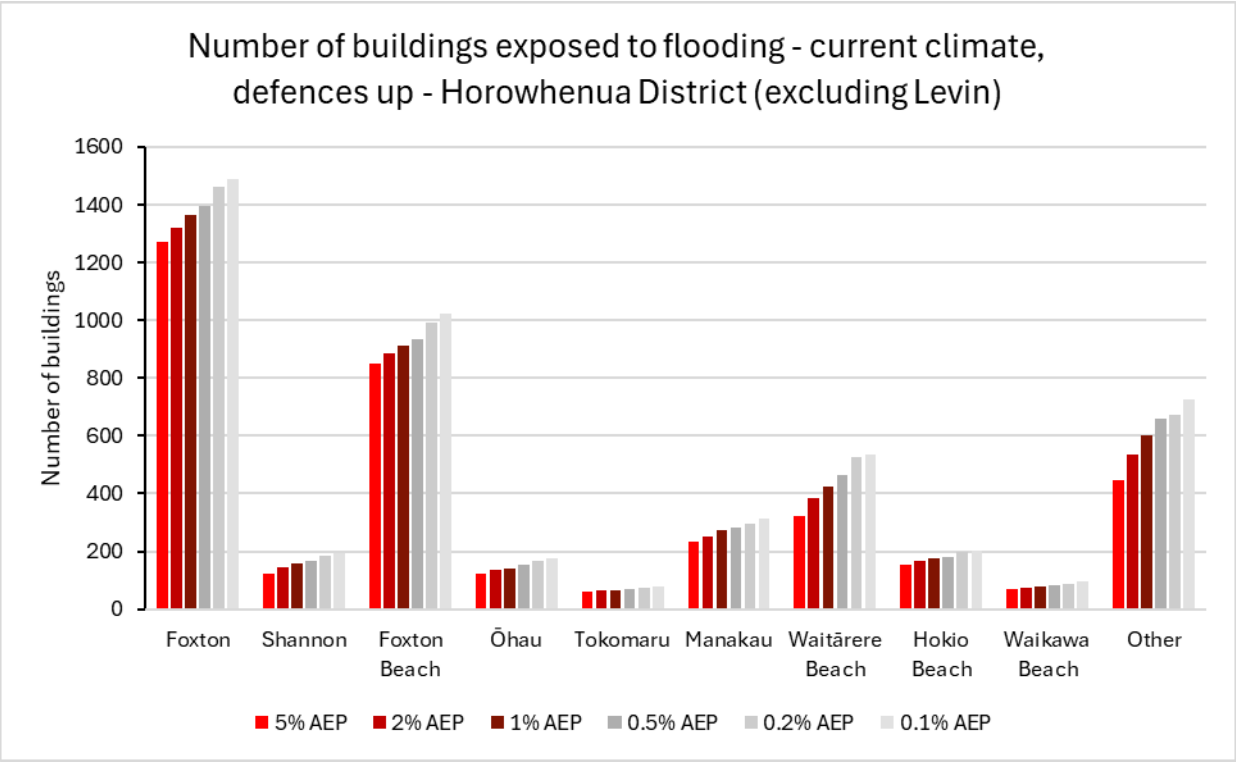


Figure 53: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Horowhenua District (excluding Levin).

4.4 MANAWATŪ DISTRICT

4.4.1 DISTRICT OVERVIEW – MANAWATŪ

Manawatū District covers an area of 2,780 km² on the lower west coast of the North Island. The district is bounded by the Rangitīkei River in the north, the Manawatū River in the south, the Ruahine Ranges to the east, and the Tasman Sea to the west. The town of Feilding serves as the district's seat (Figure 54).

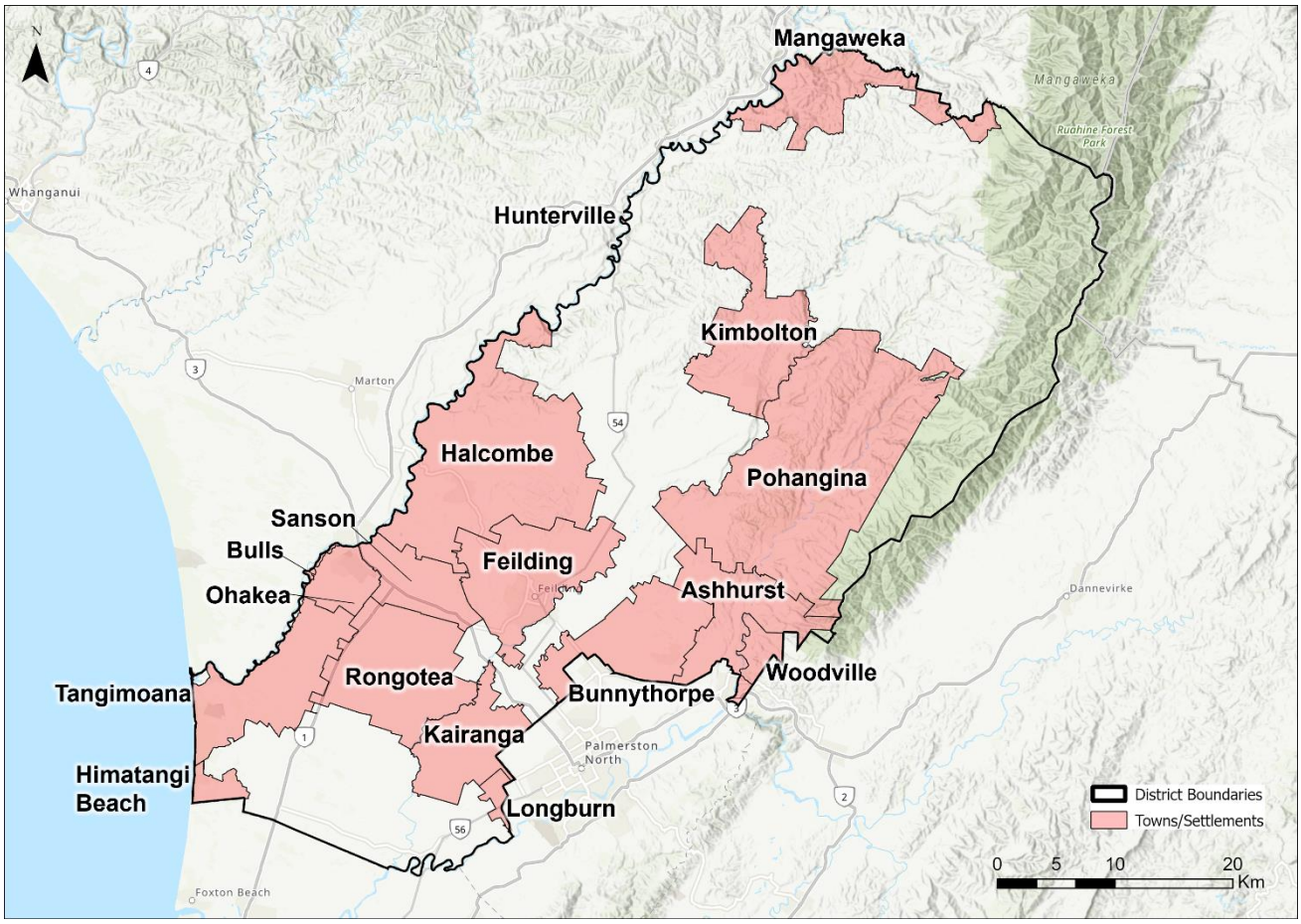


Figure 54: Map of Manawatū District with town and settlement boundaries. For the purpose of reporting, any building outside of a town or settlement boundary has been categorised as 'Other'.

Manawatū District's population is 33,700 (as at June 2024), with a median age of 41 years, slightly older than the national average (Stats NZ, 2025). Home ownership is high at 75.6%, and most households live in private dwellings (Stats NZ, 2025). The district's older age profile may increase vulnerability during flood events, particularly for evacuation and recovery. There's limited public transport use (less than 1%) in the district and strong dependence on private vehicles (over 58%) (Stats NZ, 2025). Modest median incomes ($41,700 per person) may reduce capacity for resilience and recovery after flood events (Stats NZ, 2025).

Manawatū's economy is strongly rural, with agriculture, forestry, and fishing accounting for 30.3% of businesses, far above the national average (Stats NZ, 2025). Other significant sectors include construction (10.5%), rental and real estate services (23%), and professional services (5.4%) (Stats NZ, 2025). This reliance on land-based industries, combined with dispersed rural communities, increases susceptibility to flood impacts on productivity and infrastructure and highlights the importance of robust flood protection schemes.

4.4.2 FLOOD MANAGEMENT SCHEMES

The Manawatū District is protected by six flood management schemes. Table 53 indicates that levels of service for flood management schemes in the Manawatū District range from containing a 20% AEP flood (Manawatū Drainage Scheme), up to a 1% AEP flood (Lower Kiwitea, and Lower Manawatū).

Table 53: Flood management schemes in the Manawatū District (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
LOWER KIWITEA	Protects rural land and townships from flooding and erosion. The Scheme works area is the Kiwitea Stream from Reids Line, on the north-western boundary of Feilding, up to the Cheltenham-Hunterville Road.	1% AEP.
LOWER MANAWATŪ	The Manawatū and specified tributaries protect 280 square km of pastoral, horticultural and urban land between the Manawatū Gorge and Foxton Beach.	1% AEP.
MANAWATŪ DRAINAGE	Provides land drainage to the rural land between the Manawatū and Ōroua Rivers downstream of Feilding. The Scheme also provides flood protection to a large section of the Taonui Basin.	20% AEP.
POHANGINA ŌROUA	Located to the northeast of Feilding, the Scheme provides riparian landowners a degree of protection against the adverse effects of changes in the alignment of the Pohangina and Ōroua Rivers and resultant lateral river erosion.	Not assessed.
RANGITĪKEI	Protect highly productive lower terrace land, rural and urban property and community infrastructure between Rewa and the sea.	2% AEP.
TE KAWAU	Drainage and flood protection service to rural land west of Ōroua River.	20% AEP.

4.4.3 DISTRICT FLOOD VULNERABILITY RESULTS

This section provides a summary of flood vulnerability in Manawatū District under current and future climate conditions and compares scenarios with existing flood defences up and down.

The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.4.3.1 DISTRICT FLOOD VULNERABILITY: CURRENT CLIMATE

Under current climate conditions with existing flood defences up, increases can be seen in flood exposure within the Manawatū District. At the 5% AEP event, 4,410 buildings are exposed to flooding, with 31% (1,380) of these contributing reinstatement costs, which exceed $99M. By the 0.1% AEP event this increases by 60% to 7,076 buildings exposed, with 47% (3,304) of these associated with reinstatement costs of approximately $247M. The total exposed population increases by 52% from 2,874 to 4,394 for these events, while the number of estimated fatalities increases from 1 to 4.

Feilding is the primary flood exposure hotspot within the Manawatū District. Building exposure counts increase by 45% between the 5% AEP and 0.1% AEP events. Residential properties are most affected, but commercial and rural buildings also show notable vulnerabilities. Feilding was included as a case study to explore the balance between pluvial and fluvial flood sources (see Appendix I). The findings show that, similar to Levin and Whanganui, pluvial flooding is the dominant contributor to building exposure and reinstatement costs in Feilding. The case study supports the recommendation for a comprehensive hydraulic model that covers the entire Feilding area and its upstream catchments, including the Makino Stream. This will enable more effective flood risk management and prioritisation of mitigation measures for the town.

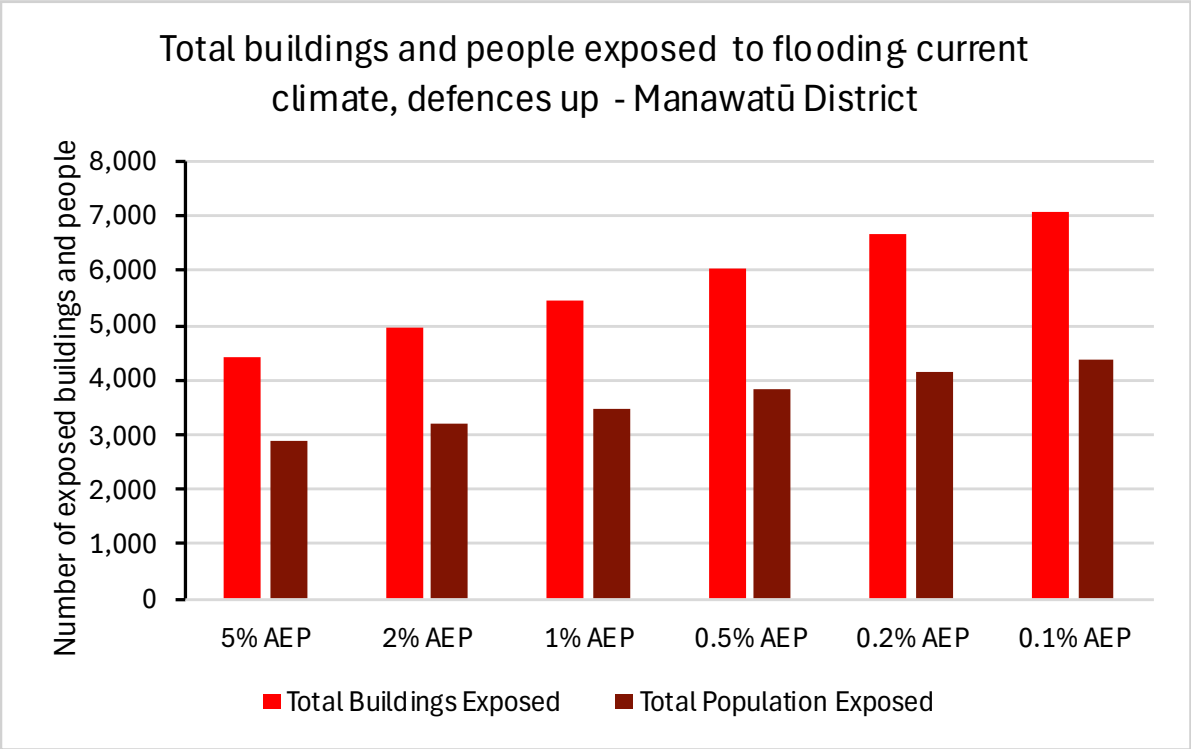


Figure 55: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Manawatū.

4.4.3.2 DISTRICT FLOOD VULNERABILITY: WARMING SCENARIOS

Climate warming increases flood vulnerability in the Manawatū District. The progression shown in Table 54 reflect a 61% increase in reinstatement costs and a 111% increase in life costs between the current climate and 3°C warming scenarios. For these events the number of estimated fatalities increases by 150%.

Table 54: Manawatū District – Vulnerability metrics for 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood Defences up.

CLIMATE SCENARIO	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALITIES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	6,053	2,508	183,070	3,822	2	2,988
1°C CLIMATE WARMING	6,558	2,881	218,314	4,187	3	3,884
2°C CLIMATE WARMING	7,087	3,280	257,222	4,517	4	5,041
3°C CLIMATE WARMING	7,528	3,594	295,328	4,769	5	6,330
3°C CLIMATE WARMING with SEA LEVEL RISE	7,525	3,592	296,324	4,769	5	6,332

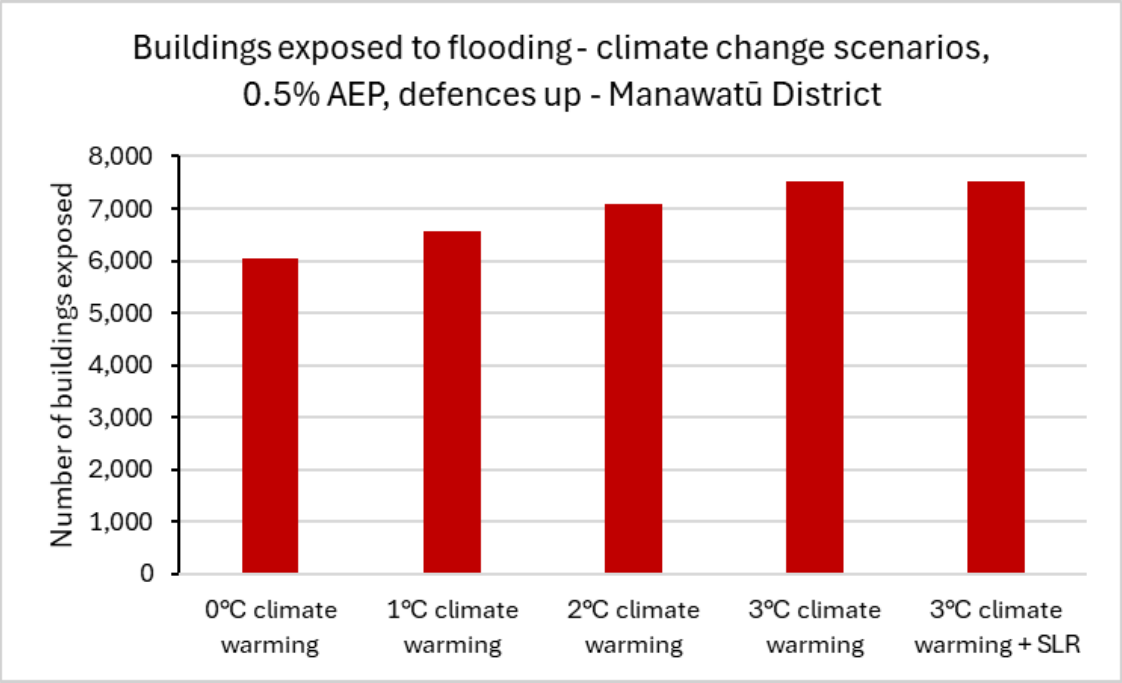


Figure 56: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C warming including with sea level rise) for the 0.5% AEP flood event with defences down for Manawatū.

The Feilding case study (see Appendix I) investigated the effects of 1°C, 2°C, and 3°C warming scenarios. Under the current climate, pluvial flooding is the dominant driver of exposure and building reinstatement costs. With increasing warming, the fluvial influence increases, and under the 3°C scenario pluvial and fluvial flooding contribute similarly to both exposure and reinstatement costs.

4.4.3.3 DISTRICT FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

Overall exposure within the district increases when flood defences are removed. When comparing the 0.5% AEP events, the number of buildings exposed to flooding increases by 26%, while the number of people exposed increases by 32%. The increase in vulnerability is contributed to by an increase in exposure and losses predominantly occurring within Feilding, Kairanga, and Tangimoana (Figure 59 and Figure 60). Smaller increases can be observed in Rongotea and Longburn. In areas like Feilding and Kairanga, the increase observed in life costs between defences up and down scenarios is 76% and 157% respectively. This highlights the importance of key infrastructure such as the Lower Manawatū Scheme and the role they play in protecting the towns and settlements. The results in Figure 57 to Figure 60 show the need for continued investment in maintenance and upgrades in critical schemes such as the Lower Manawatū Scheme. These schemes should be considered for any long-term strategic asset management for the Manawatū District and the Horizons Region.

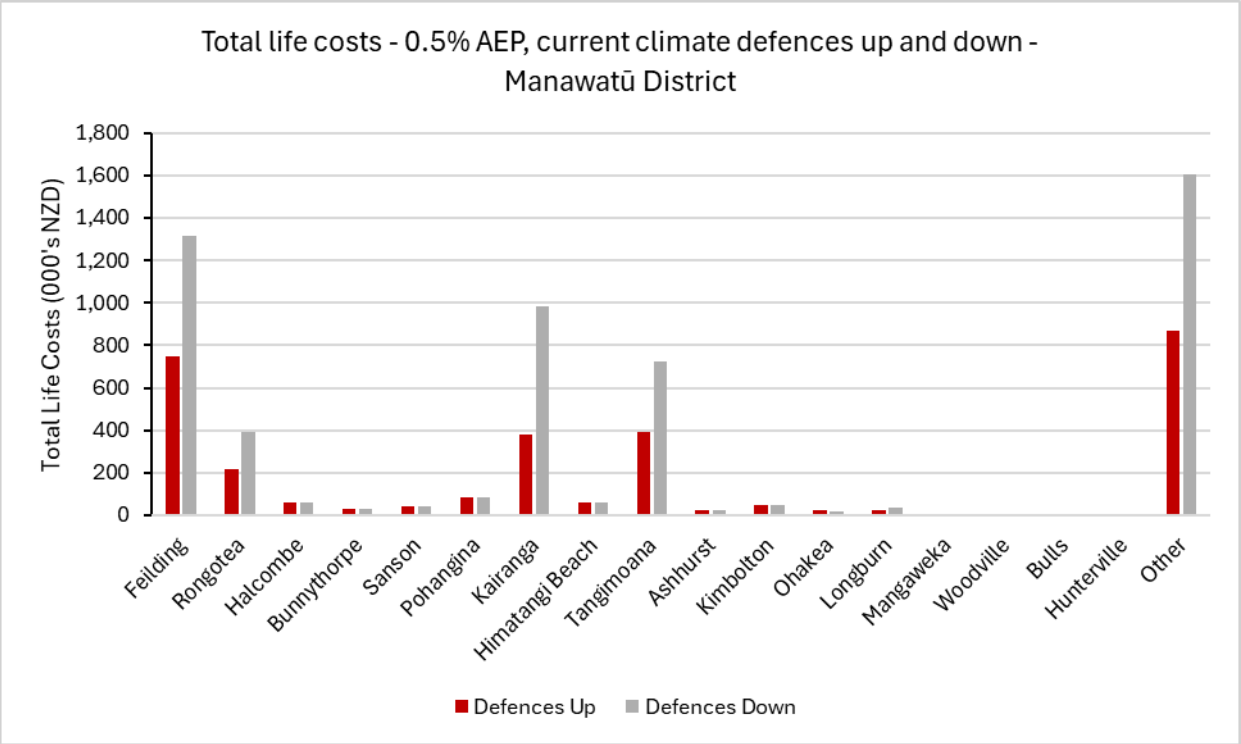


Figure 57: Total life costs for the 0.5% AEP event under current climate comparing defences up and down for the Manawatū District.

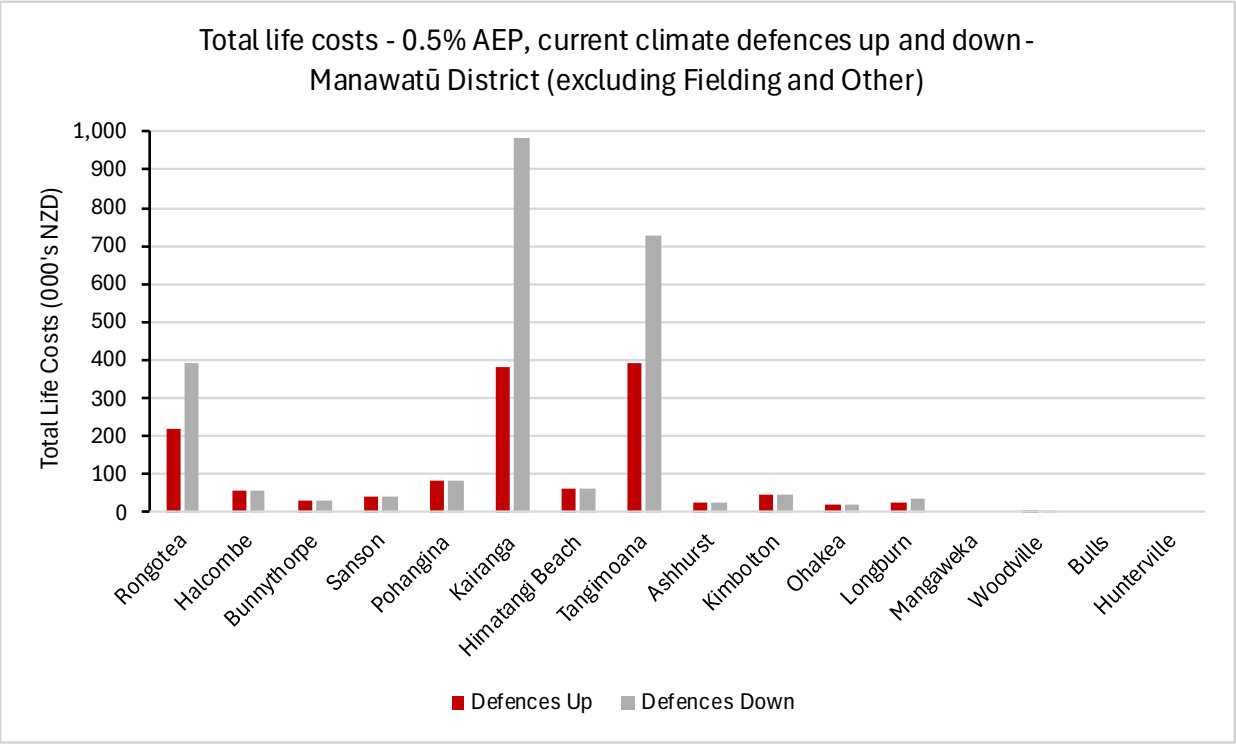


Figure 58: Total life costs for the 0.5% AEP event under current climate comparing defences up and down for the Manawatū District (excluding Feilding and 'Other').

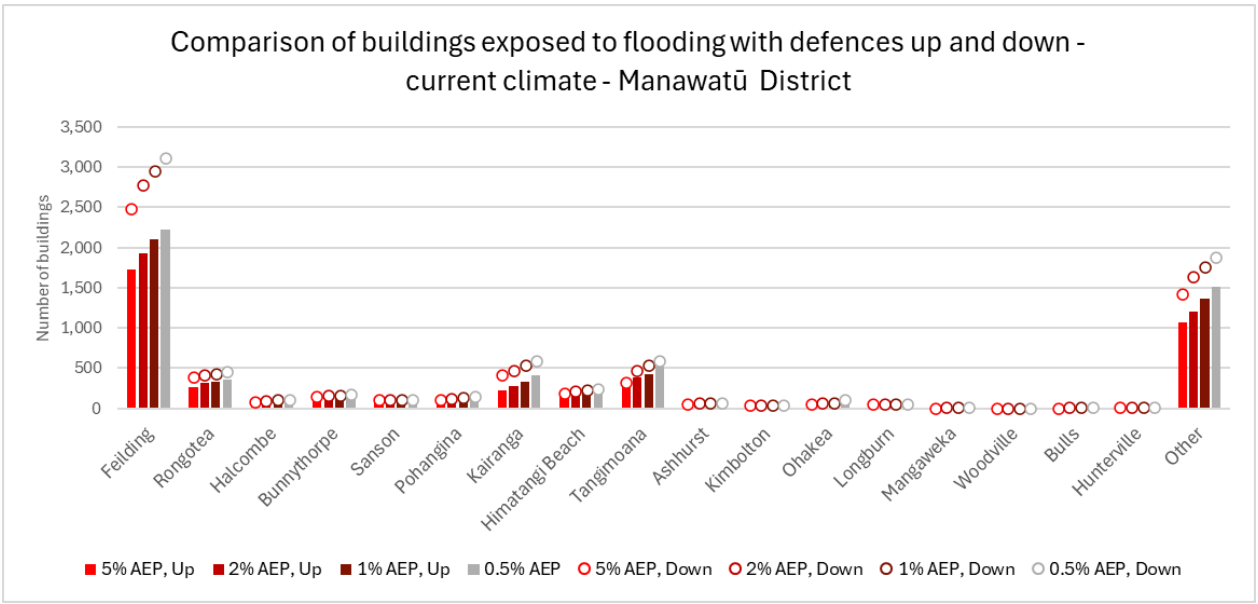


Figure 59: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Manawatū District.

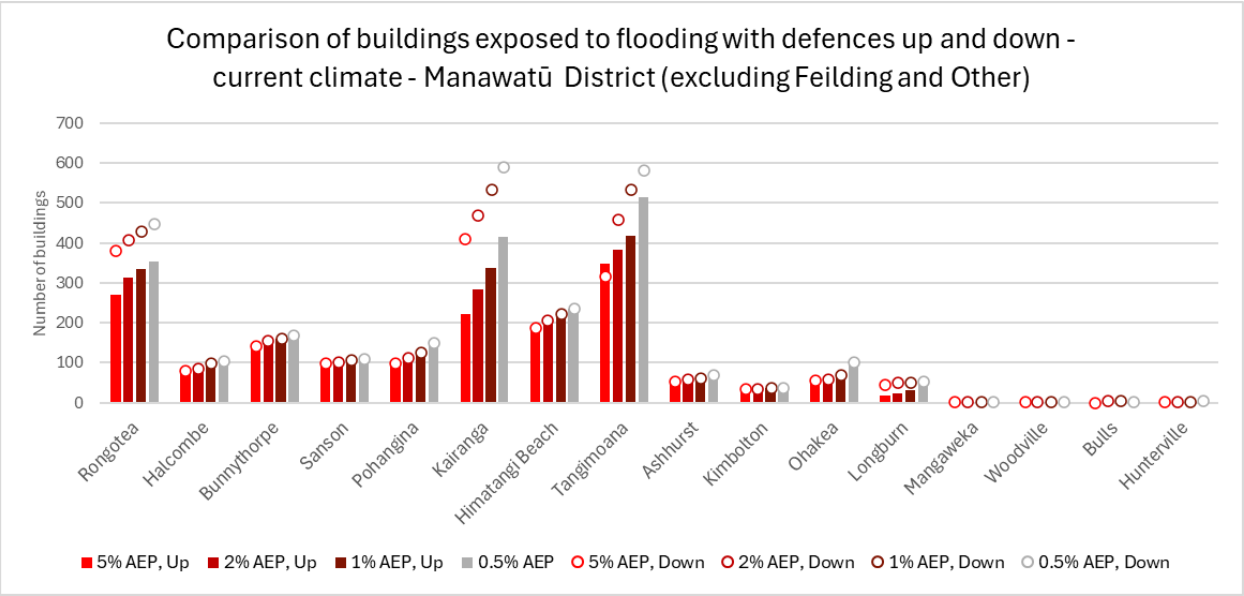


Figure 60: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Manawatū District (excluding Feilding and 'Other').

4.4.3.4 MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 55 and Table 56 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Manawatū District for six flooding scenarios. The results for these scenarios in assume no climate warming (0°C increase) and that existing flood defences are up. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 55: Manawatū District – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT	**4,410**	**1,380**	**99,879**	**2,874**	**1,446**	**4,955**	**1,664**	**121,736**	**3,193**	**1,789**	**5,467**	**2,007**	**149,010**	**3,491**	**2,267**
FEILDING	1,731	300	38,432	1,633	531	1,927	351	44,010	1,805	609	2,100	407	50,202	1,949	674
RONGOTEA	271	102	5,157	169	108	313	133	7,128	198	142	334	154	8,870	204	177
HALCOMBE	80	36	2,655	40	43	85	40	2,545	40	44	98	44	2,491	47	49
BUNNYTHORPE[8]	142	39	1,905	47	24	156	45	2,466	56	26	159	50	3,051	56	27
SANSON	98	41	1,466	47	32	102	44	1,884	49	36	107	45	2,102	56	38
POHANGINA	99	34	1,956	51	50	111	39	2,220	53	60	125	43	2,256	57	67
KAIRANGA[8]	222	79	5,300	113	44	283	134	9,447	148	100	338	187	14,055	190	201
HIMATANGI BEACH	188	88	3,720	76	42	206	103	4,278	79	47	222	113	4,672	85	54
TANGIMOANA	348	244	9,511	155	174	382	271	10,684	167	203	419	304	11,886	184	236
ASHHURST	54	17	1,281	21	16	57	17	1,263	21	19	60	20	1,338	19	22
KIMBOLTON	34	10	610	21	38	35	12	647	21	38	36	14	1,155	26	45
OHAKEA	56	12	711	26	10	58	13	623	26	16	68	15	638	26	19
LONGBURN[8]	19	6	189	7	2	22	7	242	10	2	31	10	423	12	4
MANGAWEKA[8]	1	0	0	0	0	3	0	0	0	0	3	2	31	0	0
WOODVILLE[8]	1	1	56	2	1	2	1	57	2	1	2	2	65	2	1
BULLS[8]	0	0	0	0	0	3	1	58	0	0	3	2	113	0	0
HUNTERVILLE[8]	3	3	100	0	0	3	3	74	0	0	3	3	102	0	0

OTHER	1,063	368	26,830	466	331	1,207	450	34,110	518	446	1,359	592	45,560	578	653

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 56: Manawatū District – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT	**6,053**	**2,508**	**183,070**	**3,822**	**2,988**	**6,692**	**3,048**	**223,456**	**4,141**	**3,980**	**7,076**	**3,304**	**247,617**	**4,394**	**4,731**
FEILDING	2,217	443	56,206	2,052	746	2,385	516	61,866	2,196	823	2,514	570	70,224	2,298	881
RONGOTEA	354	175	10,137	222	219	369	222	13,381	219	259	390	236	14,350	221	288
HALCOMBE	105	59	3,110	57	58	193	90	4,679	98	132	210	102	5,432	113	143
BUNNYTHORPE[8]	168	58	3,567	57	28	171	59	3,916	54	28	180	65	4,082	60	29
SANSON	108	47	2,187	56	39	115	47	1,879	58	43	118	50	1,959	58	44
POHANGINA	150	50	2,720	76	82	156	54	3,058	81	98	171	60	3,496	81	106
KAIRANGA[8]	414	268	20,178	248	382	429	277	21,837	243	355	484	331	26,686	271	497
HIMATANGI BEACH	236	134	5,517	86	63	261	146	6,542	102	68	278	166	7,667	113	78
TANGIMOANA	515	431	16,073	238	390	659	595	25,525	316	1,090	673	612	27,667	321	1,367
ASHHURST	68	23	1,622	22	23	78	25	1,672	24	25	82	26	1,632	24	25
KIMBOLTON	36	14	1,348	26	45	36	14	1,490	26	47	37	15	1,475	26	47
OHAKEA	103	28	2,692	41	21	166	111	9,692	63	90	174	117	11,026	72	112
LONGBURN[8]	51	32	2,423	12	23	54	33	2,382	12	8	55	33	2,205	12	15
MANGAWEKA[8]	3	2	27	0	0	3	2	55	0	0	3	2	63	0	0
WOODVILLE[8]	2	2	63	2	1	2	2	67	2	1	2	2	64	2	1
BULLS[8]	3	3	149	0	0	4	4	173	0	0	4	4	183	0	0
HUNTERVILLE[8]	4	4	162	0	0	4	4	199	0	0	4	4	197	0	0
OTHER	1,516	735	54,889	627	868	1,607	847	65,043	647	913	1,697	909	69,209	722	1,098

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.4.3.5 MANAWATŪ DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP

Table 57 and

Table 58 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Manawatū District for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 57: Manawatū District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT TOTAL	**6,558**	**2,881**	**218,314**	**4,187**	**3,884**	**7,087**	**3,280**	**257,222**	**4,517**	**5,041**
FEILDING	2,372	506	61,541	2,211	832	2,519	561	68,752	2,350	906
RONGOTEA	383	193	11,307	234	248	408	213	13,067	263	289
HALCOMBE	108	63	3,511	54	66	116	67	3,704	54	74
BUNNYTHORPE[8]	172	61	3,962	57	28	182	65	4,183	62	30
SANSON	114	47	2,156	64	42	115	47	2,106	64	43
POHANGINA	157	54	3,084	77	102	173	61	3,521	84	149
KAIRANGA[8]	488	328	28,093	299	675	609	446	40,980	351	1,092
HIMATANGI BEACH	257	152	6,569	98	74	279	175	7,361	105	90
TANGIMOANA	559	493	18,786	268	520	596	542	21,848	290	674
ASHHURST	68	24	1,657	28	25	70	22	1,544	28	26
KIMBOLTON	36	14	1,365	26	46	37	15	1,427	26	47
OHAKEA	138	63	5,273	65	49	149	79	5,688	75	76
LONGBURN[8]	53	32	2,507	12	30	54	32	2,604	12	38
MANGAWEKA[8]	3	2	43	0	0	3	2	68	0	0
WOODVILLE[8]	2	2	67	2	1	2	2	64	2	1
BULLS[8]	4	4	199	0	0	4	4	203	0	0
HUNTERVILLE[8]	4	4	165	0	0	4	4	234	0	0
OTHER	1,640	839	68,029	692	1,146	1,767	943	79,868	751	1,506

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 58: Manawatū District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT TOTAL	**7,528**	**3,594**	**295,328**	**4,769**	**6,330**	**7,525**	**3,592**	**296,324**	**4,769**	**6,332**
FEILDING	2,685	624	81,410	2,489	979	2,684	624	81,547	2,489	979
RONGOTEA	440	231	13,939	274	325	440	231	13,934	274	325
HALCOMBE	121	70	4,012	54	72	121	70	4,013	54	72
BUNNYTHORPE[8]	184	65	4,168	73	31	184	65	4,167	73	31
SANSON	116	47	2,165	64	44	116	47	2,165	64	44
POHANGINA	184	67	3,669	85	161	184	67	3,669	85	161
KAIRANGA[8]	666	515	50,107	369	1,540	666	515	50,054	369	1,540
HIMATANGI BEACH	303	196	8,132	109	106	300	194	9,005	109	105
TANGIMOANA	620	577	24,197	303	921	621	577	24,238	303	924
ASHHURST	73	25	1,933	31	30	73	25	1,933	31	30
KIMBOLTON	37	15	1,478	26	48	37	15	1,478	26	48
OHAKEA	162	85	6,723	79	99	162	85	6,723	79	99
LONGBURN[8]	55	32	2,862	12	48	55	32	2,862	12	48
MANGAWEKA[8]	3	2	65	0	0	3	2	61	0	0
WOODVILLE[8]	2	2	62	2	1	2	2	62	2	1
BULLS[8]	4	4	198	0	0	4	4	198	0	0

HUNTERVILLE[8]	4	4	158	0	0	4	4	158	0	0
OTHER	1,869	1,033	90,050	799	1,925	1,869	1,033	90,057	799	1,925

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.4.3.6 MANAWATŪ DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 59 and Table 60 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Manawatū District for four flooding scenarios. The results for all four flooding scenarios assume no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 59: Manawatū District – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT TOTAL	**5,800**	**2,178**	**186,346**	**3,844**	**2,767**	**6,609**	**2,822**	**238,015**	**4,358**	**3,772**
FEILDING	2,479	526	70,729	2,339	843	2,777	696	87,087	2,603	1,028
RONGOTEA	379	208	13,191	227	293	406	233	14,442	247	335
HALCOMBE	80	36	2,655	40	43	85	40	2,545	40	44
BUNNYTHORPE[8]	142	39	1,905	47	24	156	45	2,466	56	26
SANSON	98	41	1,466	47	32	102	44	1,884	49	36
POHANGINA	99	34	1,956	51	50	111	39	2,219	53	60
KAIRANGA[8]	411	254	20,806	224	432	468	312	26,328	268	643
HIMATANGI BEACH	188	88	3,720	76	42	206	103	4,278	79	47
TANGIMOANA	316	192	7,521	135	146	459	369	14,155	208	312
ASHHURST	54	17	1,281	21	16	57	17	1,263	21	19
KIMBOLTON	34	10	610	21	38	35	12	647	21	38
OHAKEA	56	12	681	26	9	58	13	636	26	15
LONGBURN[8]	44	26	1,405	12	14	49	31	2,348	12	23
MANGAWEKA[8]	1	0	0	0	0	3	0	0	0	0
WOODVILLE[8]	1	1	56	2	1	2	1	57	2	1
BULLS[8]	0	0	0	0	0	4	2	132	0	0
HUNTERVILLE[8]	3	3	100	0	0	3	3	74	0	0
OTHER	1,415	691	58,264	576	784	1,628	862	77,454	673	1,145

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 60: Manawatū District – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT TOTAL	**7,135**	**3,292**	**280,737**	**4,724**	**4,618**	**7,628**	**3,695**	**318,525**	**5,049**	**5,415**
FEILDING	2,950	839	100,886	2,778	1,167	3,106	935	115,702	2,945	1,313
RONGOTEA	428	248	16,183	266	373	448	255	16,324	271	393
HALCOMBE	98	44	2,491	47	49	105	59	3,118	57	58
BUNNYTHORPE[8]	159	50	3,051	56	27	168	58	3,567	57	28
SANSON	107	45	2,096	56	38	108	47	2,187	56	39
POHANGINA	125	43	2,256	57	67	150	50	2,720	76	82
KAIRANGA[8]	533	377	33,220	313	823	590	438	40,376	345	985
HIMATANGI BEACH	222	113	4,672	85	54	236	134	5,549	86	63
TANGIMOANA	534	457	17,988	261	508	581	532	21,432	283	726
ASHHURST	60	20	1,338	19	22	68	23	1,622	22	23
KIMBOLTON	36	14	1,155	26	45	36	14	1,348	26	45
OHAKEA	68	15	634	26	18	100	27	2,272	37	18
LONGBURN[8]	51	31	2,415	12	30	52	31	2,511	12	35
MANGAWEKA[8]	3	2	31	0	0	3	2	27	0	0
WOODVILLE[8]	2	2	65	2	1	2	2	63	2	1
BULLS[8]	4	3	178	0	0	3	3	191	0	0
HUNTERVILLE[8]	3	3	102	0	0	4	4	162	0	0
OTHER	1,752	986	91,976	720	1,396	1,868	1,081	99,354	774	1,606

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.4.3.7 MANAWATŪ DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 61 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Manawatū District for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 61: Manawatū District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
MANAWATŪ DISTRICT	**8,058**	**4,065**	**354,341**	**5,367**	**6,205**	**8,451**	**4,417**	**391,627**	**5,668**	**7,067**	**8,788**	**4,680**	**412,694**	**5,883**	**7,889**
FEILDING	3,270	1,081	130,662	3,133	1,451	3,444	1,231	149,125	3,312	1,604	3,612	1,354	154,286	3,458	1,768
RONGOTEA	469	263	17,059	289	413	484	269	17,586	298	432	506	280	18,334	307	455
HALCOMBE	108	64	3,519	54	66	116	67	3,702	54	74	120	70	4,014	54	72
BUNNYTHORPE[8]	172	61	3,962	57	28	182	65	4,183	62	30	184	65	4,168	73	31
SANSON	114	47	2,156	64	42	115	47	2,106	64	43	116	47	2,165	64	44
POHANGINA	157	54	3,081	77	102	172	61	3,522	84	149	184	67	3,671	85	161
KAIRANGA[8]	640	476	44,877	361	1,139	670	523	48,851	377	1,288	697	550	53,434	386	1,431
HIMATANGI BEACH	257	152	6,569	98	74	279	175	7,362	105	90	303	196	8,126	109	106
TANGIMOANA	613	565	23,245	295	934	629	587	25,678	309	1,159	638	594	26,642	316	1,387
ASHHURST	68	24	1,658	28	25	70	22	1,544	28	26	73	26	1,942	31	30
KIMBOLTON	36	14	1,365	26	46	37	15	1,427	26	47	37	15	1,478	26	48
OHAKEA	135	60	4,658	65	45	148	79	5,648	75	71	162	84	6,694	79	93
LONGBURN[8]	53	32	2,480	12	39	54	32	2,792	12	43	54	32	2,896	12	46
MANGAWEKA[8]	3	2	43	0	0	3	2	68	0	0	3	2	61	0	0
WOODVILLE[8]	2	2	67	2	1	2	2	64	2	1	2	2	62	2	1
BULLS[8]	4	4	199	0	0	4	4	231	0	0	4	4	191	0	0
HUNTERVILLE[8]	4	4	165	0	0	4	4	234	0	0	4	4	158	0	0

OTHER	1,953	1,160	108,576	806	1,800	2,038	1,232	117,504	860	2,010	2,089	1,288	124,372	881	2,216

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.4.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

The highest exposure to flooding within the Manawatū District is within Feilding, where exposure of buildings to flooding increases by 45% when comparing the 5% AEP event to the 0.1% AEP event. Feilding has the highest population within the district. The results also indicate a major concentration of flood prone buildings. Exposure is dominated by residential buildings but results show similar risk in commercial/industrial and rural buildings. These results highlight the importance of flood protection schemes providing protection, not only for urban areas consisting predominately of residential buildings, but also in protecting commercial and rural buildings. Results of the pluvial-fluvial case study show that pluvial flooding is the main flood driver in Feilding.

Tangimoana and Ohakea show a steep increase in building exposure particularly noticed between the 0.5% and 0.2% AEP events. In Tangimoana, exposure increases by 93% when comparing the 5% AEP event to the 0.1% AEP event. These towns and settlements are both located to the south of the Rangitīkei River within a scheme designed to provide protection up to a 2% AEP flood event. Figure 61 suggests that risk escalates between the 0.5% and the 0.2% AEP events highlighting vulnerability to rarer, more severe flood events. Further detailed flood modelling could be conducted to understand whether enhanced structural defences would provide cost-effective risk reduction.

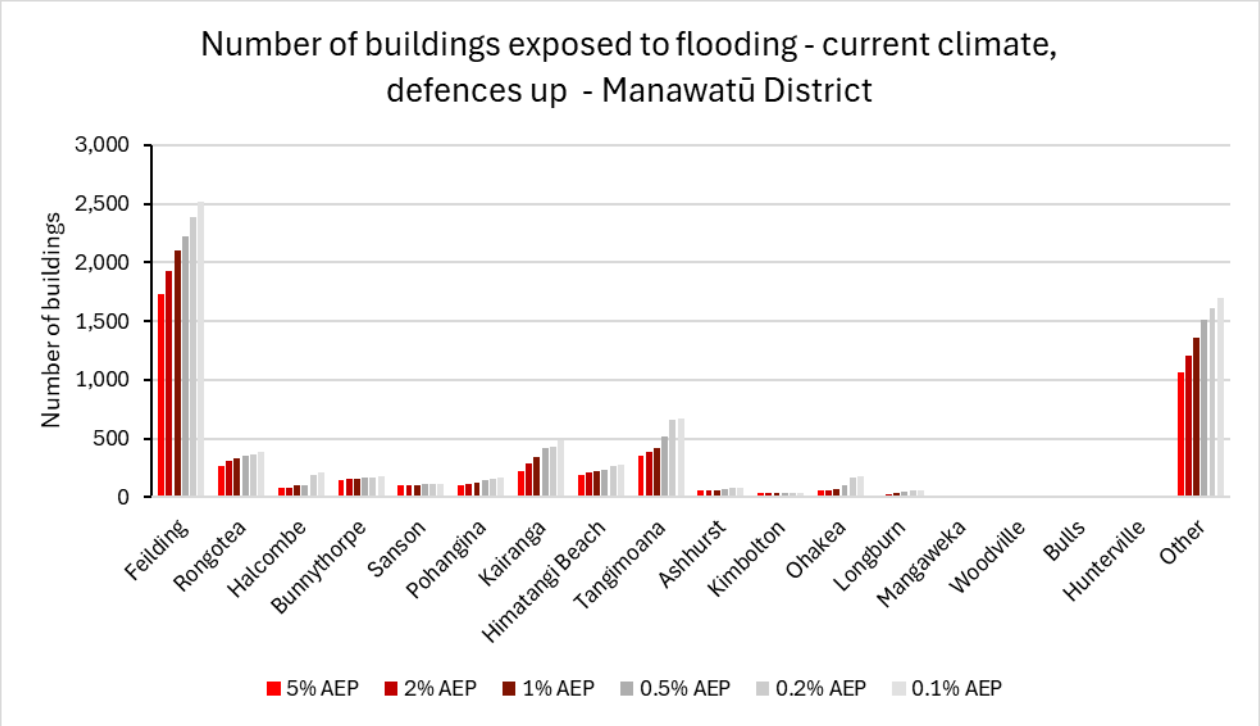


Figure 61: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Manawatū District.

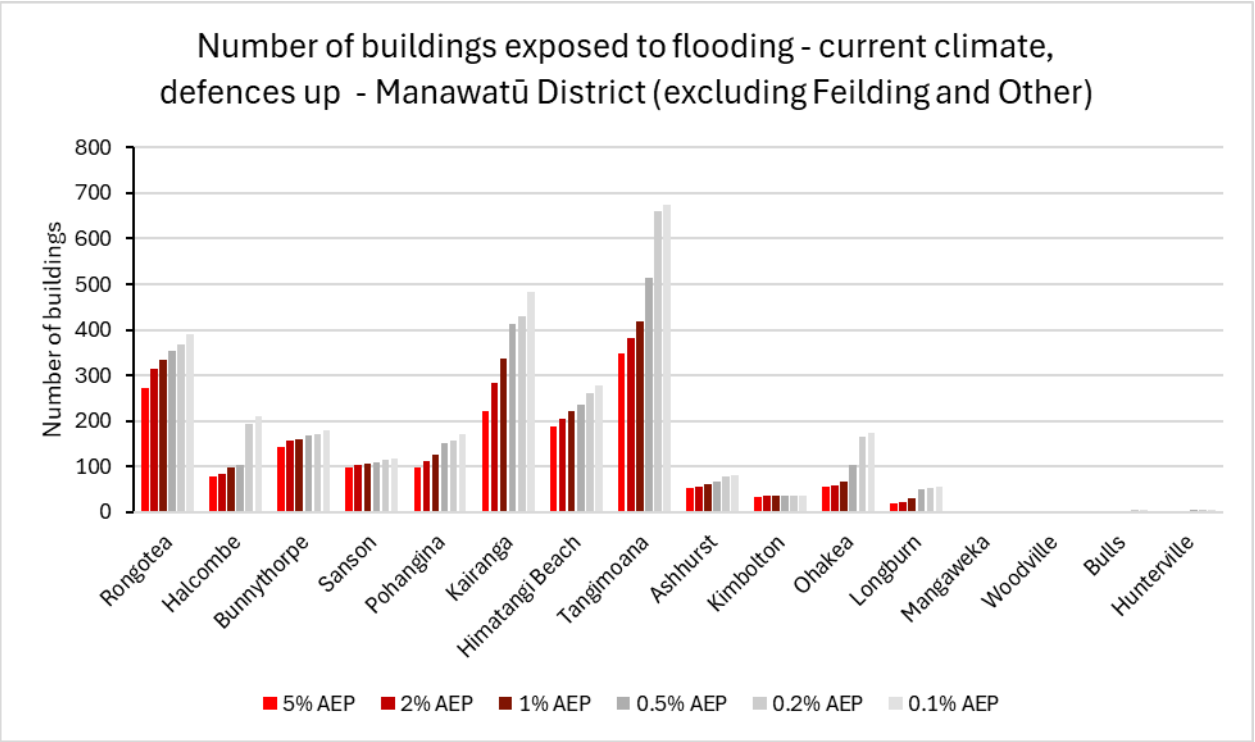


Figure 62: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Manawatū District (excluding Feilding and 'Other').

4.5 TARARUA DISTRICT

4.5.1 DISTRICT OVERVIEW – TARARUA

The Tararua District is located in the south-east of Aotearoa New Zealand's North Island. The district stretches from the Ruahine Range in the north to the southern edge of the Manawatū River catchment in the south. The eastern boundary of the district is the Pacific Ocean. The district's main town is Dannevirke (Figure 63).

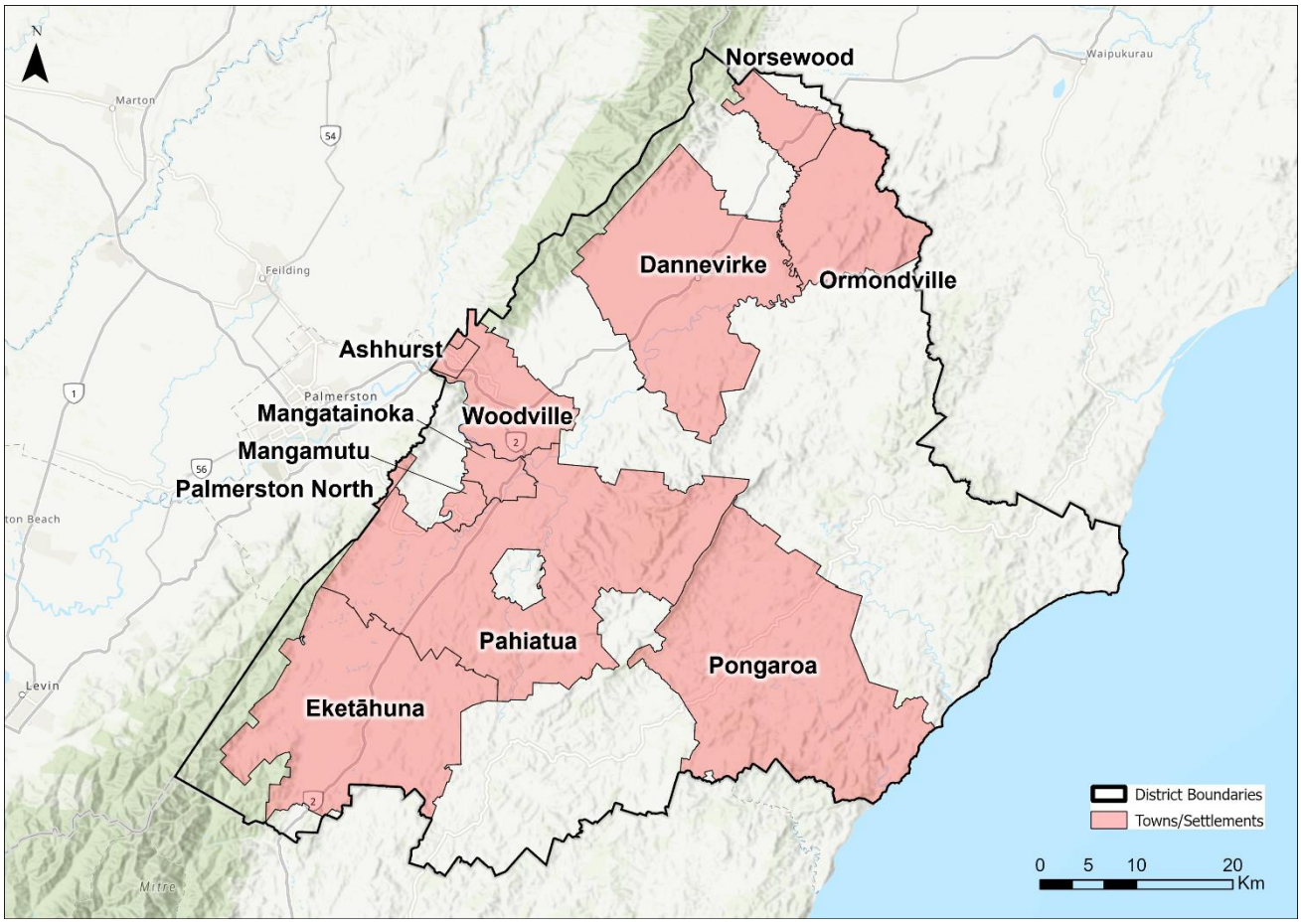


Figure 63: Map of Tararua District with town and settlement boundaries. Note that the Palmerston North town and settlement boundary extends into the Tararua District boundary; however, has not been included within results for this district. For the purpose of reporting, any buildings outside of a town or settlement boundary have been categorised as 'Other'.

The district's total population is 18,660 (according to the 2023 Census) with a median age of 42.4 years, notably older than the national average (Stats NZ, 2025). Home ownership is high at 72.5%, but median personal income of $33,600 is low compared to the $41,500 national average (Stats NZ, 2025). These factors, combined with an aging population and rural isolation, suggest potential vulnerability during flood events, particularly for evacuation and recovery.

Economically, Tararua is strongly rural: agriculture, forestry, and fishing account for 41.8% of local businesses, compared with 9.9% nationally (Stats NZ, 2025). Dairy and sheep/beef farming are the main economic activity, supported by forestry and niche manufacturing. The primary industry sector contributes 31% of local GDP, making Tararua one of the most agriculture-dependent districts in New Zealand (Infometrics, 2024). Manufacturing employs about 9.6% of the workforce, while construction and retail trade each account for around 8% (Infometrics, 2024). The primary industries sector faces strain from cyclone recovery costs (Cyclone Gabrielle repairs alone required $12 million), high input prices, and global market pressures, prompting some land-use shifts away from livestock farming toward forestry and carbon farming (Infometrics, 2024). The district's overall dependency on land-based economic activities make it particularly vulnerable to flooding.

4.5.2 FLOOD MANAGEMENT SCHEMES

The Tararua District is protected by five flood management schemes. Table 62 indicates that levels of service for flood management schemes in the Tararua District range from containing a 20% AEP flood (Mangatainoka and Upper Manawatū) up to a 5% AEP flood (Mangatainoka and Tawataia Mangaone).

Table 62: Flood management schemes in the Tararua District (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
MANGATAINOKA	Includes sections of the Mangatainoka River, Makakahi River, and Mangaramarama Stream and provides benefits to 39,646 ha of rural and urban land, including the township of Pahiatua.	5-20% AEP.
SOUTH EAST RUAHINE	Includes eighteen streams and part of the Manawatū River. The Scheme offers benefit to 64,543 ha of mainly productive land, but also includes the townships of Dannevirke, Woodville and Norsewood.	20% AEP.
TARARUA	Channel maintenance scheme.	Not assessed.
TAWATAIA MANGAONE	Protects rural land from flooding and provide land drainage.	5% AEP.
UPPER MANAWATŪ	Includes sections of the Manawatū River, Mangahao River and 19 km of drains and provides benefit to 24,000 ha of rural and urban land, including the townships of Dannevirke, Woodville and Pahiatua.	20% AEP.

4.5.3 DISTRICT FLOOD VULNERABILITY RESULTS

This section provides a summary of flood vulnerability in Tararua District under current and future climate conditions and compares scenarios with and without existing flood defences. The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.5.3.1 DISTRICT FLOOD VULNERABILITY: CURRENT CLIMATE

Under current climate conditions and with existing flood defences up, the Tararua District experiences increases in flood vulnerability across all AEP scenarios. At the 5% AEP, 3,410 buildings are exposed to flooding, with 45% (1,528) contributing to reinstatement costs exceeding $142M. By the 0.1% AEP, the number of buildings exposed increases by 45% to 4,954, with 57% (2,841) of those associated with reinstatement costs of $334M. The total population exposed increases by 50% from 1,889 to 2,860 between the 5% AEP to the 0.1% AEP. The estimated number of fatalities increases from 3 to 35 for these events.

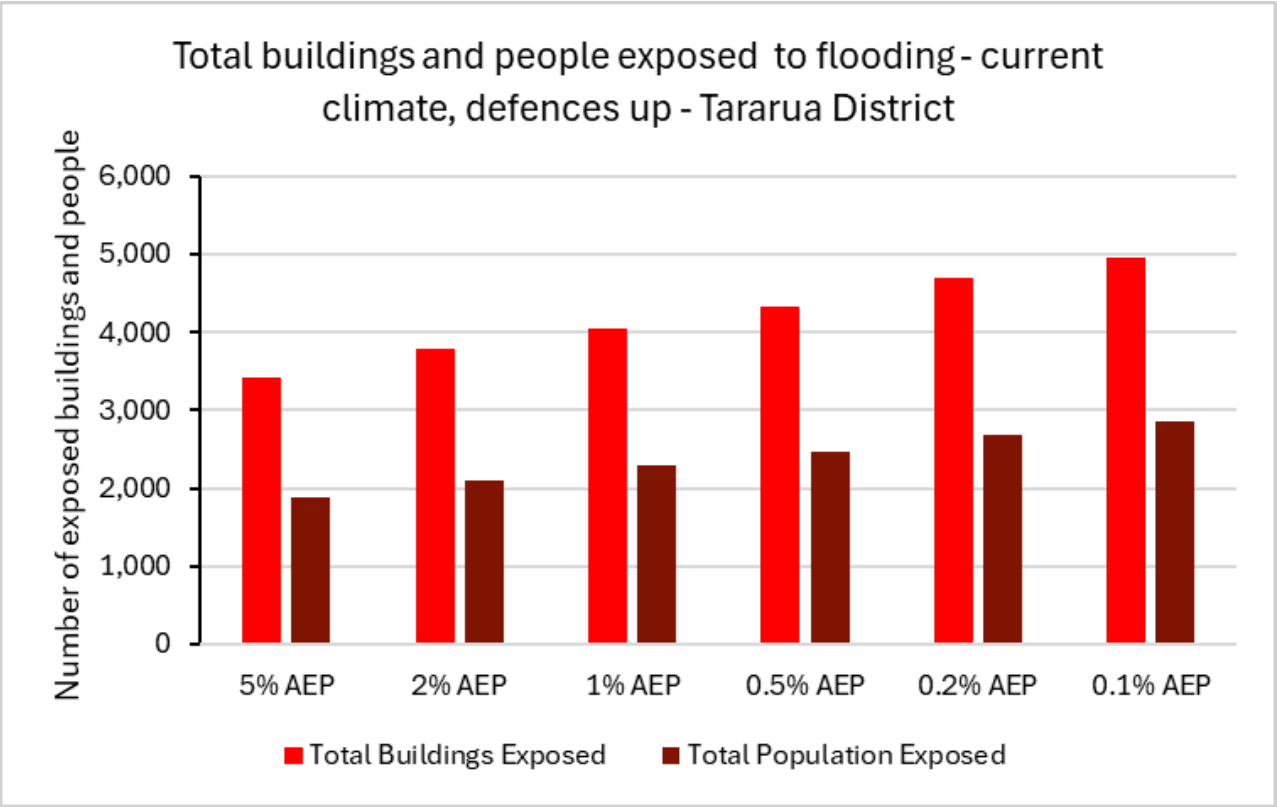


Figure 64: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Tararua.

4.5.3.2 DISTRICT FLOOD VULNERABILITY: WARMING SCENARIOS

Climate warming increases flood vulnerability in the Tararua District. The progression shown in Table 63 reflect a notable increase in life costs (771%) and a 22% increase in building reinstatement costs between the current climate and 3°C warming scenarios. The large increase in life costs, with reinstatement costs remaining moderate, may be reflective of the severity of flooding increasing in affected areas, where depth and velocity increase, resulting in higher life costs. We recommend as a next step, detailed Level C flood modelling of climate change scenarios to better understand the vulnerability towards flooding under climate change within the Tararua District. This modelling can guide evidence- based decision making to improve flood risk management, including potential upgrading of defences, development of new standards for defences that include climate change, or community evacuation planning.

Table 63: Tararua District – Vulnerability metrics for 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood Defences up.

TOWN/ SETTLEMENT*	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALIITES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	4,332	2,312	251,035	2,466	8	10,200
1°C CLIMATE WARMING	4,449	2,364	230,904	2,541	22	27,474
2°C CLIMATE WARMING	5,021	2,869	318,000	2,923	50	61,994
3°C CLIMATE WARMING	5,275	3,015	306,547	3,031	72	88,859
3°C CLIMATE WARMING with SEA LEVEL RISE	5,287	3,032	307,340	3,036	72	88,879

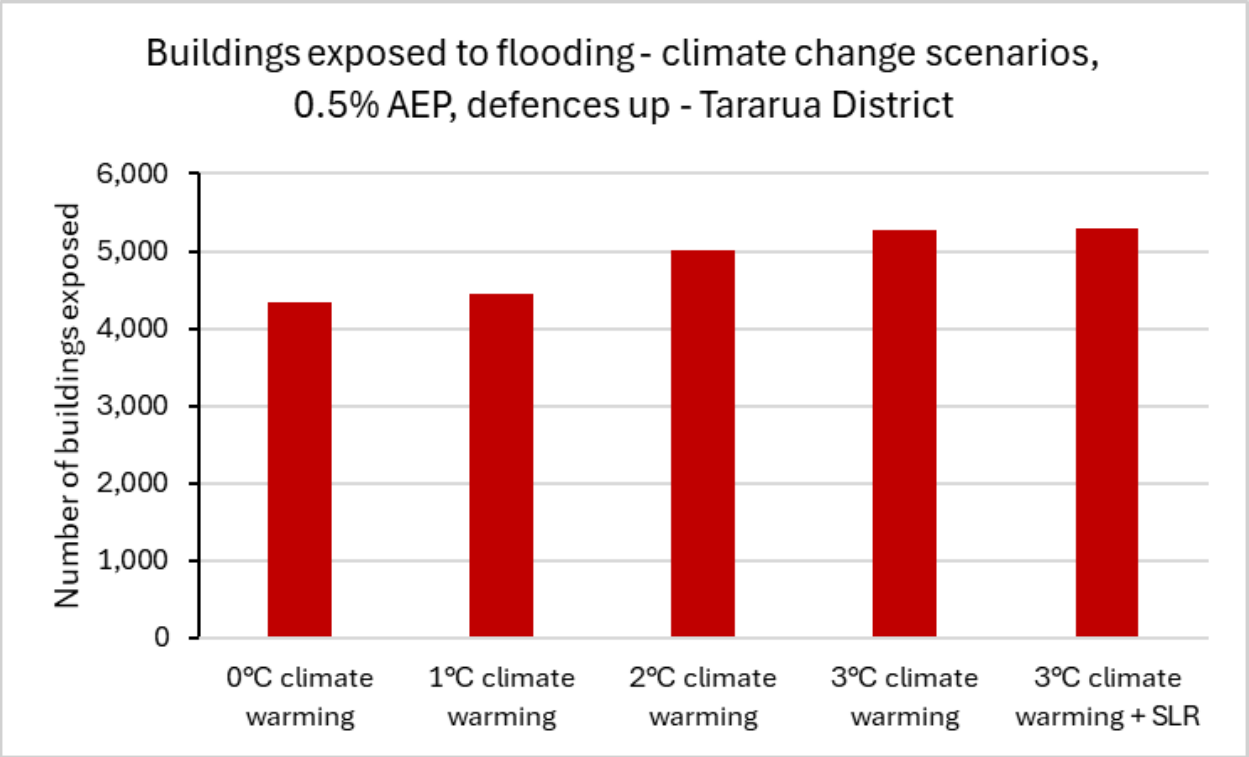


Figure 65: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C warming including with sea level rise) for the 0.5% AEP flood event with defences down for Tararua.

4.5.3.3 DISTRICT FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

When comparing the defences up and defences down scenarios, overall vulnerability for the district shows only slight changes. At the town and settlement level, differences are minimal (refer Figure 66 to Figure 68). For example, Woodville and Pahiatua record only slight increases in life costs. This may indicate that there are no flood defences protecting these communities, or that flooding is overwhelming the defences that do exist. As shown in Table 62, many schemes offer protection up to a 20% AEP event, which is more frequent and less severe than the lowest AEP event (0.2%) used in this vulnerability assessment. Even where schemes provide a higher level of protection (for example, 5% or 1% level of service) the minimal change in vulnerability suggests that they are positioned in areas that do not substantially alter flood pathways or reduce exposure within towns and settlements of the Tararua District.

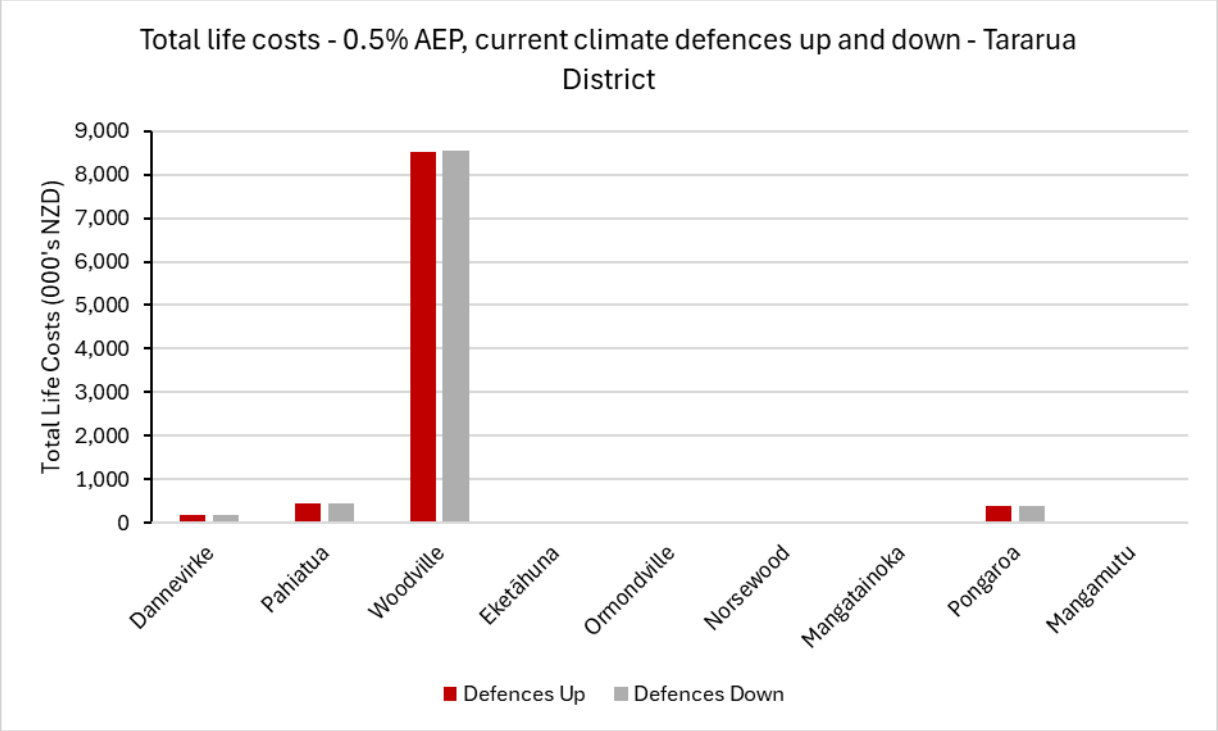


Figure 66: Total life costs for the 0.5% AEP event under current climate comparing defences up and down for the Tararua District.

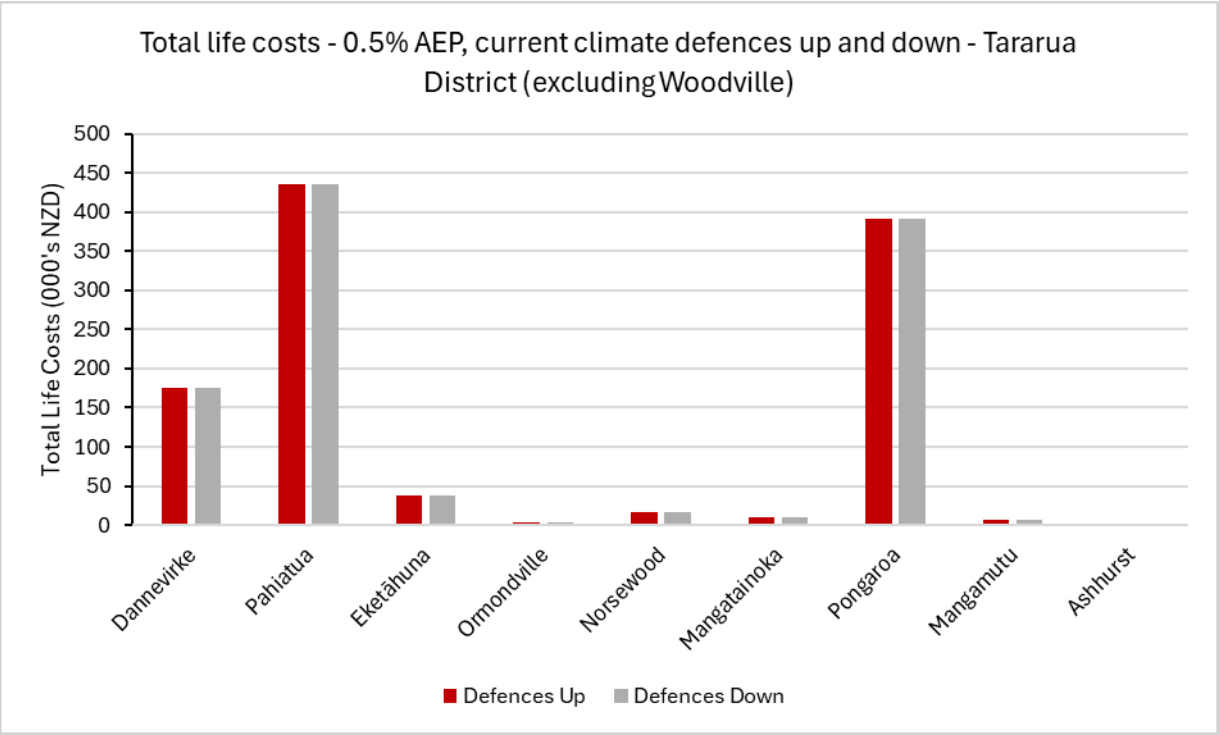


Figure 67: Total life costs for the 0.5% AEP event under current climate comparing defences up and down for the Tararua District (excluding Woodville).

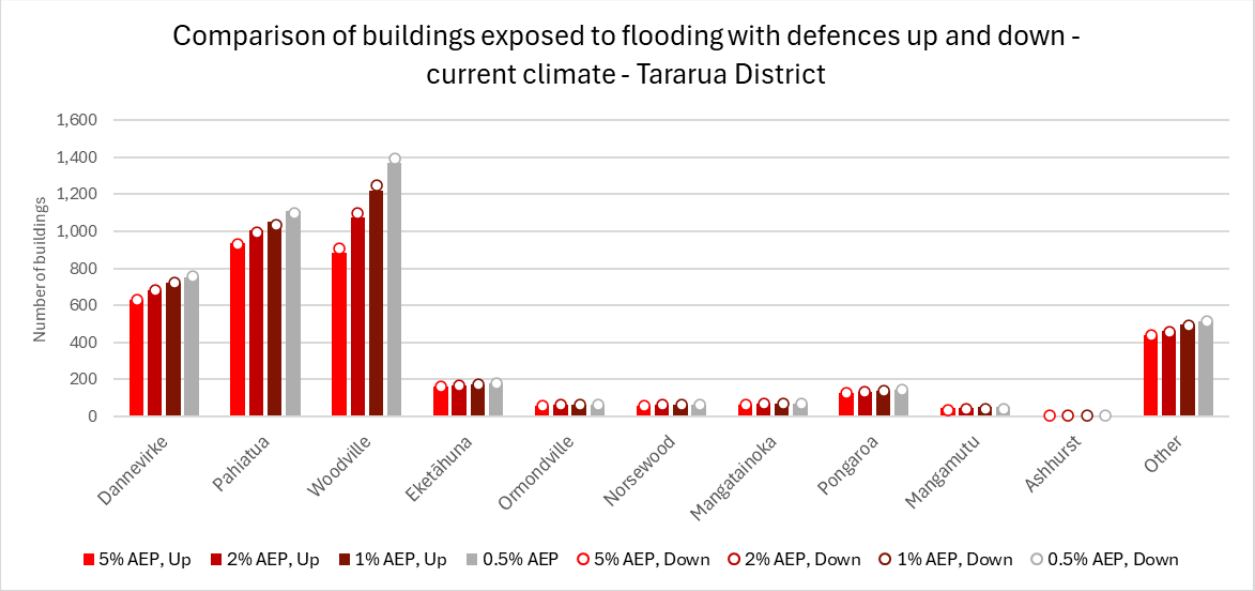


Figure 68: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Tararua District.

4.5.3.4 TARARUA DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 64 and Table 65 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Tararua District for six flooding scenarios. The results for these scenarios assume no climate warming (0°C increase) and that existing flood defences are up. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 64: Tararua District – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3,4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED3	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
TARARUA DISTRICT TOTAL	**3,410**	**1,528**	**142,249**	**1,889**	**3,769**	**3,784**	**1,827**	**175,790**	**2,104**	**5,756**	**4,055**	**2,077**	**207,794**	**2,285**	**7,726**
DANNEVIRKE	629	113	7,080	382	118	682	130	8,098	404	131	722	146	9,331	436	143
PAHIATUA	937	371	24,852	657	365	1,008	414	27,757	703	393	1,055	452	29,972	722	406
WOODVILLE[8]	885	607	60,923	516	2,533	1,076	814	85,301	658	4,372	1,219	984	109,095	773	6,212
EKETĀHUNA	160	57	3,456	55	32	167	56	3,333	69	36	172	67	3,730	73	37
ORMONDVILLE	60	15	406	14	2	64	16	434	14	3	66	17	437	14	3
NORSEWOOD	60	19	768	33	16	63	20	812	37	17	63	20	790	37	17
PONGAROA	62	32	2,122	19	15	72	39	2,971	17	17	67	31	2,250	16	15
MANGATAINOKA	127	109	15,810	23	232	135	118	17,358	22	300	136	119	18,951	22	347
MANGAMUTU	44	15	12,798	10	5	46	17	14,512	10	5	51	21	16,027	10	5
ASHHURST[8]	7	5	410	0	0	8	6	541	0	0	8	6	538	0	0
OTHER	439	185	13,624	180	451	463	197	14,673	170	482	496	214	16,673	182	541

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 65: Tararua District – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
TARARUA DISTRICT TOTAL	**4,332**	**2,312**	**251,035**	**2,466**	**10,200**	**4,692**	**2,631**	**283,163**	**2,690**	**27,541**	**4,954**	**2,841**	**334,616**	**2,860**	**43,400**
DANNEVIRKE	753	161	10,397	448	176	809	179	11,597	491	211	841	190	12,413	517	228
PAHIATUA	1,108	488	34,660	760	436	1,164	532	38,533	801	462	1,217	567	41,152	828	496
WOODVILLE[8]	1,372	1,141	135,337	904	8,534	1,558	1,339	162,802	1,012	25,081	1,660	1,455	191,177	1,093	35,634
EKETĀHUNA	178	65	3,633	71	38	191	71	3,949	73	39	199	75	4,230	73	40
ORMONDVILLE	66	17	460	14	3	68	17	452	14	3	69	18	511	14	3
NORSEWOOD	63	20	791	37	17	65	20	792	37	17	66	21	806	37	17
PONGAROA	69	33	2,197	16	10	87	51	3,179	33	584	95	56	3,764	40	926
MANGATAINOKA	147	129	26,240	22	392	152	134	27,877	24	454	167	145	30,050	25	494
MANGAMUTU	52	21	20,065	10	6	60	29	14,082	10	6	81	43	29,451	23	16
ASHHURST[8]	8	6	533	0	0	8	6	556	0	0	8	6	552	0	0
OTHER	516	231	16,722	184	588	530	253	19,344	195	684	551	265	20,510	210	5,546

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.5.3.5 TARARUA DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT –WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP

Table 66 and Table 67 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Tararua District for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 66: Tararua District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C and 2°C) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
TARARUA DISTRICT TOTAL	**4,449**	**2,364**	**230,904**	**2,541**	**27,474**	**5,021**	**2,869**	**318,000**	**2,923**	**61,996**
DANNEVIRKE	803	177	11,604	489	208	852	196	13,194	531	236
PAHIATUA	1,169	538	38,956	809	466	1,244	585	42,815	838	509
WOODVILLE[8]	1,314	1,073	118,791	845	17,993	1,649	1,448	186,348	1,099	51,782
EKETĀHUNA	204	84	5,100	83	59	211	79	4,686	87	52
ORMONDVILLE	68	17	455	14	3	71	18	511	14	3
NORSEWOOD	65	20	792	37	17	67	22	831	37	18
PONGAROA	87	51	3,126	33	528	95	56	3,795	40	932
MANGATAINOKA	141	123	18,879	22	2,778	172	145	29,673	31	2,897
MANGAMUTU	58	26	14,049	10	6	91	45	14,914	33	20
ASHHURST[8]	8	6	559	0	0	8	6	552	0	0
OTHER	532	249	18,593	199	5,416	561	269	20,681	213	5,547

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 67: Tararua District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
DANNEVIRKE	**5,275**	**3,015**	**306,547**	**3,031**	**88,859**	**5,287**	**3,032**	**307,341**	**3,036**	**88,879**
PAHIATUA	905	230	15,999	582	264	905	230	15,999	582	264
WOODVILLE[8]	1,340	640	46,059	891	562	1,340	640	46,059	891	562
EKETĀHUNA	1,575	1,339	161,564	1,029	61,938	1,575	1,339	161,564	1,029	61,938
ORMONDVILLE	245	107	6,183	99	2,556	245	107	6,183	99	2,556
NORSEWOOD	78	20	652	25	72	78	20	652	25	72
PONGAROA	67	22	826	37	18	67	22	826	37	18
MANGATAINOKA	101	62	4,092	45	1,303	101	62	4,092	45	1,303
MANGAMUTU	210	181	30,669	45	6,928	210	181	30,669	45	6,928
ASHHURST[8]	107	69	15,044	41	30	107	69	15,044	41	30
OTHER	8	8	629	0	0	8	8	629	0	0
DANNEVIRKE	639	337	24,830	237	15,188	651	354	25,624	242	15,208

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.5.3.6 TARARUA DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 68 and Table 69 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Tararua District for four flooding scenarios. The results for all four flooding scenarios assume no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 68: Tararua District – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
TARARUA DISTRICT TOTAL	**3,415**	**1,528**	**143,159**	**1,901**	**3,776**	**3,785**	**1,824**	**184,958**	**2,132**	**5,761**
EKETĀHUNA	632	119	7,619	382	118	683	135	8,649	404	131
ORMONDVILLE	931	375	25,315	656	366	996	413	27,536	702	393
NORSEWOOD	905	603	60,749	529	2,539	1,101	817	85,635	688	4,378
PONGAROA	161	58	3,502	55	32	167	56	3,310	69	36
MANGATAINOKA	60	15	406	14	2	64	16	435	14	3
MANGAMUTU	60	19	768	33	16	63	20	812	37	17
ASHHURST[8]	62	32	2,122	19	15	72	39	2,971	17	17
OTHER	127	109	15,782	23	232	135	118	17,362	22	300
DANNEVIRKE	33	9	13,030	10	5	38	11	23,605	10	5
PAHIATUA	7	5	410	0	0	8	6	541	0	0
WOODVILLE[8]	437	184	13,456	180	451	458	193	14,102	169	481

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 69: Tararua District – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
TARARUA DISTRICT TOTAL	**4,055**	**2,063**	**215,191**	**2,309**	**7,735**	**4,329**	**2,296**	**244,747**	**2,485**	**10,212**
DANNEVIRKE	723	152	9,700	436	143	755	165	10,698	448	176
PAHIATUA	1,037	443	29,266	718	406	1,096	480	33,383	758	436
WOODVILLE[8]	1,251	984	108,707	805	6,222	1,394	1,137	135,854	926	8,547
EKETĀHUNA	172	67	3,738	73	37	178	65	3,634	71	38
ORMONDVILLE	66	17	439	14	3	66	17	460	14	3
NORSEWOOD	63	20	790	37	17	63	20	791	37	17
PONGAROA	67	31	2,250	16	15	69	33	2,197	16	10
MANGATAINOKA	136	119	18,569	22	347	147	129	26,240	22	392
MANGAMUTU	42	14	25,117	10	5	41	17	14,925	10	6
ASHHURST[8]	8	6	538	0	0	8	6	533	0	0
OTHER	490	210	16,077	178	540	512	227	16,032	183	587

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[4] Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[5] Population values are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele et al. (2021).

[6] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[7] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.5.3.7 TARARUA DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 70 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Tararua District for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 70: Tararua District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [5]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
TARARUA DISTRICT TOTAL	**4,648**	**2,562**	**284,126**	**2,684**	**31,465**	**5,033**	**2,858**	**316,184**	**2,953**	**62,047**	**5,472**	**3,238**	**358,595**	**3,158**	**91,373**
DANNEVIRKE	806	180	11,844	491	208	854	197	13,373	533	236	909	230	16,053	584	265
PAHIATUA	1,157	521	37,532	795	459	1,231	581	42,548	847	511	1,331	628	45,510	892	558
WOODVILLE[8]	1,536	1,293	155,801	1,011	21,878	1,669	1,440	186,398	1,112	51,823	1,771	1,554	213,551	1,165	66,814
EKETĀHUNA	191	71	4,033	73	40	211	79	4,685	87	52	233	97	5,249	89	62
ORMONDVILLE	68	17	455	14	3	71	18	512	14	3	77	20	656	25	72
NORSEWOOD	65	20	792	37	17	67	22	831	37	18	67	22	826	37	18
PONGAROA	87	51	3,126	33	528	95	56	3,795	40	932	101	62	4,092	45	1,303
MANGATAINOKA	152	134	27,862	24	2,848	174	146	29,761	33	2,899	222	190	34,934	46	6,976
MANGAMUTU	49	19	23,850	10	6	97	45	13,489	42	27	119	84	12,530	44	48
ASHHURST[8]	8	6	559	0	0	8	6	552	0	0	8	8	629	0	0
OTHER	529	250	18,272	196	5,478	556	268	20,240	208	5,546	634	343	24,565	231	15,257

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.5.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

There are multiple towns and settlements that contribute to high flooding exposure within the Tararua District. This includes Dannevirke, Pahiatua and Woodville. Despite Dannevirke being the largest town within the district, it is Woodville that has the highest building exposure in all but the 5% AEP event. Woodville also has the highest life and building reinstatement costs in all current day climate scenarios for the district. Exposure in Woodville is predominantly made up of residential and rural buildings (60% and 35% of exposed buildings for the 0.5% AEP event). Shown in Figure 69, Woodville also the steepest percentage change in exposure across all events, while the overall increase in exposure from the 5% to the 0.1% AEP events is 87%.

The dominance of flood exposure within Woodville is likely due to the town's location on a floodplain near multiple rivers, including the Manawatū, which backs up in the upper catchments during large flood events spilling onto floodplains. We recommend as a next step, integrating the existing Level C modelling for Woodville and/or the Manawatū River into the vulnerability assessment. Doing this will provide additional insights into the vulnerability of Woodville that can guide decision making, including forming emergency management plans or upgrades to flood protection schemes. Additional Level C modelling focusing on solely pluvial or fluvial sources could be conducted to better understand the contributing sources for flooding within Woodville.

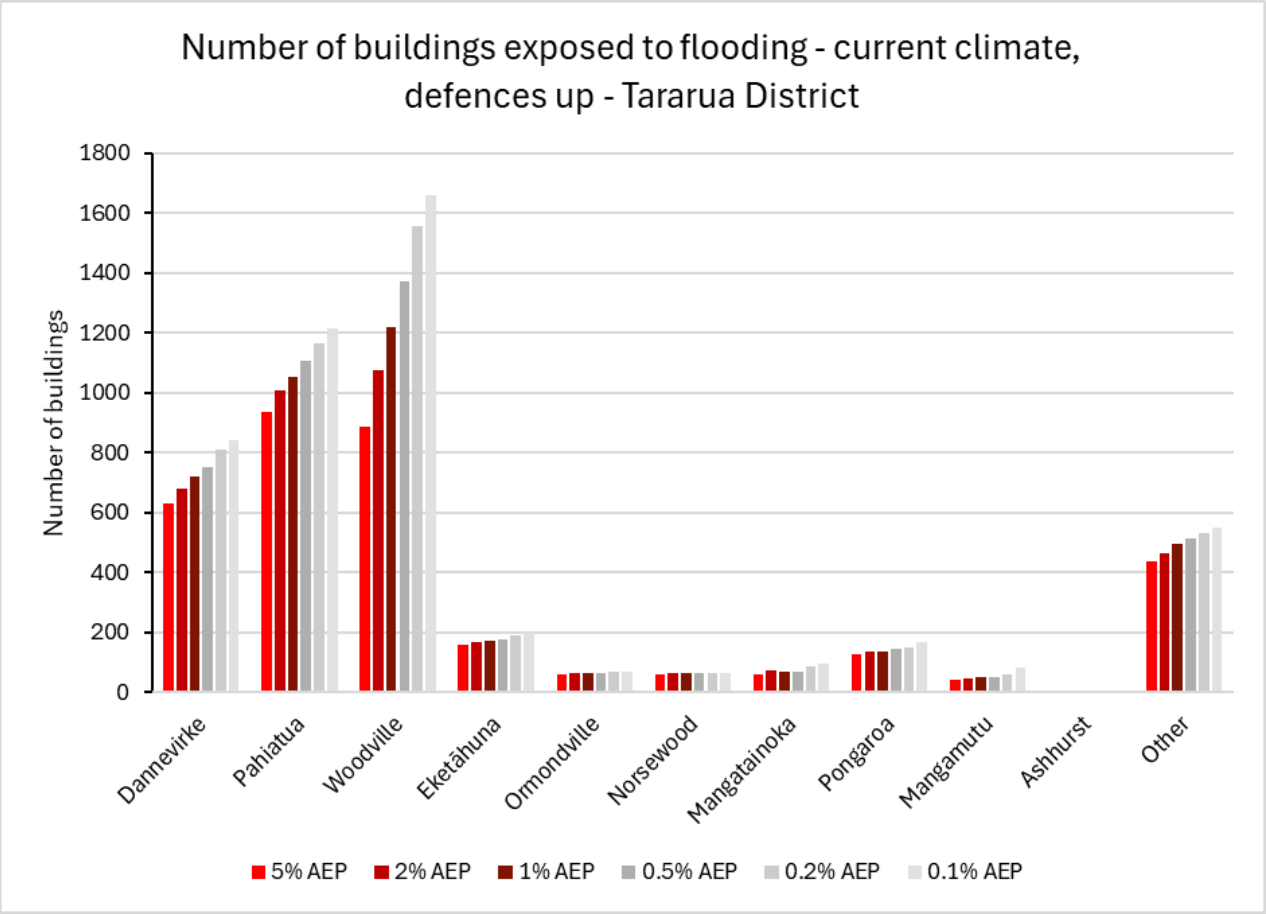


Figure 69: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Tararua District.

4.6 RANGITĪKEI DISTRICT

4.6.1 DISTRICT OVERVIEW – RANGITĪKEI

Rangitīkei District follows the catchment area of the Rangitīkei River in the south-west of the North Island, ranging from the Kaimanawa and Ruahine Range southeast of Lake Taupō to the Tasman Sea in the west. The district is primarily located in the Manawatū-Whanganui region, with a small northestern area falling within the Hawke's Bay Region. The predominantly rural district is comprised of five main townships shown in Figure 70– Bulls, Marton, Taihape, Mangaweka, and Hunterville – with a population of 15,663 (per the 2023 Census).

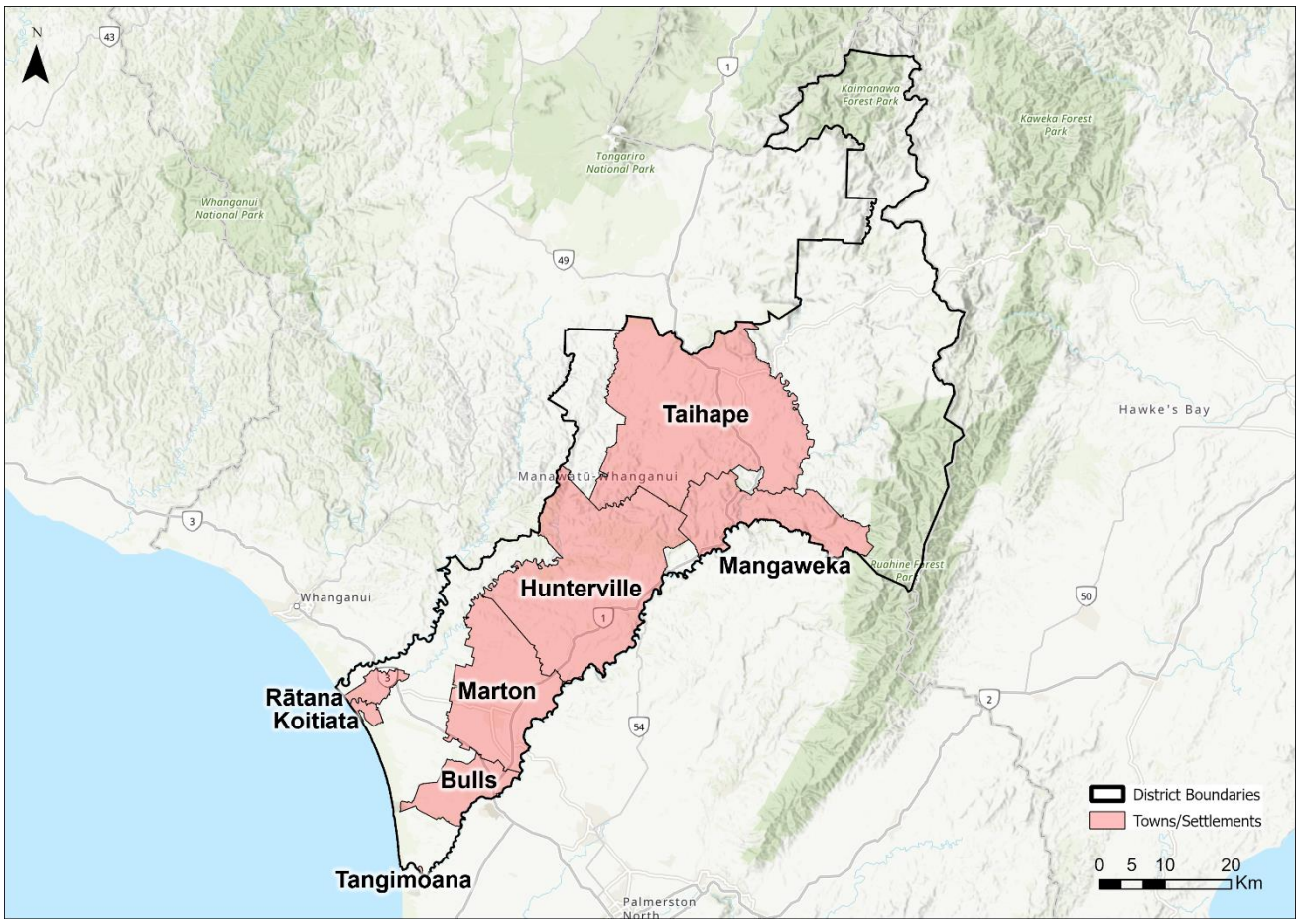


Figure 70: Map of Rangitīkei District with town and settlement boundaries. For the purpose of reporting, any buildings outside of a town or settlement boundary have been categorised as 'Other'.

The district's median age of 41.1 years is higher than the national average. Home ownership is relatively high at 70.5%, but incomes are lower than the national average: the median personal income is $36,600 compared to $41,500 nationally (Stats NZ, 2025). These factors, combined with an aging population (20.2% aged 65+), rural isolation, and limited access to services, increase vulnerability during flood events, particularly for evacuation and recovery (Stats NZ, 2025). Infrastructure challenges—such as maintaining extensive rural roads and bridges—further heighten exposure to flood-related risks, as seen in recent years when $4.2 million was spent by the District Council on roading repairs following adverse weather events in 2022 and 2023 (Rangitīkei District Council, 2024).

Economically, Rangitīkei is strongly rural: agriculture, forestry, and fishing account for 37.4% of local businesses and employ nearly 20% of the workforce, compared to 5.1% nationally (Stats NZ, 2025). Sheep

and beef farming are one of the primary economic activities, alongside dairy and forestry, supported by manufacturing (11.1% of employment) and construction (7.8%) (Stats NZ, 2025). Other significant sectors include public administration (9.4%), education (7.6%), and health care (7%) (Stats NZ, 2025). While primary industries provide stability for the local economy, their reliance on land-based activities makes them sensitive to extreme weather and flood damage.

4.6.2 FLOOD MANAGEMENT SCHEMES

The Rangitīkei District is protected by eight flood management schemes. Table 71 indicates that levels of service for flood management schemes in the Rangitīkei District range from containing a 50% AEP flood (Makirikiri) up to a 0.5% AEP flood (Lower Whanganui).

Table 71: Flood management schemes in the Rangitīkei District (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
ASHHURST	Provides drainage to rural land upstream of Ashhurst to Ulysses Road and flood protection to Ashhurst Township.	1% AEP.
FOREST ROAD	The Forest Road Drainage Scheme provides a degree of flood protection to 1,250 ha of rural land.	Not assessed.
HAUNUI	Provides a degree of flood protection to 10 rural properties. The Scheme is located in the Haunui Road area of the lower Whangaehu River Valley, upstream of State Highway 3.	Not assessed.
MAKIRIKIRI	The Makirikiri Flood Control Scheme is a small but complex Scheme that provides flood protection and drainage benefits (direct and indirect) to three rural properties comprising a rated area of 386 ha.	50% AEP.
POREWA VALLEY	Protects the townships of Rata and Hunterville, together with approximately 800 ha of rural land on the valley floor.	4% AEP.
RANGITĪKEI	Protect highly productive lower terrace land, rural and urban property and community infrastructure between Rewa and the sea.	2% AEP.
TURAKINA	Channel maintenance scheme	Not assessed.
TUTAENUI	Protects the townships of Bulls and Marton and surrounding rural land from flooding. The Scheme is located on the catchment of the Tutaenui Stream.	5% AEP.

4.6.3 DISTRICT FLOOD VULNERABILITY RESULTS

This section provides a summary of flood vulnerability in the Rangitīkei District under current and future climate conditions and compares scenarios with flood defences up and down.

The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of

regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.6.3.1 DISTRICT FLOOD VULNERABILITY: CURRENT CLIMATE

Under current climate conditions and with existing flood defences up, Rangitīkei District experiences increasing flood vulnerability across the range of AEP scenarios. At the 5% AEP level, 2,390 buildings are exposed to flooding, with 40% (963) of those incurring over $54M in reinstatement costs. By the 0.1% AEP event, the number of buildings exposed increases by 72.5% to 4,123, with 61.5% (2,536) associated with reinstatement costs totalling approximately $192M. Increases can be seen across exposure rates to people within the district also, with the total exposed population increasing by 72% from 1,402 to 2,420 between the 5% AEP and the 0.1% AEP. The estimated number of fatalities within the Rangitīkei District increases from 1 to 12 when comparing the 5% and 0.1% AEP events.

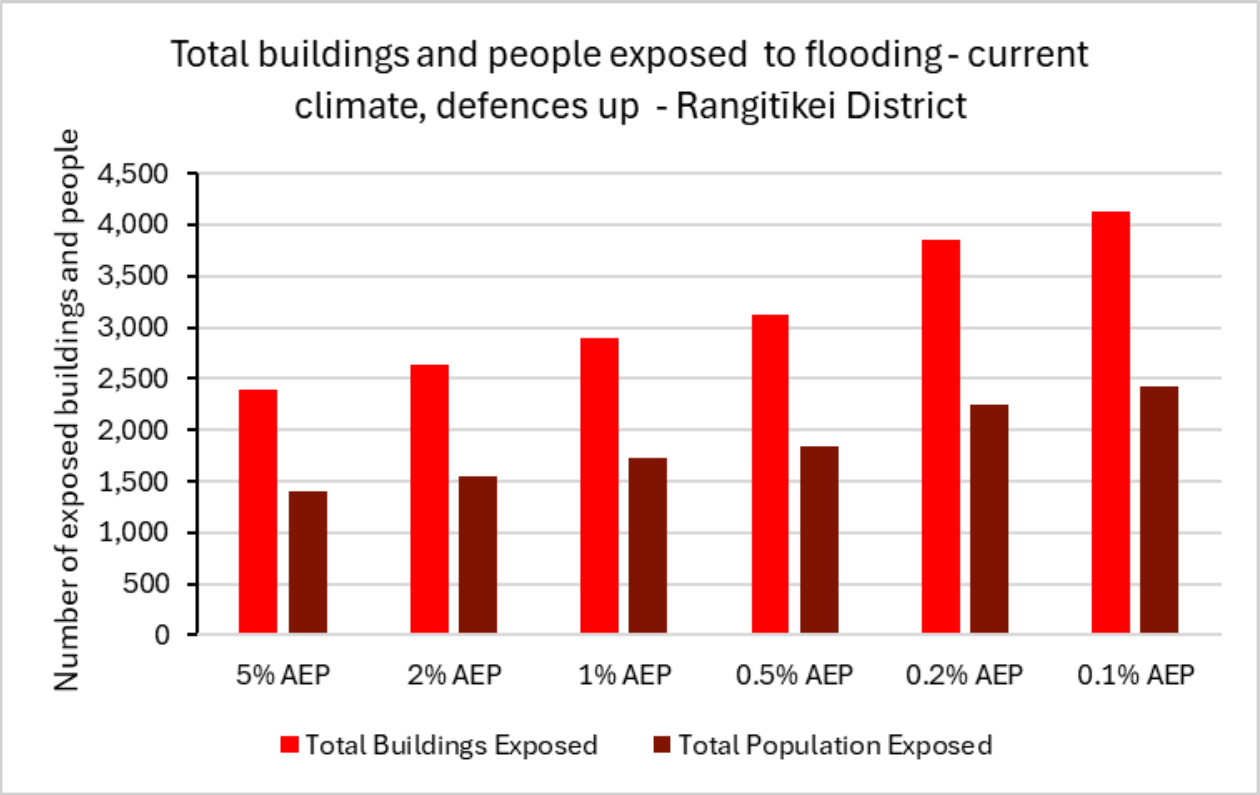


Figure 71: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Rangitīkei District.

4.6.3.2 DISTRICT FLOOD VULNERABILITY: WARMING SCENARIOS

Climate warming increases flood vulnerability in the Rangitīkei District. The progression shown in

Table 72 reflect a notable increase in life costs (152%) and a 53% increase in reinstatement costs between the current climate and 3°C warming scenarios.

Table 72: Rangitīkei District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood Defences up.

CLIMATE SCENARIO	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALITIES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	3,115	1,504	101,702	1,840	5	6,109
1°C CLIMATE WARMING	3,368	1,713	121,933	1,961	5	5,703
2°C CLIMATE WARMING	3,578	1,903	139,941	2,063	10	12,444
3°C CLIMATE WARMING	3,784	2,051	154,980	2,190	12	15,391
3°C CLIMATE WARMING with SEA LEVEL RISE	3,795	2,060	155,199	2,189	12	15,411

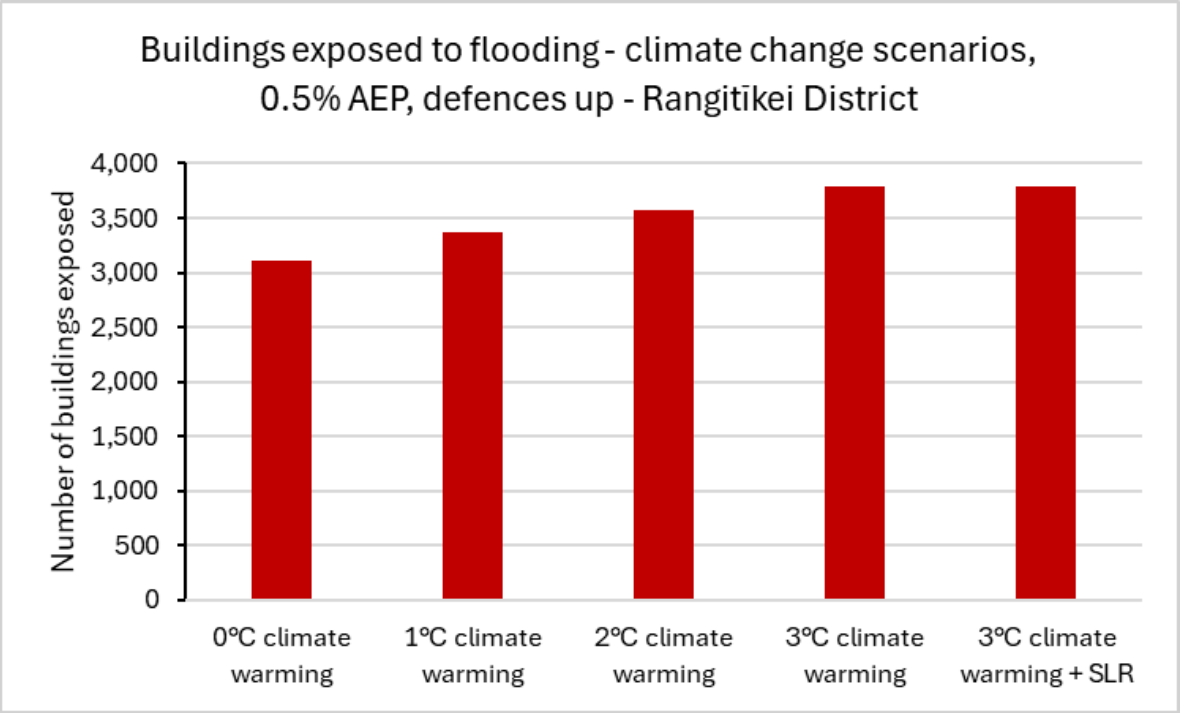


Figure 72: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C deg warming including with sea level rise) for the 0.5% AEP flood event with defences down for Rangitīkei District.

4.6.3.3 DISTRICT FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

For the overall district, removal of flood defences in Rangitīkei leads to higher building and people exposure and costs as flood severity increases. For a 0.5% AEP event in current climate conditions, the removal of flood defences results in the number of exposed buildings rising from 3,115 to 3,288. The number of buildings damaged by flooding and contributing to reinstatement costs increases from 1,504 to 1,676 causing building reinstatement costs to increase from approximately $101M to $122M. Life costs also increase from around $6.1M to $6.3M. Slight increases in cost and exposure are visible in Marton, with changes becoming more pronounced in the severe and climate warming scenarios. Larger increases in exposure and cost when defences are removed occur in Hunterville and for buildings not within a town or settlement ('Other'). Results of these trends in life costs and building exposure can be seen in Figure 73 to Figure 76). For buildings that are not in a town or settlement, the results suggest that the removal of flood defences within Rangitīkei District may disproportionately affect the dispersed buildings outside of town and settlement boundaries.

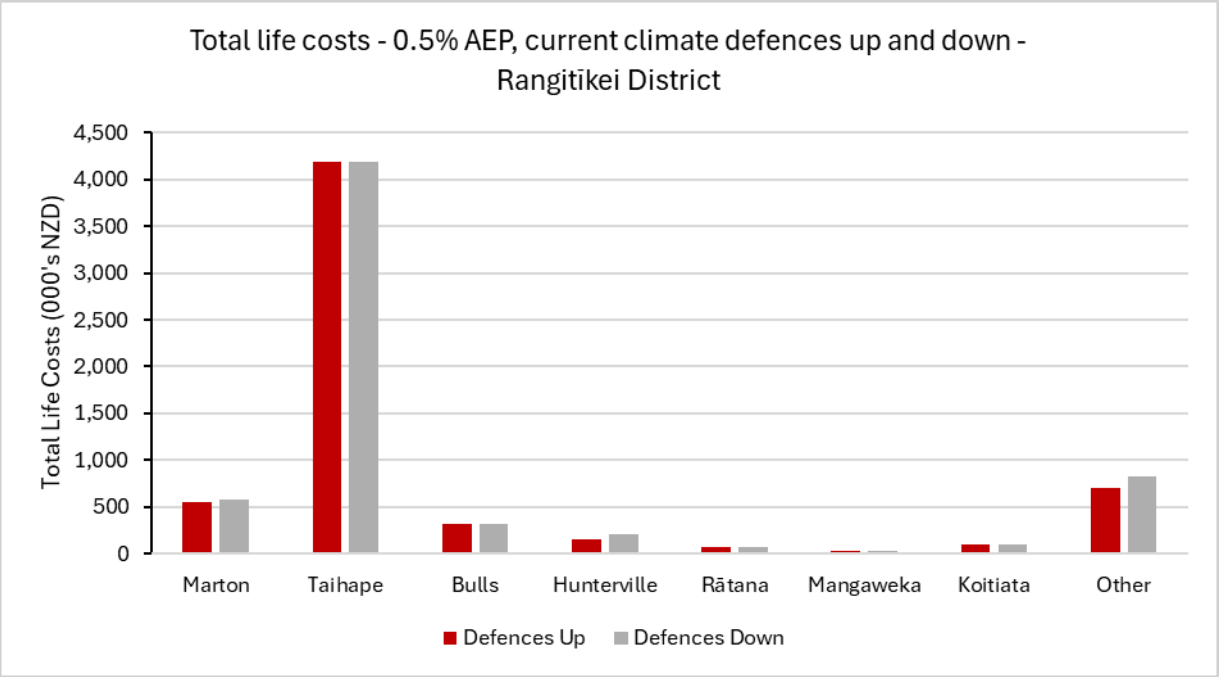


Figure 73: Total life costs for the 0.5% AEP event under today's climate comparing defences up and down for the Rangitīkei District.

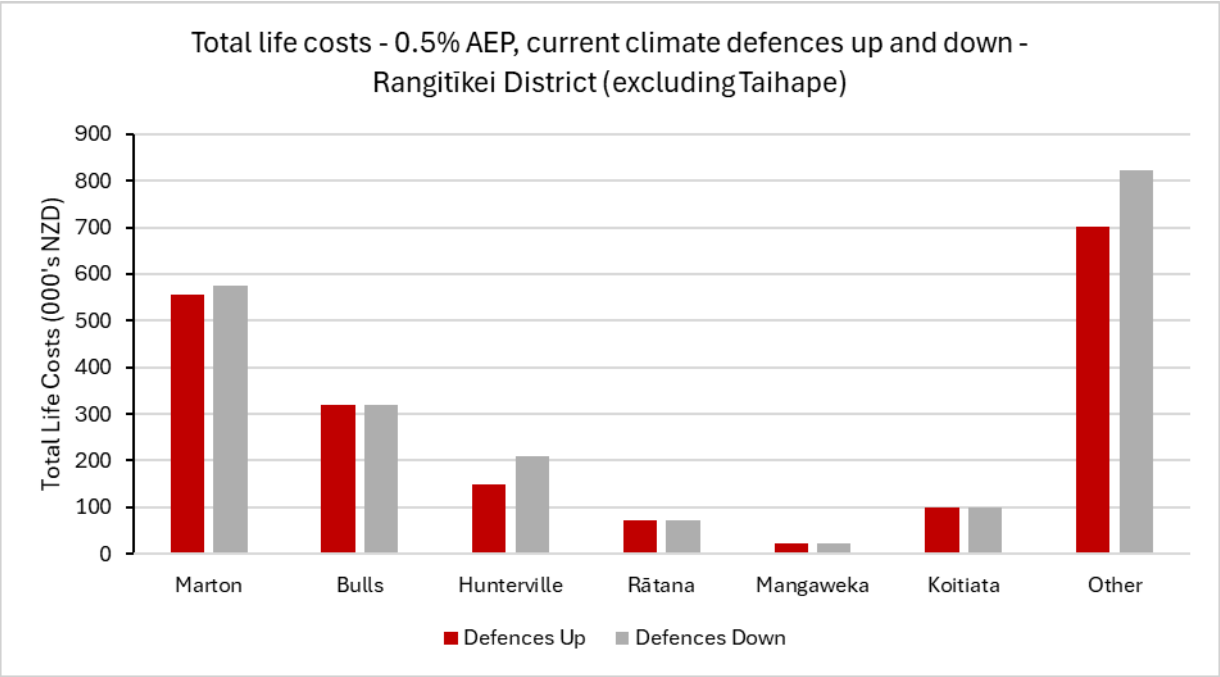


Figure 74: Total life costs for the 0.5% AEP event under today's climate comparing defences up and down for the Rangitīkei District (excluding Taihape)

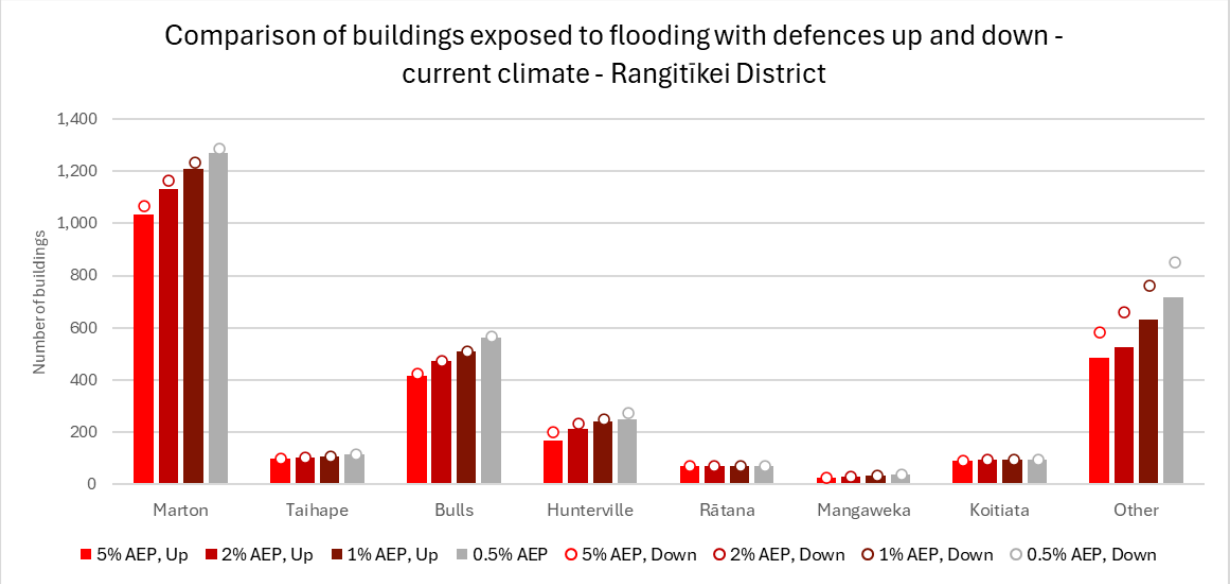


Figure 75: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Rangitīkei District.

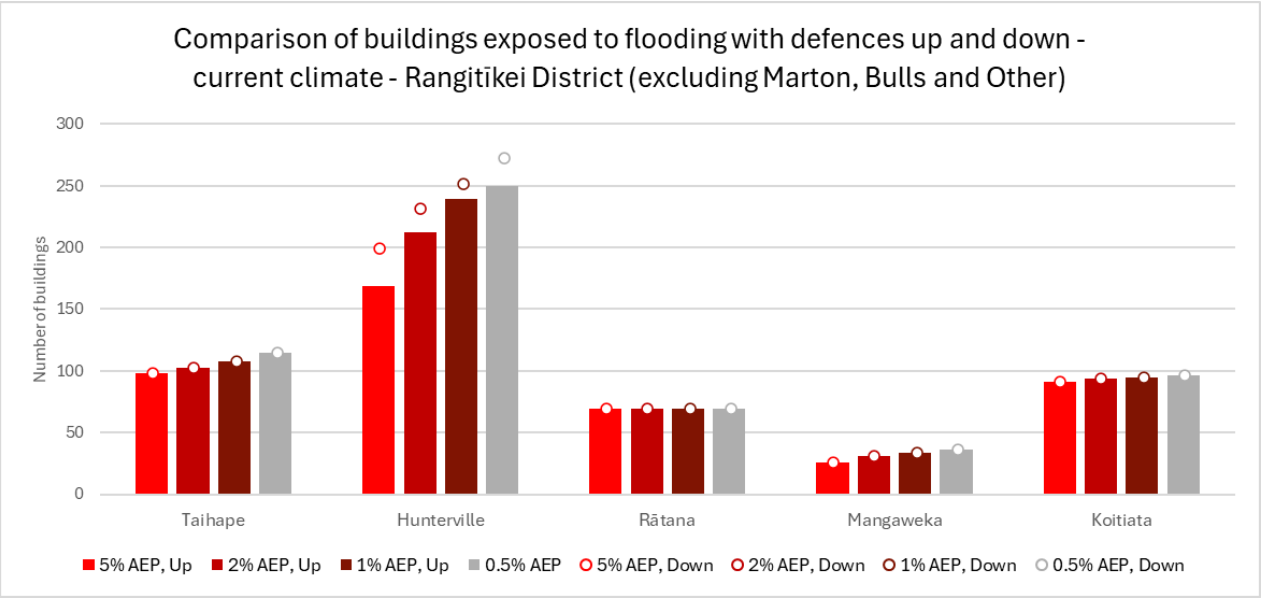


Figure 76: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Rangitīkei District (excluding Marton, Bulls and 'Other').

4.6.3.4 RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 73 and Table 74 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Rangitīkei District for six flooding scenarios. The results for these scenarios assume no climate warming (0°C increase) and that existing flood defences are up. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 73: Rangitīkei District – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 4]
RANGITĪKEI DISTRICT TOTAL	**2,390**	**963**	**54,825**	**1,402**	**1,211**	**2,637**	**1,127**	**67,347**	**1,556**	**1,488**	**2,895**	**1,323**	**82,763**	**1,720**	**5,804**
MARTON	1,035	327	17,658	670	340	1,130	402	23,712	756	447	1,207	453	28,574	840	509
TAIHAPE[8]	98	38	2,148	46	200	102	37	2,450	46	226	108	41	2,665	50	4,263
BULLS[8]	416	132	8,253	284	203	472	164	10,181	315	244	510	196	12,712	339	285
HUNTERVILLE[8]	169	89	5,131	101	86	212	111	6,535	115	107	239	139	8,359	124	134
RĀTANA	69	37	1,783	66	71	69	36	1,811	68	72	69	36	1,810	68	72
MANGAWEKA[8]	26	7	751	15	11	31	9	887	16	19	34	9	894	16	20
KOITIATA	91	81	3,033	45	89	94	84	3,303	45	94	95	84	3,146	49	97
OTHER	486	252	16,068	175	211	527	284	18,468	195	279	633	365	24,603	234	424

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 74: Rangitīkei District – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RANGITĪKEI DISTRICT TOTAL	**3,115**	**1,504**	**101,702**	**1,840**	**6,109**	**3,845**	**2,311**	**167,765**	**2,246**	**11,734**	**4,123**	**2,536**	**192,369**	**2,420**	**14,982**
MARTON	1,269	501	33,140	878	556	1,478	833	60,866	1,001	3,369	1,615	926	68,402	1,110	4,733
TAIHAPE[8]	115	44	3,090	55	4,192	174	73	3,870	84	6,081	181	76	5,426	84	7,777
BULLS[8]	562	224	15,854	369	319	825	516	36,210	560	777	858	550	41,342	581	688
HUNTERVILLE[8]	250	154	9,498	137	148	313	179	11,798	163	189	351	211	15,326	192	241
RĀTANA	69	35	1,785	68	72	71	36	1,531	76	70	71	36	1,549	76	70
MANGAWEKA[8]	36	12	1,013	20	22	48	23	1,546	20	28	55	28	1,809	23	32
KOITIATA	96	83	3,220	49	99	101	84	3,190	45	102	104	87	3,276	45	104
OTHER	718	451	34,102	264	701	835	567	48,754	297	1,118	888	622	55,239	309	1,337

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.6.3.5 RANGITĪKEI DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP

Table 75 and Table 76 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Rangitīkei District for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 75: Rangitīkei District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C and 2°C) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RANGITĪKEI DISTRICT TOTAL	**3,368**	**1,713**	**121,933**	**1,961**	**5,703**	**3,578**	**1,903**	**139,941**	**2,063**	**12,444**
MARTON	1,316	548	37,176	914	3,056	1,382	594	40,155	958	4,340
TAIHAPE[8]	123	50	3,723	55	933	126	52	3,954	55	5,475
BULLS[8]	669	295	21,339	395	376	716	367	28,483	421	440
HUNTERVILLE[8]	264	167	10,919	162	185	288	175	12,386	176	218
RĀTANA	72	37	1,536	76	70	72	37	1,556	76	70
MANGAWEKA[8]	37	12	1,006	20	23	39	12	1,002	23	24
KOITIATA	97	82	3,219	49	101	98	85	3,206	49	103
OTHER	790	522	43,015	290	959	857	581	49,199	305	1,774

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 76: Rangitīkei District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RANGITĪKEI DISTRICT TOTAL	**3,784**	**2,051**	**154,980**	**2,190**	**15,391**	**3,795**	**2,060**	**155,199**	**2,189**	**15,411**
MARTON	1,478	653	44,297	1,038	4,444	1,478	653	44,297	1,038	4,444
TAIHAPE[8]	129	55	4,110	55	7,244	129	55	4,110	55	7,244
BULLS[8]	750	394	30,712	445	509	750	394	30,712	445	509
HUNTERVILLE[8]	308	190	13,716	184	268	308	190	13,715	184	268
RĀTANA	71	36	1,554	76	70	71	36	1,554	76	70
MANGAWEKA[8]	40	13	1,081	23	25	40	13	1,081	23	25
KOITIATA	101	88	3,357	49	104	113	98	3,646	48	121
OTHER	907	622	56,153	320	2,727	906	621	56,084	320	2,730

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.6.3.6 RANGITĪKEI DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 77 and Table 78 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Rangitīkei District for four flooding scenarios. The results for all four flooding scenarios assume no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 77: Rangitīkei District – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RANGITĪKEI DISTRICT TOTAL	**2,560**	**1,141**	**70,023**	**1,490**	**1,509**	**2,824**	**1,324**	**88,327**	**1,648**	**1,777**
MARTON	1,068	379	21,399	713	401	1,163	452	28,874	801	480
TAIHAPE[8]	98	38	2,147	46	200	102	37	2,446	46	226
BULLS[8]	425	142	9,154	288	208	474	165	10,036	315	247
HUNTERVILLE[8]	199	115	6,534	117	113	231	137	8,187	127	141
RĀTANA	69	37	1,783	66	71	69	36	1,811	68	72
MANGAWEKA[8]	26	7	751	15	11	31	9	887	16	19
KOITIATA	91	81	3,033	45	89	94	84	3,303	45	94
OTHER	584	342	25,222	200	416	660	404	32,783	230	498

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population. 2

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 78: Rangitīkei District – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RANGITĪKEI DISTRICT TOTAL	**3,062**	**1,501**	**100,660**	**1,790**	**6,043**	**3,288**	**1,676**	**122,072**	**1,915**	**6,310**
MARTON	1,233	495	31,060	858	530	1,285	535	35,002	891	574
TAIHAPE[8]	108	41	2,665	50	4,262	115	44	3,093	55	4,192
BULLS[8]	511	196	12,769	339	286	565	228	16,209	369	320
HUNTERVILLE[8]	251	152	9,427	149	185	272	164	12,000	166	209
RĀTANA	69	36	1,810	68	72	69	35	1,785	68	72
MANGAWEKA[8]	34	9	894	16	20	36	12	1,013	20	22
KOITIATA	95	84	3,146	49	97	96	83	3,220	49	99
OTHER	761	488	38,889	261	591	850	575	49,750	297	822

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.6.3.7 RANGITĪKEI DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 79 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Rangitīkei District for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 79: Rangitīkei District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RANGITĪKEI DISTRICT TOTAL	**3,543**	**1,889**	**154,238**	**2,026**	**5,860**	**3,755**	**2,094**	**172,841**	**2,134**	**12,603**	**3,951**	**2,231**	**189,399**	**2,275**	**15,531**
MARTON	1,333	572	38,819	931	3,077	1,404	626	42,550	985	4,375	1,508	681	46,452	1,080	4,475
TAIHAPE[8]	123	50	3,724	55	933	126	52	3,945	55	5,475	129	55	4,096	55	7,244
BULLS[8]	670	298	21,691	398	378	720	369	28,232	422	440	754	397	30,867	446	509
HUNTERVILLE[8]	288	182	12,793	174	238	301	187	13,532	183	277	311	191	15,084	188	305
RĀTANA	72	37	1,536	76	70	72	37	1,556	76	70	71	36	1,554	76	70
MANGAWEKA[8]	37	12	1,006	20	23	39	12	1,002	23	24	40	13	1,081	23	25
KOITIATA	97	82	3,219	49	101	98	85	3,206	49	103	101	88	3,357	49	104
OTHER	923	656	71,450	323	1,040	995	726	78,818	341	1,839	1,037	770	86,908	358	2,799

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.6.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

The risk from flooding within the Rangitīkei District is predominantly in Marton where the number of buildings exposed increases with the rarer AEP events. Exposure in Bulls shows a steep increase between the 0.5% AEP and 0.2% AEP events, with almost 300 additional buildings exposed to flooding. Risk to buildings remains consistent across the smaller towns and settlements of Rātana, Mangaweka, and Koitiata, where there are fewer buildings and people exposed to flooding. Rather than being low risk areas, this is likely due to these towns and settlements having smaller building and population numbers. Buildings within the 'Other' category, and within the district but outside of a town or settlement boundary, show notable exposure, with almost 900 buildings exposed at the 0.1% AEP event. This suggests that there is dispersed vulnerability within the Rangitīkei District beyond the main towns and settlements. Further investigations or modelling undertaken outside of the town and settlement boundaries will help Horizons and the Rangitīkei District Council better understand the exposure of these buildings and the flood risk.

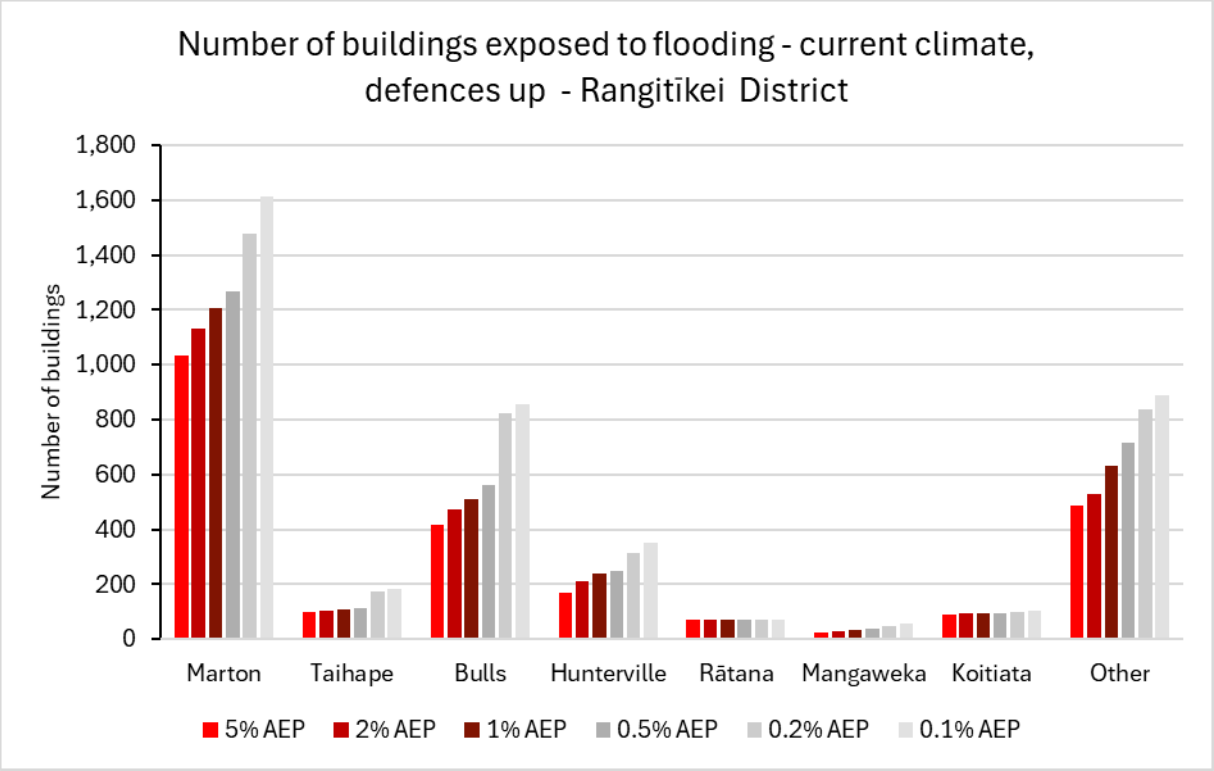


Figure 77: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Rangitīkei District.

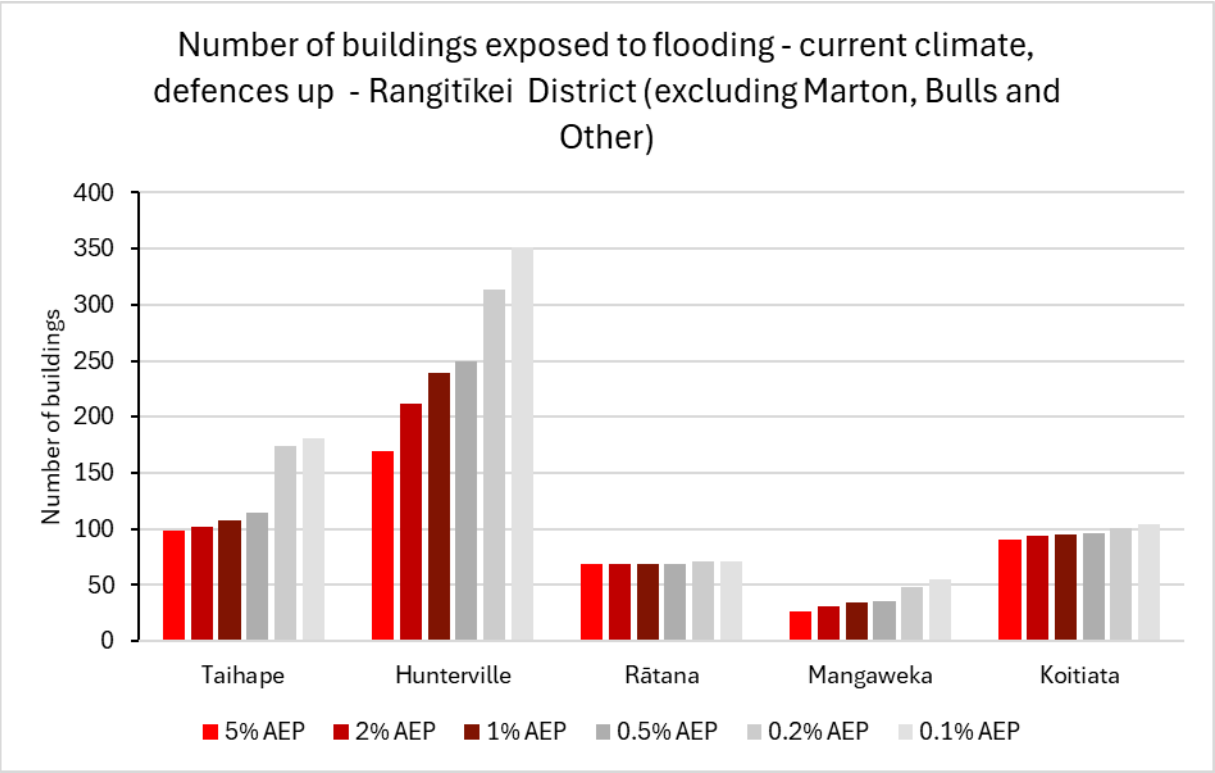


Figure 78: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Rangitīkei District (excluding Marton, Bulls and 'Other').

4.7 RUAPEHU DISTRICT

4.7.1 DISTRICT OVERVIEW – RUAPEHU

Ruapehu District is a landlocked district in the centre of the North Island which includes the western half of Tongariro National Park and part of Whanganui National Park, as well as the towns of Taumarunui, Ohakune, National Park Village, Whakapapa Village, and Raetihi (Figure 79). At 6,730 km², Ruapehu is one of the largest districts in Aotearoa New Zealand by land area but has one of the smallest population counts with 13,095 residents (according to the 2023 Census).

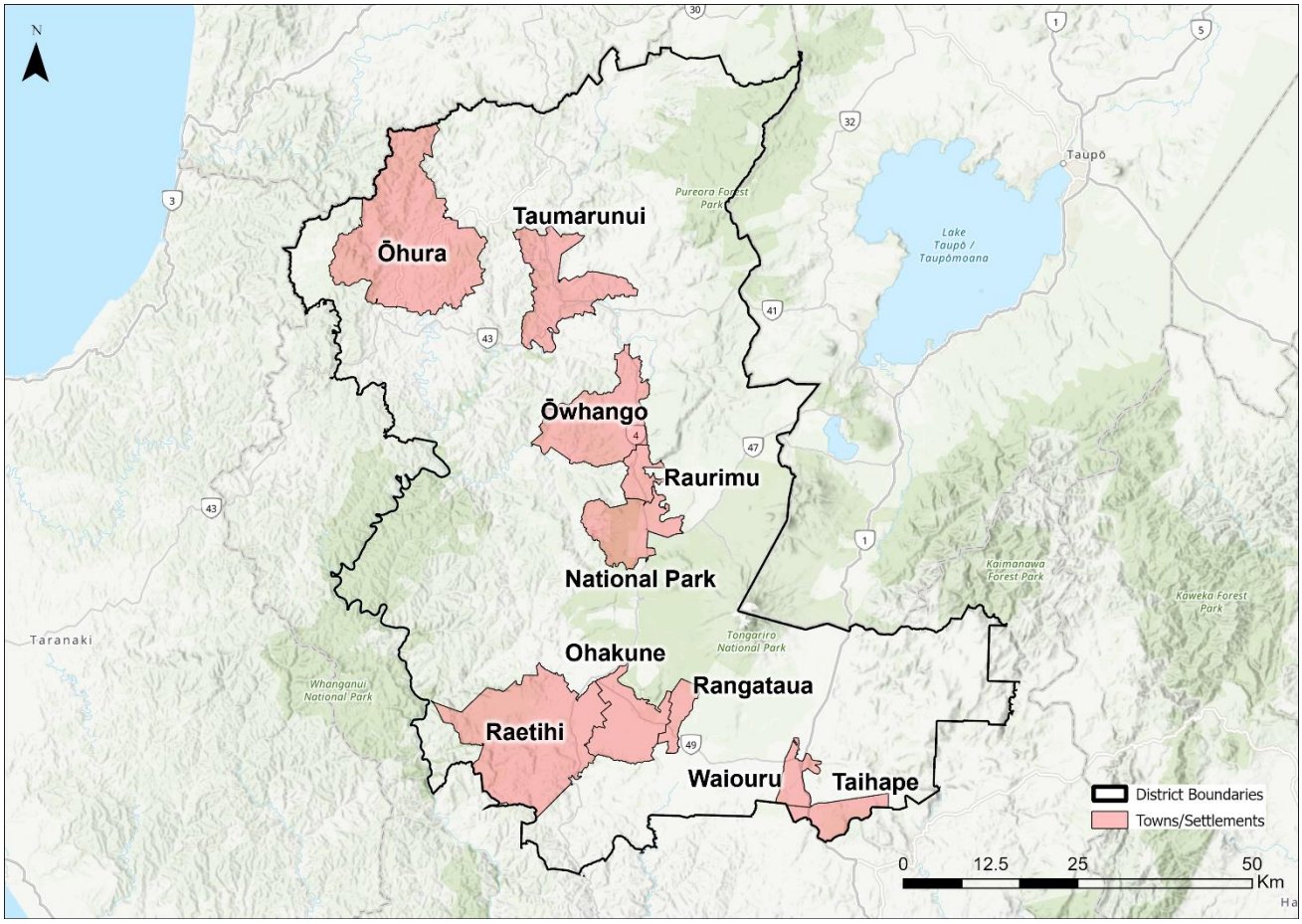


Figure 79: Map of Ruapehu District with town and settlement boundaries. For the purpose of reporting, any buildings outside of a town or settlement boundary have been categorised as 'Other'.

Ruapehu District has a median age of 39 years, close to the national median (Stats NZ, 2025). Household incomes are modest, with a median of $66,000, and personal median income at $33,800, below the national average (Stats NZ, 2025). Home ownership is relatively high (61.6%), but lower incomes and aging infrastructure may increase vulnerability during flood events (Stats NZ, 2025). The district's rural nature and dispersed population can also complicate emergency response.

Economically, Ruapehu is strongly reliant on agriculture, forestry, and fishing, which account for 32.2% of businesses and nearly 20% of employment, alongside construction (10%), education (9.8%), and public administration (9.7%) (Stats NZ, 2025). Tourism is significant, with accommodation and food services employing 8.4% of workers and recent investment in eco-tourism trails (Te Ara Mangawhero and Te Hangāruru) to boost visitor numbers (Ruapehu District Council, 2025). While these sectors support local jobs, they are sensitive to climate impacts, particularly flooding, which can disrupt land-based activities, transport and tourism infrastructure.

4.7.2 *FLOOD MANAGEMENT SCHEMES*

The Ruapehu District is protected by five flood management schemes. Table 80 indicates that levels of service for flood management schemes in the Ruapehu District range from containing a 2% AEP flood (Rangitīkei) up to a 1% AEP flood (Upper Whanganui and Pakihi Valley).

Table 80: Flood management schemes in the Ruapehu District (Horizons Regional Council, 2025).

SCHEME NAME	PROVIDES DRAINAGE / FLOOD PROTECTION TO	SCHEME LEVEL OF SERVICE
UPPER WHANGANUI	Provides landowners adjacent to, and in the floodplain of, the Whanganui River through Manunui and Taumarunui, with a degree of protection against flooding and riverbank erosion.	1% AEP.
PAKIHI VALLEY	Protects rural land from flooding.	1% AEP.
WHANGAEHU - MANGAWHERO	Channel maintenance scheme.	Not assessed.
OHAKUNE	Channel maintenance scheme.	Not assessed.
RUAPEHU	Channel maintenance scheme.	Not assessed.

4.7.3 *DISTRICT FLOOD VULNERABILITY RESULTS*

This section provides a summary of flood vulnerability in Ruapehu District under current and future climate conditions and compares scenarios with flood defences up and down.

The result presented below are based on Level A regional modelling, which applies uniform flood events across the region and is not calibrated to historic floods. This means results may be overstated. In addition, because stormwater networks are not included, exposure in urban areas and for more frequent events may also be overestimated. The outputs are therefore intended only as high-level, comparative indicators of regional risk and should not be used for site-specific interpretation. Further detail on the modelling methodology and considerations for reviewing results can be found in Section 1.3.

4.7.3.1 DISTRICT FLOOD VULNERABILITY: CURRENT CLIMATE

Under current climate conditions and with existing flood defences up, Ruapehu District experiences increasing flood vulnerability across the range of AEP scenarios. At the 5% AEP level, 1,995 buildings are flooded, with 45% (900) of these buildings incurring approximately $54M in reinstatement costs. By the 0.1% AEP event, the number of flooded buildings increases by 74% to 3,478, with 63% (2,191) of these contributing to reinstatement costs of approximately $163M. Increases can be seen across the population exposure within the district also, increasing by 103% from 859 to 1,746, and in the estimated number of fatalities which increases from 5 to 39.

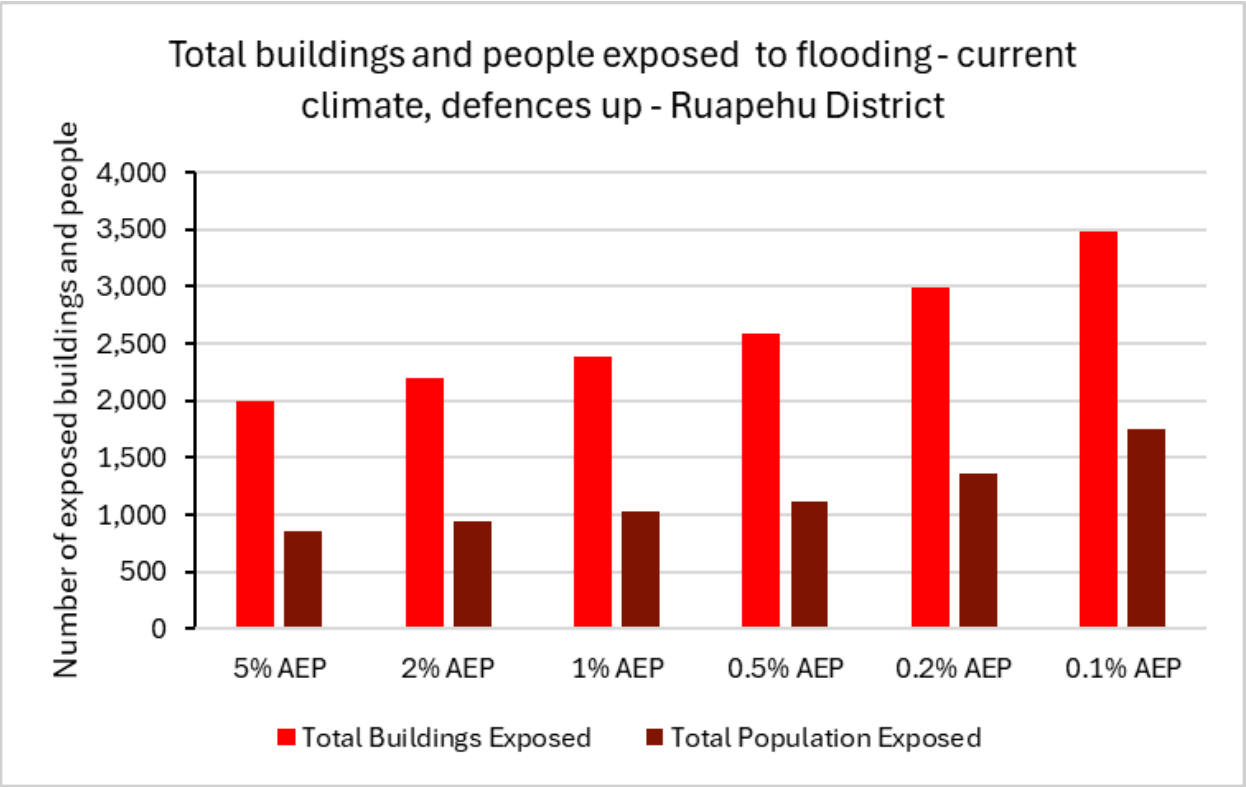


Figure 80: Number of exposed buildings and people for 5% to 0.1% AEP flood events with defences up for Ruapehu District.

4.7.3.2 DISTRICT FLOOD VULNERABILITY: WARMING SCENARIOS

Climate warming increases flood vulnerability in the Ruapehu District. The progression in Table 81 reflect a notable increase in both life costs and building reinstatement costs between the current climate and 3°C warming scenarios. No changes are observed within the results between the 3°C warming scenario and the 3°C scenario with sea level rise which may be reflective of the district being inland and less influenced by coastal processes.

Table 81: Ruapehu District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios in the current climate (0°C) and climate warming (1°C, 2°C, 3°C, and 3°C with sea level rise), with existing flood Defences up.

CLIMATE SCENARIO	0.5% AEP FLOOD – DEFENCES UP					
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)	TOTAL POPULATION EXPOSED	TOTAL NO. FATALITIES	TOTAL LIFE COST (NZD 000s)
CURRENT CLIMATE	2,594	1,363	97,039	1,109	18	22,767
1°C CLIMATE WARMING	3,055	1,774	132,801	1,425	34	41,956
2°C CLIMATE WARMING	3,692	2,410	181,528	1,906	41	51,118
3°C CLIMATE WARMING	4,102	2,832	221,899	2,135	50	61,967
3°C CLIMATE WARMING with SEA LEVEL RISE	4,102	2,832	221,899	2,135	50	61,967

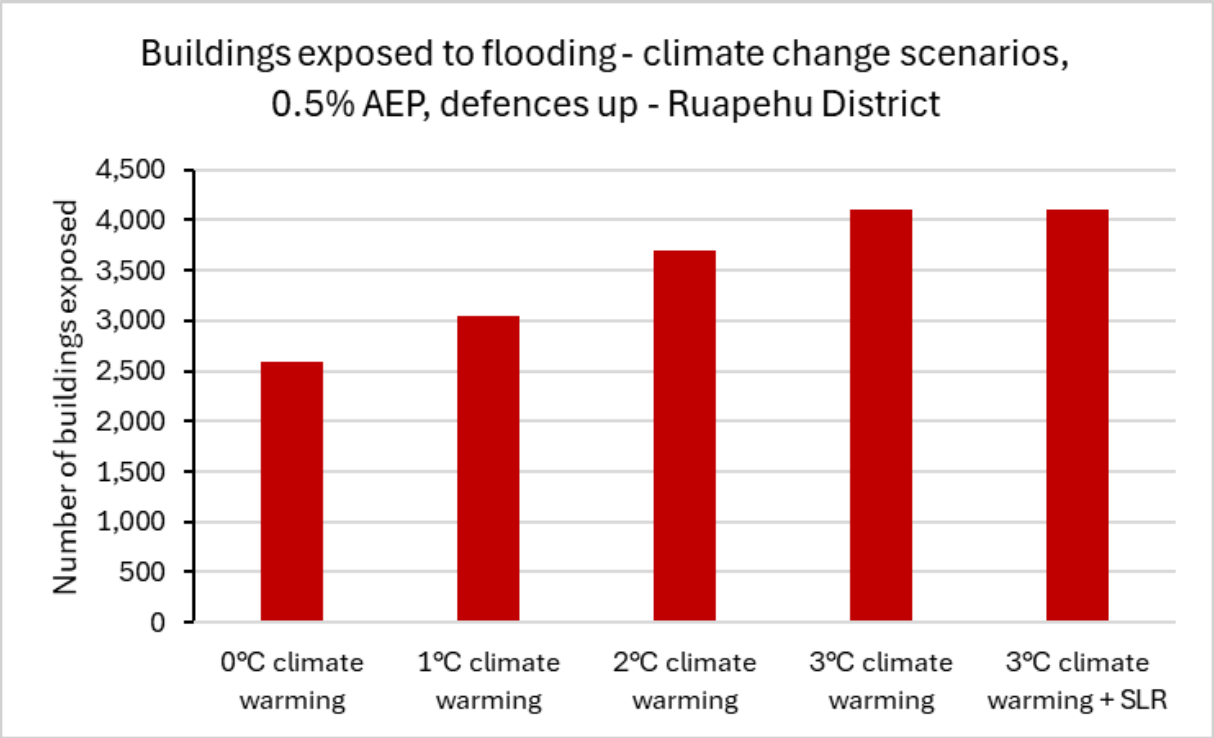


Figure 81: Number of buildings exposed for current day and each warming scenario (1 °C, 2 °C and 3 °C deg warming including with sea level rise) for the 0.5% AEP flood event with defences down for Ruapehu District.

4.7.3.3 DISTRICT FLOOD VULNERABILITY: DEFENCES DOWN

Defences-down scenarios are included only to illustrate the relative regional flood risk if stopbanks were not present. These results are not predictions of actual conditions but help demonstrate the benefit of existing flood protection and allow comparison of relative risk across the region.

Across most flood events for the towns and settlements within the Ruapehu District, when comparing defences up to defences down there is minimal change in total life costs and other flood vulnerability metrics (refer Figure 82 to Figure 85). Overall, minimal changes in the defences down scenarios are observed and may be reflective of a lower level of defences within the district, resulting in minimal changes in costs and exposure.

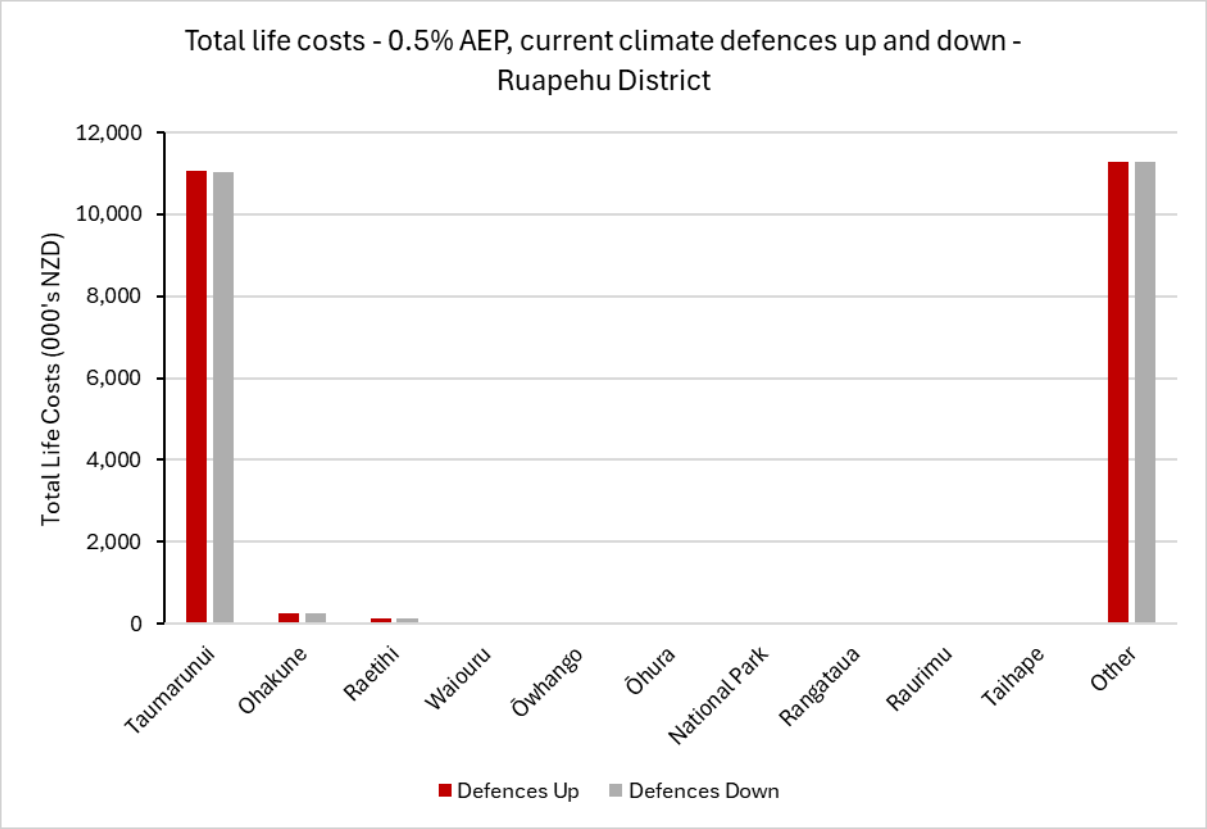


Figure 82:Total life costs for the 0.5% AEP event under current climate with and without flood defences for the Ruapehu District.

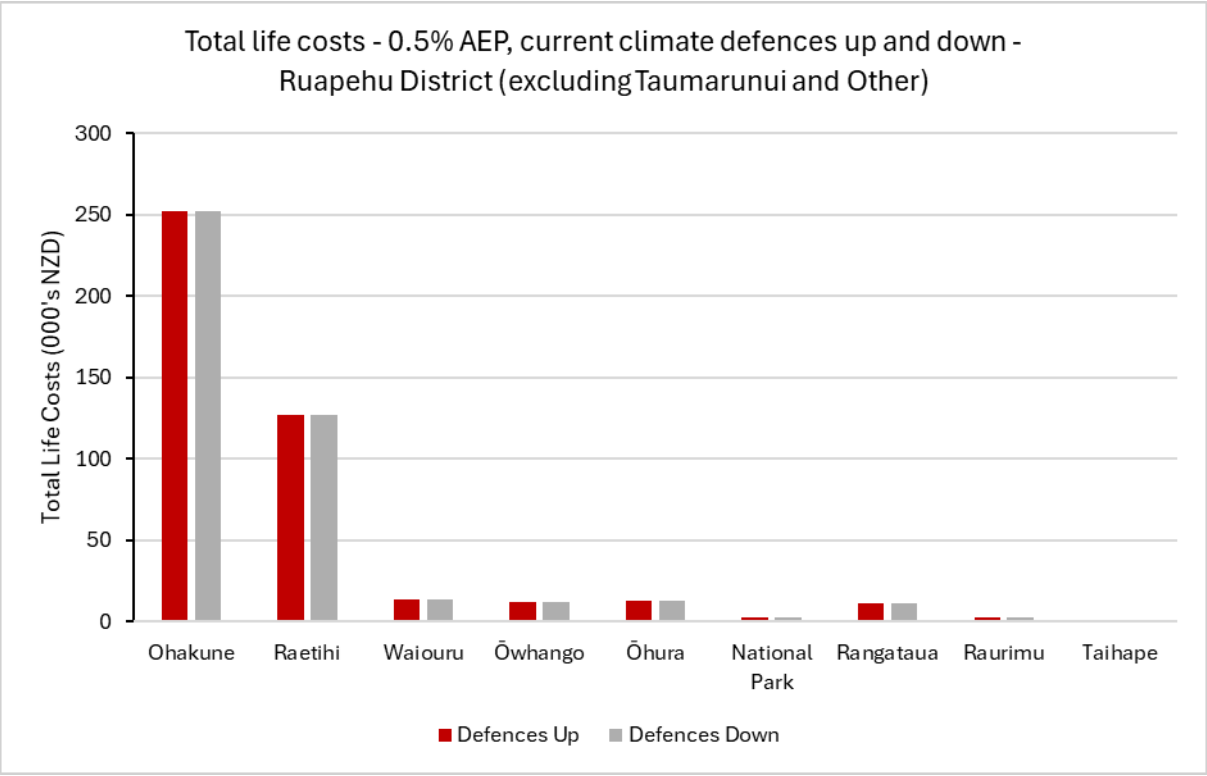


Figure 83: Total life costs for the 0.5% AEP event under current climate with and without flood defences for the Ruapehu District (excluding Taumarunui and Other).

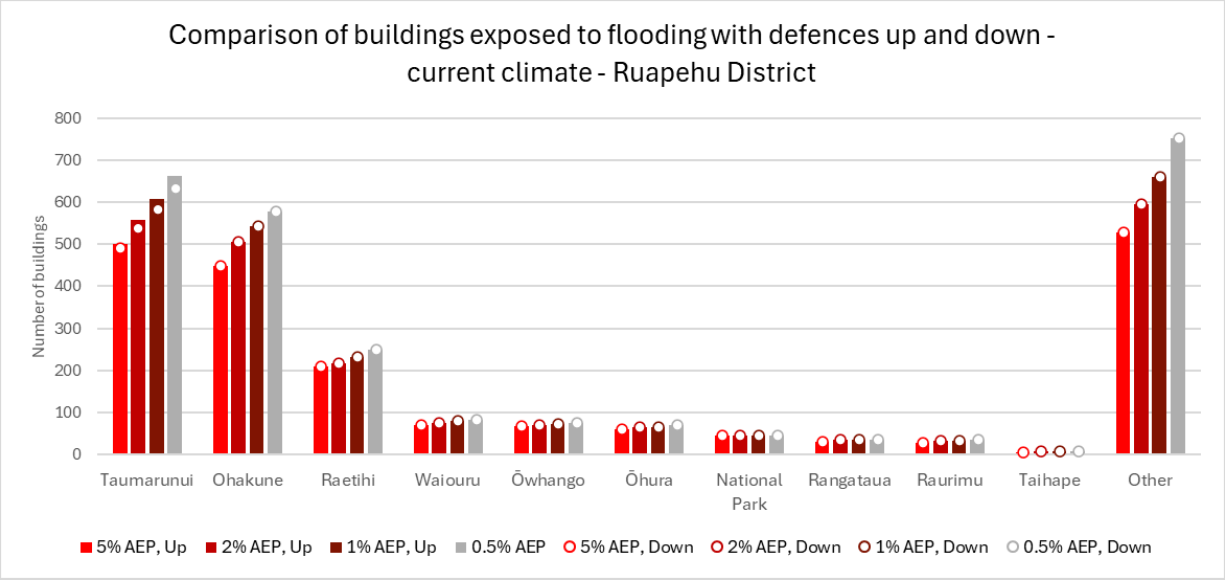


Figure 84: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Ruapehu District.

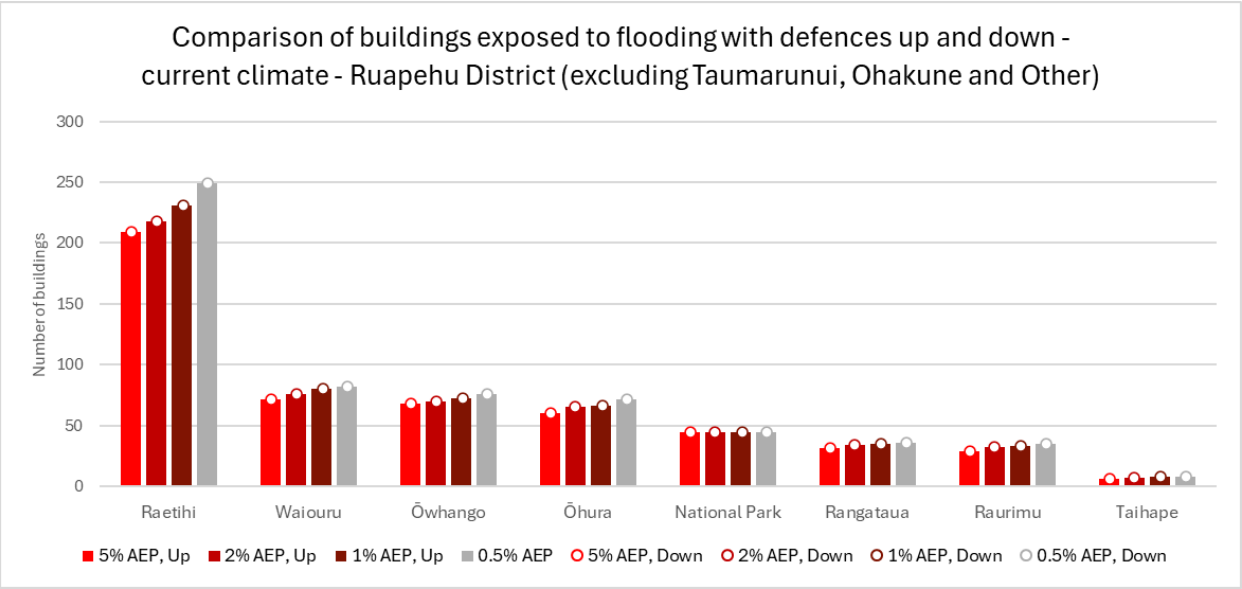


Figure 85: Change in building exposure for 5% to 0.5% AEP flood events for defences down in towns/settlements of Ruapehu District (excluding Taumarunui, Ohakune and 'Other').

4.7.3.4 RUAPEHU DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES UP

Table 82 and Table 83 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Ruapehu District for six flooding scenarios. The results for these scenarios assume current climate (0°C increase) and that existing flood defences are up. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 82: Ruapehu District – Vulnerability metrics for Level A regional model results 5%, 2% and 1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood Defences up.

TOWN/ SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)					1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**1,995**	**900**	**54,149**	**859**	**5,798**	**2,203**	**1,046**	**68,768**	**939**	**16,866**	**2,380**	**1,194**	**77,583**	**1,022**	**18,675**
TAUMARUNUI	500	246	14,024	334	5,260	557	288	16,840	364	10,353	608	330	19,561	392	10,636
OHAKUNE	449	211	14,377	189	165	505	240	16,244	217	188	544	280	19,239	239	224
RAETIHI	209	97	5,064	120	92	218	102	5,150	127	102	231	109	5,712	137	112
WAIOURU	71	22	1,691	20	12	76	23	3,417	20	13	80	24	3,330	20	14
ŌWHANGO	68	22	852	22	10	70	22	923	26	11	72	23	971	26	12
ŌHURA	60	30	2,265	11	12	65	29	3,267	12	12	66	29	3,802	12	13
NATIONAL PARK	44	9	1,650	12	2	44	11	2,509	12	2	44	11	860	12	3
RANGATAUA	31	11	275	15	10	34	15	352	15	11	35	16	360	15	11
RAURIMU	29	10	260	8	3	32	10	261	9	3	33	10	255	9	3
TAIHAPE[8]	6	3	29	0	0	7	5	125	0	0	8	6	179	0	0
OTHER	528	239	13,662	128	232	595	301	19,680	137	6,171	659	356	23,314	160	7,647

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population. 2

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 83: Ruapehu District – Vulnerability metrics for Level A regional model results 0.5%, 0.2% and 0.1% AEP flood scenarios[1] in the current climate (0°C) and with existing flood Defences up.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)					0.2% AEP FLOOD – CURRENT CLIMATE (0°C)					0.1% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**2,594**	**1,363**	**97,039**	**1,109**	**22,767**	**2,992**	**1,695**	**128,005**	**1,367**	**41,689**	**3,478**	**2,191**	**163,269**	**1,746**	**48,535**
TAUMARUNUI	663	381	22,813	423	11,063	836	541	37,246	557	26,766	1,192	914	61,684	882	28,476
OHAKUNE	577	309	21,684	249	252	635	337	24,854	283	301	670	375	27,600	302	1,577
RAETIHI	249	119	6,350	150	127	259	124	6,794	168	144	266	130	7,094	179	157
WAIOURU	82	24	3,810	20	14	98	40	4,981	25	21	99	40	4,710	26	21
ŌWHANGO	76	23	1,013	26	12	76	24	1,045	26	12	78	27	1,152	26	12
ŌHURA	71	33	4,069	12	13	82	40	4,430	20	15	89	46	4,632	23	19
NATIONAL PARK	44	11	1,050	12	3	47	11	1,248	12	3	47	11	1,209	12	4
RANGATAUA	36	16	460	15	11	41	16	474	18	12	42	16	474	18	12
RAURIMU	35	10	266	9	3	37	11	258	9	3	39	12	296	9	4
TAIHAPE[8]	8	6	235	0	0	9	6	276	0	0	9	6	300	0	0
OTHER	753	431	35,289	193	11,269	872	545	46,399	249	14,412	947	614	54,118	269	18,253

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.7.3.5 RUAPEHU DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, 3°C AND 3°C WITH SEA LEVEL RISE) AND EXISTING FLOOD DEFENCES UP

Table 84 and Table 85 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Ruapehu District for a 0.5% AEP flood event. The results are provided for four climate warming scenarios: a 1°C increase, a 2°C increase, a 3°C increase, and a 3°C increase with sea level rise. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results assume that existing flood defences are up. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 84: Ruapehu District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C and 2°C) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**3,055**	**1,774**	**132,802**	**1,425**	**41,955**	**3,692**	**2,410**	**181,528**	**1,906**	**51,118**
TAUMARUNUI	904	616	40,886	628	26,945	1,354	1,087	75,865	1,029	30,039
OHAKUNE	628	335	24,879	278	304	685	379	27,773	304	1,584
RAETIHI	259	124	6,574	168	143	269	130	7,080	184	158
WAIOURU	84	27	4,403	21	14	89	29	5,166	21	14
ŌWHANGO	76	25	1,065	26	12	82	28	1,214	29	13
ŌHURA	82	40	4,499	16	15	93	49	4,684	23	19
NATIONAL PARK	47	11	1,200	12	3	47	11	1,125	12	4
RANGATAUA	41	16	457	18	12	41	16	505	18	12
RAURIMU	38	11	257	9	3	39	12	292	9	4
TAIHAPE[8]	8	6	248	0	0	8	6	264	0	0
OTHER	888	563	48,334	249	14,504	985	663	57,560	277	19,271

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 85: Ruapehu District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (3°C and 3°C sea level rise) and with flood defences up.

TOWN/SETTLEMENT[2]	0.5% AEP FLOOD – 3°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING + SEA LEVEL RISE				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**4,102**	**2,832**	**221,900**	**2,135**	**61,967**	**4,102**	**2,832**	**221,900**	**2,135**	**61,967**
TAUMARUNUI	1,608	1,380	97,112	1,199	36,551	1,608	1,380	97,112	1,199	36,551
OHAKUNE	731	420	31,690	316	1,630	731	420	31,690	316	1,630
RAETIHI	280	134	7,258	188	168	280	134	7,258	188	168
WAIOURU	97	31	5,812	24	15	97	31	5,812	24	15
ŌWHANGO	85	29	1,256	29	14	85	29	1,256	29	14
ŌHURA	99	52	4,892	23	20	99	52	4,892	23	20
NATIONAL PARK	48	11	935	12	4	48	11	935	12	4
RANGATAUA	43	16	493	18	13	43	16	493	18	13
RAURIMU	45	16	312	15	8	45	16	312	15	8
TAIHAPE[8]	8	6	279	0	0	8	6	279	0	0
OTHER	1,058	737	71,861	311	23,544	1,058	737	71,861	311	23,544

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.7.3.6 RUAPEHU DISTRICT – VULNERABILITY METRICS FOR FLOOD EVENTS – CURRENT CLIMATE (0°C) AND EXISTING FLOOD DEFENCES DOWN

Table 86 and Table 87 show the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Ruapehu District for four flooding scenarios. The results for all four flooding scenarios assume no climate warming (0°C increase) and that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 86: Ruapehu District – Vulnerability metrics for Level A regional model results 5% and 2% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	5% AEP FLOOD – CURRENT CLIMATE (0°C)					2% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S)[6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**1,986**	**893**	**53,773**	**856**	**5,790**	**2,185**	**1,033**	**68,021**	**928**	**16,850**
TAUMARUNUI	491	239	13,652	331	5,252	539	275	16,102	353	10,336
OHAKUNE	449	211	14,377	189	165	505	240	16,244	217	188
RAETIHI	209	97	5,064	120	92	218	102	5,150	127	102
WAIOURU	71	22	1,691	20	12	76	23	3,417	20	13
ŌWHANGO	68	22	852	22	10	70	22	923	26	11
ŌHURA	60	30	2,266	11	12	65	29	3,267	12	12
NATIONAL PARK	44	9	1,650	12	2	44	11	2,509	12	2
RANGATAUA	31	11	275	15	10	34	15	351	15	11
RAURIMU	29	10	260	8	3	32	10	261	9	3
TAIHAPE[8]	6	3	29	0	0	7	5	125	0	0
OTHER	528	239	13,657	128	232	595	301	19,672	137	6,172

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table 87: Ruapehu District – Vulnerability metrics for Level A regional model results 1% and 0.5% AEP flood scenarios[1] in the current climate (0°C) and with existing flood defences down.

TOWN/SETTLEMENT[2]	1% AEP FLOOD – CURRENT CLIMATE (0°C)					0.5% AEP FLOOD – CURRENT CLIMATE (0°C)				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**2,355**	**1,178**	**76,699**	**1,008**	**18,656**	**2,564**	**1,339**	**95,547**	**1,091**	**22,742**
TAUMARUNUI	583	314	18,704	378	10,616	633	357	21,314	405	11,037
OHAKUNE	544	280	19,239	239	224	577	309	21,684	249	252
RAETIHI	231	109	5,712	137	112	249	119	6,350	150	127
WAIOURU	80	24	3,330	20	14	82	24	3,810	20	14
ŌWHANGO	72	23	971	26	12	76	23	1,013	26	12
ŌHURA	66	29	3,803	12	13	71	33	4,069	12	13
NATIONAL PARK	44	11	860	12	3	44	11	1,050	12	3
RANGATAUA	35	16	360	15	11	36	16	460	15	11
RAURIMU	33	10	255	9	3	35	10	266	9	3
TAIHAPE[8]	8	6	179	0	0	8	6	235	0	0
OTHER	659	356	23,286	160	7,648	753	431	35,296	193	11,270

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.7.3.7 RUAPEHU DISTRICT – COSTS (NZD) FOR A 0.5% AEP FLOOD EVENT – WITH CLIMATE WARMING (1°C, 2°C, AND 3°C) AND EXISTING FLOOD DEFENCES DOWN

Table 88 shows the total building reinstatement costs in New Zealand Dollars (NZD) and the total life costs (NZD) estimated for the Ruapehu District for a 0.5% AEP flood event. The results are provided for three climate warming scenarios: a 1°C increase, a 2°C increase, and a 3°C increase. The results assume that existing flood defences are down. The number of buildings exposed and the total population exposed per flooding scenario are provided for context. The results presented are based on Level A regional modelling. This modelling method assumes a uniform flood event throughout the region, is not calibrated to historic and observed events, and excludes representation of the stormwater network. Results from the modelling may be overstated. Outputs are intended as a high-level comparative indicators of regional risk and should not be used for site-specific analysis or compared to historic events.

Table 88: Ruapehu District – Vulnerability metrics for Level A regional model results 0.5% AEP flood scenarios[1] with climate warming (1°C, 2°C, and 3°C) and with existing flood defences down.

TOWN/ SETTLEMENT[2]	0.5% AEP FLOOD – 1°C CLIMATE WARMING					0.5% AEP FLOOD – 2°C CLIMATE WARMING					0.5% AEP FLOOD – 3°C CLIMATE WARMING				
	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]	NO. OF BUILDINGS EXPOSED[3, 4]	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS[5]	TOTAL BUILDING REINSTATEMENT COST (NZD 000S) [6]	TOTAL POPULATION EXPOSED[3]	TOTAL LIFE COST (NZD 000S)[6, 7]
RUAPEHU DISTRICT TOTAL	**3,160**	**1,869**	**138,321**	**1,524**	**42,154**	**3,759**	**2,474**	**184,948**	**1,948**	**51,229**	**4,122**	**2,857**	**224,947**	**2,160**	**62,307**
TAUMARUNUI	1,009	711	46,412	727	27,145	1,418	1,151	79,277	1,065	30,148	1,628	1,405	100,164	1,224	36,893
OHAKUNE	628	335	24,879	278	304	685	379	27,773	304	1,584	731	420	31,690	316	1,630
RAETIHI	259	124	6,574	168	143	269	130	7,086	184	158	280	134	7,258	188	168
WAIOURU	84	27	4,403	21	14	89	29	5,166	21	14	97	31	5,812	24	15
ŌWHANGO	76	25	1,065	26	12	82	28	1,214	29	13	85	29	1,256	29	14
ŌHURA	82	40	4,499	16	15	93	49	4,684	23	19	99	52	4,892	23	20
NATIONAL PARK	47	11	1,200	12	3	47	11	1,125	12	4	48	11	935	12	4
RANGATAUA	41	16	457	18	12	41	16	505	18	12	43	16	493	18	13
RAURIMU	38	11	257	9	3	42	12	294	15	4	45	16	315	15	8
TAIHAPE[8]	8	6	248	0	0	8	6	264	0	0	8	6	279	0	0
OTHER	888	563	48,327	249	14,503	985	663	57,560	277	19,273	1,058	737	71,853	311	23,542

[1]This Level A Regional scale modelling was developed using design storm events, and not calibrated against previous observed flood events. The contribution of storm water networks to relieving pluvial flooding, particular for smaller from frequent flooding, was not considered. In real world flood events the number of buildings and population exposed to flooding could be quite different. These results describe relative regional flood risk to inform strategic planning.

[2] Towns are listed in order from highest to lowest total population.

[3] Building and population values may differ to Census 2023 results. Population values used in this study are based on downscaled Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. This has been extracted from a New Zealand population model developed by Scheele, Benson, & Horspool, 2021 and may may differ to Census 2023 population values.

[4] Buildings exposed to flooding are buildings that meet the conditions for 5 cm floor height and 50% exposure ratio. Total buildings includes all building types (residential, commercial/industrial, rural and other) and both primary and secondary structures that are greater than 10.1sqm.

[5]Buildings contributing to reinstatement costs include buildings that meet the conditions for 20 cm floor height and 50% exposure ratio.

[6] Totals for building reinstatement and life costs may differ by up to 1 unit from regional totals due to rounding.

[7] The total life cost represents the cost of human fatalities. One fatality represents $12.5M (NZD).

[8] Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

4.7.3.8 TOWN/SETTLEMENT FLOOD VULNERABILITY: CURRENT CLIMATE

The highest exposure to flooding within the Ruapehu District can be seen in the results for Taumarunui and Ohakune, which have the highest number of buildings and people exposed to flooding across all scenarios. Residential buildings contribute the most to this exposure. When comparing the 5% AEP event with the 0.1% AEP event for Taumarunui, building exposure increases by 138% and population exposure increases by 164%. As shown in Figure 86, there is also a steep increase in exposure of buildings between 0.2% and 0.1% AEP events, where more than 350 additional buildings are exposed to flooding. This increase is much steeper than what is reported within the results elsewhere within the Ruapehu District, and would suggest that additional detailed flood modelling for the 0.1% AEP event may be required to better understand the cause of this increased exposure.

Notable changes in the level of exposure can also be seen in the buildings within the Ruapehu District that are outside of a town or settlement boundary. When comparing the 5% and 0.1% events, building exposure increases by 79% and population exposure increases by 110%. This highlights that while there is a notable risk from flooding to Taumarunui and Ohakune, and more moderate risk to other towns and settlements within the district, there is still a large risk to people and assets outside of these town and settlement boundaries. This may require additional higher resolution flood modelling outside of the towns and settlements to better understand the extent of flooding and performance of infrastructure protecting these people and buildings.

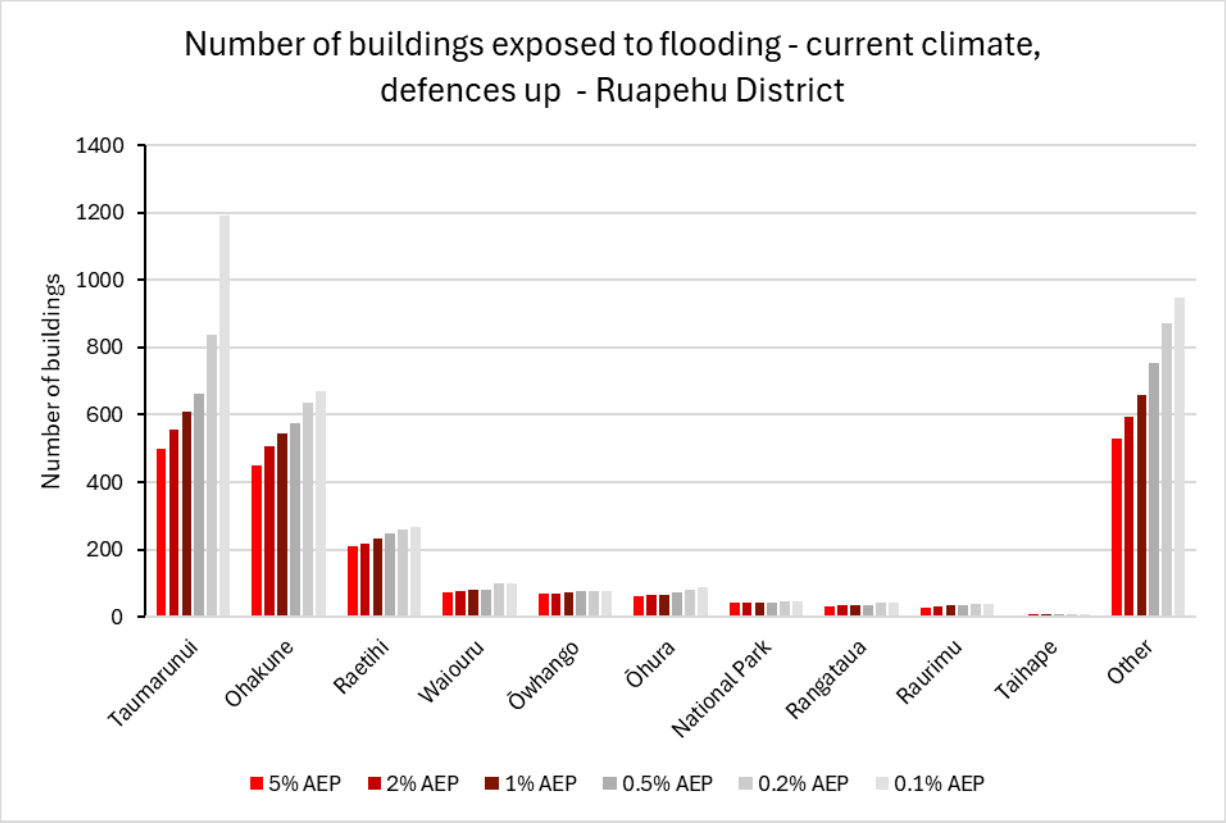


Figure 86: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Ruapehu District.

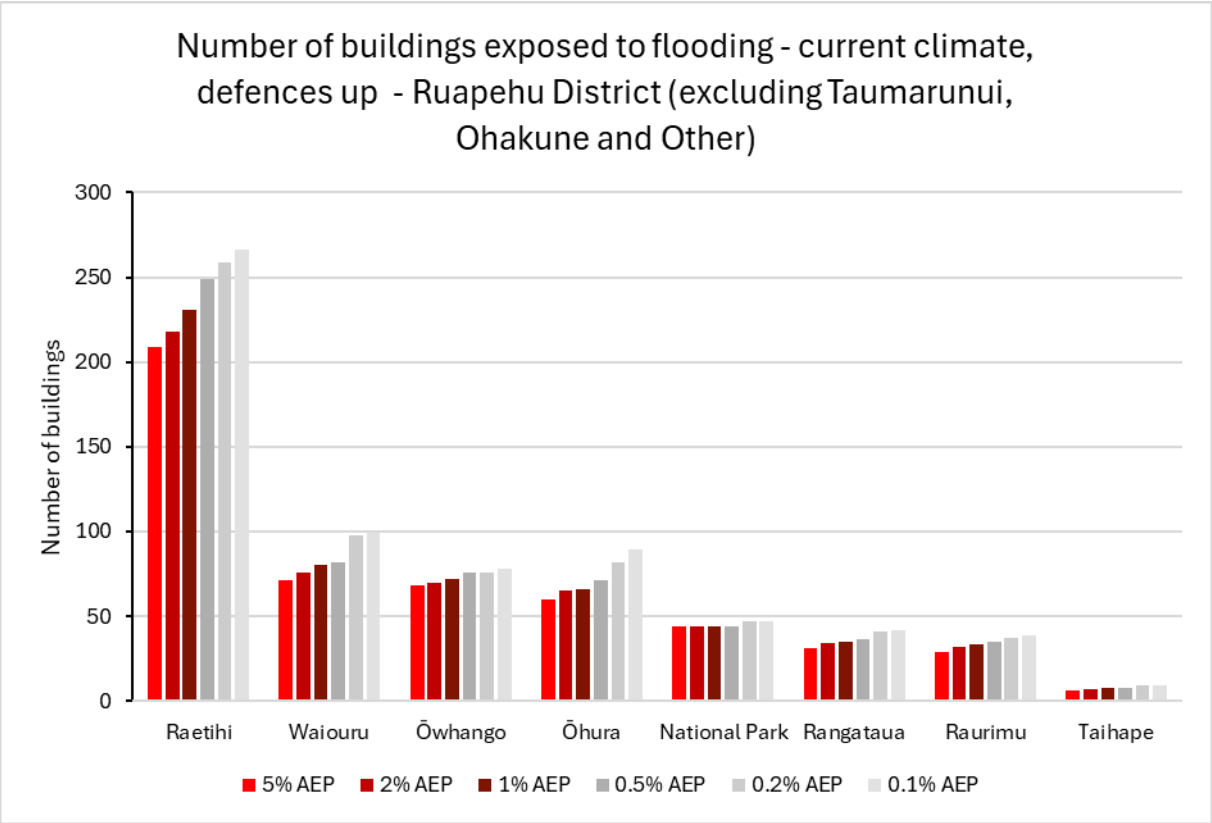


Figure 87: Number of buildings exposed for 5% to 0.1% AEP flood scenario under current climate with defences up for each town/settlement within the Ruapehu District (excluding Taumaranui, Ohakune and 'Other').

4.8 SUMMARY OF DISTRICT VULNERABILITY RESULTS

This section presents a summary of the key results and interpretations of the vulnerability assessment. These are based on the results of the Level A modelling, which as explained in Section 1.3, may be overstated due to the modelling methodology. Overall, the findings reinforce the need for evidence-based flood risk management that considers current and future climate scenarios to ensure that towns and settlements across the Horizons Region are resilient to flood hazards.

- In general, results consistently show that as the flood event increases, the severity of exposure and costs for people and buildings increase. This also occurs as climate change impacts worsen. This trend highlights the importance of Horizons Regional Council and the corresponding district councils continuing investment and coordinating their flood risk management activities throughout the region.
- Districts with higher population and building concentrations, such as Palmerston North and Whanganui, show the greatest increases in vulnerability for higher severity events. Highest vulnerabilities are also recorded for built-up urban areas, including Palmerston North, Whanganui, Levin and Feilding. These are focal points for losses and highlight the importance of flood protection assets to protect these towns and settlements.
    - Higher resolution flood modelling (Level C and D), where the stormwater network is integrated into the model, can provide additional insights into the influence of pluvial flooding.
- Exposure, reinstatement costs, and life costs all increase as the flood severity increases; however, in some towns and settlements, this increase is more pronounced. Within the Whanganui District, exposure and costs notably increase with climate warming and in more extreme events (0.2% AEP and 0.1% AEP). This is influenced by the results for the city of Whanganui. These results highlight potential pinch points in existing defences particularly between the 0.5% and 0.2% AEP events, where the defences are

overtopped. Where this is observed, further detailed modelling, such as Level C or D modelling for the infrequent severe flood scenarios, could be conducted to inform decision making to better understand the role of pluvial flooding in severe events. These insights could inform decisions on whether enhanced structural defences or upgrades to stormwater systems would provide cost-effective risk reduction.

    - Similar trends where exposure steeply increases can be observed at a town and settlement level for areas like Bulls, Taumarunui and Tangimoana.

- Some towns and settlements show consistently steep increases in exposure and costs across all AEP events. This can be observed in areas like Woodville and Marton. Where steep increases are observed within results, this may suggest flood defences protecting these areas are underperforming or non-existent, or there may be complex flood pathways. Areas such as Woodville and Marton would benefit from detailed Level C modelling to better understand local flood mechanisms, which will help in understanding the performance of existing flood defences.
- Results have been disaggregated for each district, by town or settlement area. Buildings that are outside of a town or settlement boundary have been categorised as ‘other’. Throughout the entire region, there are over 39,000 buildings that have been categorised as ‘other’. Primarily, these comprise of residential and rural buildings. The results show that, in some areas, there is a high exposure of buildings that do not fall into a town or settlement boundary. This can be seen for Rangitīkei, Ruapehu and Manawatū. In these areas, exposure for the ‘Other’ category is often exceeding that of some of the towns and settlements. While the focus of this vulnerability assessment has been for populations and buildings within the 52 towns and settlements, these results show that risk within the Horizons Region is not confined to these 52 towns and settlements. This should be considered when reviewing the results and may suggest:
    - The benefit of investment in higher resolution modelling outside of the towns and settlements to better understand exposure in these areas and make informed decisions on flood protection assets.
    - Community engagement to focus on community planning for flood risk management.
- In some communities, when comparing defences up to defences down, the vulnerability results show higher exposure and costs for defences up scenarios. This includes Palmerston North and Ashhurst. While this is generally for the more frequent less severe flood events, this still highlights the complex role of flood defences within the region. These results may be due to the following:
    - Flood waters may be pooling in other areas upstream before reaching communities. This can alter the distribution of exposure, whereby some communities experience a lower level of flooding as areas previously protected by defences are no longer protected and experience a higher level of flooding. Similarly, redistribution of flood waters may result in a higher concentration of damages and therefore exposure and losses from particular buildings. For example, for buildings within the ‘Other’ extent within Ruapehu, there is an increase in life cost despite the same number of buildings and people exposed when comparing defences up and down results.
    - Defences may alter the natural flow paths of water and inadvertently direct them towards other locations. The removal of defences may allow water to follow its natural paths or may be diffused or rerouted to other locations. This is relevant for urban areas where defences act as unintended channels or barriers.
    - In lower AEP flood events, pluvial flooding plays a more notable role. When defences are in place, water can drain into rivers that are relatively low. This leads to decreased local ponding and reduces exposure to buildings and people.
    - In some towns and settlements this is consistent across all AEPs which may indicate where defences are underperforming. This should be considered when planning a strategic forward programme of works for these areas.

- When comparing the results for defences down and up scenarios at a town and settlement level, many of the results show minimal changes. This includes Whanganui, Levin, Foxton and Taumarunui. These results may be explained by the following:
    - This could indicate that flood defences are generally underperforming at lower AEP's and are being overtopped. It may also be reflective of a lower level of protection from flood protection schemes and assets in comparison to the modelled scenarios (e.g., a 20% AEP level of protection for a scheme, while the minimum AEP modelled for the vulnerability assessment is 5%). Horizons and local councils should look at the results in more detail to better understand what communities are protected by what schemes and to understand the required level of service, in comparison to the results of the defences down and up scenarios.
    - Minimal changes in exposure and losses may be reflective of towns and settlements that are not protected by flood protection schemes. For example, flood protection schemes around Bulls predominately offer erosion protection, meaning minimal change in conditions for flood modelling and the vulnerability assessment.
- The relative changes in reinstatement and life costs can be more notable between flood model scenarios for smaller towns and settlements. These areas have fewer exposed buildings and populations, so minor changes in the flood results (as few as one building) can lead to more noticeable changes between the flood model results.
- Changes in exposure to climate change are variable throughout the Horizons Region. Some districts show notable increases in reinstatement and/or life costs when comparing current climate conditions against 3°C warming scenarios.
    - Tararua District has a notable increase in life costs under the 3°C warming scenario despite only a moderate increase in building costs. This may be reflective of the depth and velocity of flooding increasing in some areas, disproportionately impacting exposure. Whanganui District has a notable increase in building reinstatement costs, while results of the pluvial-fluvial case study show a higher influence of fluvial flooding under climate warming scenarios. Ruapehu District, while it has lower total reinstatement costs compared to other districts, has disproportionately higher reinstatement costs under the 3°C warming scenario.
    - These scenarios highlight the importance of completing detailed modelling that considers climate change conditions to guide future decision making. This can inform evidence-based decision making for prioritising upgrades of flood protection assets, emergency management planning, or guiding land use planning decisions.
    - These results may form the basis of further detailed catchment or site-specific studies to better understand how flood protection assets perform against the impacts of climate change and may lead to updating design standards of flood protection assets.

5 RECOMMENDATIONS

The Flood Vulnerability Assessment provides Horizons with a region-wide, consistent view of flood exposure, consequence, and climate-driven change across both urban and rural communities. The assessment highlights where vulnerability is concentrated, where defences play the greatest role in influencing flood impacts, and where climate warming is expected to change flood risk. To translate these insights into practical value, the following recommendations outline how the FVA may be applied across Horizons' core functions, from strategic planning and modelling to emergency management, asset investment, and partnership with Territorial Authorities. Together, these recommendations form a cohesive pathway for strengthening risk-based decision-making, improving alignment across teams and organisations, and ensuring the FVA becomes an enduring foundation for regional resilience.

5.1 USING THE FVA WITHIN A FIT-FOR-PURPOSE CONTEXT

The Flood Vulnerability Assessment provides Horizons with a regional-scale, comparative understanding of flood exposure and consequences. It is designed to guide high-level prioritisation, not to provide property-specific or scheme-specific flood predictions. Its value lies in identifying regional patterns, areas of elevated vulnerability, climate-driven escalation, and communities where further detailed modelling is justified. Ensuring the FVA is consistently communicated and used as a regional decision-support tool will help avoid misinterpretation while enabling stronger strategic alignment across Horizons and with external partners.

RECOMMENDATIONS

- Use the FVA only for regional comparisons, prioritisation, and strategic direction-setting, not as a site-specific hazard or engineering design tool.
- Embed clear guidance on FVA limitations in internal and TA workflows to avoid misapplication (e.g., district advice, consent processes).
- Develop standard messaging and training for Horizons staff and TAs on "how to use" and "how not to use" the FVA.
- Use the FVA to identify where detailed modelling (Level C/D) is necessary to inform asset investment and planning decisions.
- Adopt the FVA results as the first filter in regional flood risk screening, ensuring consistency across the region.

5.2 USING THE FVA TO INFORM THE INFRASTRUCTURE STRATEGY

The FVA highlights where flood exposure, potential losses, and life-safety consequences are highest across the region. These insights can be used to inform into the Infrastructure Strategy to support future investment prioritisation, help justify long-term upgrades, and establish region-wide resilience pathways under climate change. The strong signals around high-risk urban areas and small vulnerable communities provide a defensible basis for long-term funding decisions.

RECOMMENDATIONS

- Prioritise long-term investment in high-risk urban centres, especially Palmerston North and Whanganui using FVA exposure and consequence results.

- Highlight climate escalation of risk in the Infrastructure Strategy to support adaptive investment pathways.
- Use district-level FVA results to inform staged upgrades to high-performing schemes (e.g., Lower Manawatū, Moutoa Gates).
- Identify small towns with disproportionately high vulnerability (e.g., Tangimoana, Koitiata) as priority locations for targeted resilience interventions.
- Integrate FVA metrics (exposure, reinstatement cost, life-safety indicators) into the Infrastructure Strategy's prioritisation framework.

5.3 USING THE FVA TO INFORM THE FUTURE FLOOD MODELLING PROGRAMME

The FVA makes clear which areas warrant more detailed modelling due to high exposure, complex interactions between pluvial and fluvial flooding, or sensitivity to climate change. It also highlights the need for improved model resolution, better representation of stormwater networks, and region-wide consistency in modelling approaches.

RECOMMENDATIONS

- Develop a regional modelling roadmap that advances priority areas from Level A → Level B/C/D modelling.
- Upgrade urban centres to integrated fluvial–pluvial stormwater models, focusing on Whanganui, Palmerston North, Levin, and Feilding.
- Commission Level C/D models for small towns with high proportional impacts.
- Standardise modelling methodologies and metadata across Horizons and TAs to reduce duplication and improve interoperability.
- Time future modelling updates to coincide with district plan reviews and scheme review cycles.
- Include climate warming scenarios in all new detailed models to capture future-state risk.

5.4 USING THE FVA TO INFORM EMERGENCY MANAGEMENT

The FVA provides region-wide insights into population exposure, vulnerable communities, fatality risks, and climate-driven life-safety impacts. These results can strengthen emergency planning, prioritisation, and readiness across the region.

RECOMMENDATIONS

- Update evacuation planning for high-risk towns using FVA building exposure and life-safety results.
- Identify priority communities for enhanced readiness programmes, especially where exposure is high but population is small.
- Integrate FVA life-safety outputs into lifeline planning, especially for transport, stormwater, and electricity assets.
- Prioritise emergency management exercises in districts with major climate-driven escalations, such as Whanganui and Ruapehu.
- Use FVA maps and results in public education and preparedness campaigns to support risk transparency.

5.5 USING THE FVA TO INFORM ASSET MANAGEMENT (CRITICALITY, RENEWALS, CONSEQUENCES)

By incorporating FVA insights into Horizons' asset management system, the organisation can continue the shift towards risk-based, consequence-driven decision-making. The FVA can be used to inform a risk-based approach to understand where stopbank performance matters most, where asset failure leads to disproportionate losses, and where renewals should be prioritised.

RECOMMENDATIONS

- Integrate FVA exposure and consequence metrics into asset criticality scoring to supplement condition-based measures.
- Use FVA-determined high-consequence areas to prioritise renewals and level-of-service upgrades, especially where development or population density is increasing.
- Target detailed modelling (Level C/D) in river reaches where assets protect high-exposure towns, ensuring renewal decisions are evidence-based.
- Improve asset inspection and monitoring (drones, sensors, geospatial workflows) starting with high-risk areas highlighted in the FVA.
- Develop a region-wide risk-based renewals programme explicitly tied to FVA results and climate escalation trends.

5.6 INTEGRATED FLOOD & STORMWATER MODELLING AND ALIGNED PLANNING CYCLES

The FVA underscores the regional need for integrated, cross-jurisdictional flood modelling and coordinated planning cycles. Many towns exhibit significant pluvial flooding influences, requiring tight alignment between Horizons and TAs. The FVA results also offer a shared platform for prioritising modelling updates, timing plan changes, and improving regional consistency.

RECOMMENDATIONS

- Establish a joint Horizons–TA modelling consultation group to coordinate flood, pluvial, and stormwater modelling programmes.
- Create a shared regional modelling calendar aligned with district plan review cycles, LTP cycles, and growth planning stages.
- Co-develop integrated fluvial–pluvial models for major urban areas and growth centres.
- Develop shared data standards, version control, metadata requirements, and QA processes for all modelling undertaken by Horizons and TAs.
- Use FVA hotspot analysis to prioritise where TAs and Horizons should jointly invest.
- Formalise co-funding agreements for detailed modelling in growth zones to ensure modelling is ready when planning decisions need it.

6 CONCLUSION

This Flood Vulnerability Assessment has been undertaken to provide Horizons Regional Council with a regionally consistent and comparative understanding of flood risk. This work will support Horizons ten-year flood hazard mapping programme and wider regulatory, planning and infrastructure investment needs. By consolidating existing data, applying a uniform regional flood modelling approach (Level A) that includes integration of climate-change and defences down scenarios, the assessment establishes a consistent evidence base which Horizons can use to prioritise future detailed modelling, guide asset management decisions, and support Territorial Authorities in district planning and adaptation work.

The results of this assessment demonstrate the value in applying a consistent, region-wide approach to understand and visualise flood risk. This project has delivered Horizons a comprehensive overview of flooding across 12 inundation domains, combining pluvial and fluvial processes, and spanning a range of design storm and climate-change scenarios. This consistency enables direct comparison of vulnerability across the region. While the results are from a regional scale, this Level A approach provides a robust, evidence-based starting point for identifying priority areas for refinement through detailed Level C and D modelling.

The results of the regional-scale vulnerability assessment show clear trends. Exposure of people and buildings increases with flood magnitude, and climate warming amplifies these effects. Large urban centres, such as Palmerston North and Whanganui, account for the greatest exposure due to their population density and proximity to major waterways. Flood vulnerability is not limited to these large urban centres, with smaller towns and settlements showing disproportionately high vulnerability. This includes Woodville, Tangimoana, Koitiata and Mangatainoka, where a large proportion of buildings contribute to reinstatement costs, despite the smaller number of buildings.

This assessment also provides insight into the complex role of flood defences. The regional scale results provide generalised trends and patterns that may differ from localised flooding behaviour. From a regional scale, the removal of flood defences decreases exposure and vulnerability for high frequency low magnitude flood events (e.g. 5% 2% AEP), while increase exposure and vulnerability for the low frequency high magnitude floods (e.g. 0.5% AEP). These trends are generalised and differ from localised flooding behaviour. The regional trend is most prevalent in Palmerston North, however in areas like the Manawatū District in communities such as Feilding, the removal of flood defences increases exposure and vulnerability across all flood events, therefore highlighting the role of flood defences in protecting buildings and people in this location. These trends demonstrate that the influence of flood defences varies across the region while reinforcing the need for detailed, scheme-specific modelling to understand the localised behaviour and support evidence-based decisions about flood protection assets.

The vulnerability assessment highlights many gaps that can be used to guide future steps. The regional model does not include the stormwater networks, does not explicitly sperate pluvial and fluvial behaviour, and is not calibrated to historic events. Case studies in urban areas of Palmerston North, Feilding, Whanganui and Levin confirm that pluvial flooding dominates in urban areas, and emphasises the need for improved representation of rainfall-runoff processes within modelling. Results highlight that exposure outside of towns and settlements dominate vulnerability and require further investigation to support targeted resilience planning.

The flood vulnerability assessment results provide the broad regional foundation to identify high-priority areas, inform strategic investment, and support alignment across Horizons' District Advice, asset management, planning, and emergency management functions. Future phases of work would involve producing higher-resolution modelling in priority areas, that integrates stormwater networks and is calibrated to observed events. These detailed studies would support risk-based asset management decisions and improve understanding of localised exposure.

7 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Horizons Regional Council ('Client') in accordance with the CCCS 4th Edition Dec 2017 dated 21 July 2025.

Permitted Purpose

This Report has been prepared expressly for the purpose of supporting Horizons in developing a comprehensive flood vulnerability study for the region ('Permitted Purpose'). WSP accepts no liability whatsoever for the use of the Report, in whole or in part, for any purpose other than the Permitted Purpose. Unless expressly stated otherwise, this Report has been prepared without regard to any special interest of any party other than the Client.

WSP accepts no liability whatsoever for any use of this Report, in whole or in part, by any party other than the Client. Unless WSP agrees otherwise in writing, any use or any reliance on this Report by a third party is at its sole risk without recourse to WSP. Third parties must make their own enquiries and obtain independent advice in relation to any matter dealt with or any conclusion expressed in this Report.

Qualifications and Assumptions

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Agreement and the Report and are subject to the scope, qualifications, assumptions and limitations set out in the Report and/or otherwise communicated to the Client. Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and/or recommendations in the Report ('Conclusions') are based in whole or in part on information provided by the Client and other parties ('Information'). The Information has not been and have not been verified by WSP and WSP accepts no liability for the reliability, adequacy, accuracy and completeness of the Information.

The data reported and Conclusions drawn by WSP in this Report are based solely on information made available to WSP at the time of preparing the Report. The passage of time; unexpected variations in ground conditions; manifestations of latent conditions; or the impact of future events (including (without limitation) changes in policy, legislation, guidelines, scientific knowledge; and changes in interpretation of policy by statutory authorities); may require further investigation or subsequent re-evaluation of the Conclusions.

Disclaimer

No warranty, undertaking or guarantee whether expressed or implied, is made with respect to the data reported or the Conclusions drawn. To the fullest extent permitted at law, WSP, its related bodies corporate and its officers, employees and agents assumes no liability and will not be liable to any third party for, or in relation to any losses, damages or expenses (including any indirect, consequential or punitive losses or damages or any amounts for loss of profit, loss of revenue, loss of opportunity to earn profit, loss of production, loss of contract, increased operational costs, loss of business opportunity, site depredation costs, business interruption or economic loss) of any kind whatsoever, suffered or incurred by a third party.

APPENDIX A – LETTER OF COMPLETION

30 June 2025

Horizons Regional Council
11 Victoria Avenue
Palmerston North
4410

Letter of Completion: Flood Vulnerability Report

1-E0118.00

Dear Jon Roygard,

Thank you for the opportunity to complete the Horizons Flood Vulnerability Assessment project in collaboration with NIWA and yourselves. This has been an extensive and ambitious piece of work with a goal to provide Horizons with a strong foundation to improve the region's flood risk management. This letter serves as a formal completion report, summarising the deliverables and key findings associated with the project. Below is a detailed overview of the deliverables:

Task 2-2 Desktop Review Report: This report is a comprehensive guideline developed for Horizons to support flood risk management through improved modelling and mapping practices. It consolidates international and New Zealand best practices and legislative frameworks to develop a regional flood modelling framework tailored to Horizons' needs. The framework introduces four levels of assessment, from broad regional overviews to detailed site-specific models, each aligned with specific user personas such as emergency managers, planners, and asset managers. The framework is designed to be adaptable, enabling Horizons to assess current capabilities, identify gaps, and guide future flood modelling efforts to enhance resilience and decision-making across the region.

Task 2-3 Current State Analysis Report: The current state analysis report provides a comprehensive current state analysis of flood modelling and asset data for Horizons. The report includes:

Model Review: WSP and NIWA reviewed 59 hydraulic modelling reports spanning 1997–2024. These models primarily support flood risk assessment, hazard mapping, and infrastructure planning. Most models were rated as Level C (localised catchment models) or Level D (site-specific assessments) under the Regional Flood Modelling Framework, with varying degrees of calibration, climate change consideration, and data quality

Asset Data: The report also evaluates asset management documentation and geospatial datasets provided by Horizons. These include condition ratings, asset quantities, and infrastructure strategies, which are essential for understanding the state and resilience of flood protection infrastructure

Framework and Recommendations: A detailed hydraulic modelling methodology framework is proposed, categorising models from Level A (basic desktop) to Level D (detailed site-specific). Recommendations include standardising modelling practices, integrating Shared Socioeconomic Pathways (SSPs), improving documentation, and enhancing model calibration and validation processes

This analysis establishes a baseline for future flood risk modelling and supports strategic planning for flood resilience across the Horizons region.

Task 3-1 Regional Flood Modelling Report: The study models flood inundation across 12 domains in the Horizons Region using a combination of hydrological (TopNet) and 2D hydrodynamic (BG-Flood) models. It assesses flood hazards under current and future climate scenarios, including sea level rise and stopbank failure conditions. Flood scenarios include 20-, 50-, 100-, 200-, 500-, and 1000-year return periods, with climate change increments of +1°C, +2°C, and +3°C above current climate. Coastal

WSP
Christchurch
12 Moorhouse Avenue
Christchurch 8011
New Zealand
+64 3 363 5400
wsp.com/nz

domains also include sea level rise scenarios. The modelling produced high-resolution flood maps showing maximum water depth, elevation, depth-velocity product, and water rise rates.

Task 3-2 Asset Condition Report: This report provides a comprehensive review of Horizons' flood protection assets and outlines a roadmap for transitioning from a largely reactive to a proactive, risk-informed asset management approach. It highlights that Horizons currently manages nearly 3,800 flood protection assets valued at approximately $1.2 billion, with historical practices relying heavily on visual inspections and basic criticality classifications. The report identifies several limitations in this approach, including insufficient consideration of societal risks, lack of defined service levels for erosion protection assets, and the aggregation of condition ratings for linear assets, which can obscure localized vulnerabilities. To address these challenges, the report recommends enhancing asset criticality assessments by incorporating factors such as service importance, performance reduction, and downtime. It also recommends integrating updated flood modelling and vulnerability assessments to refine service level evaluations.

Task 3-3 Flood Frequency Report: This report presents a detailed flood frequency analysis for 74 river sites across the Horizons Region, using both systematic and historical flood data. It identifies the Generalised Extreme Value (GEV) distribution as the most reliable model for estimating flood peaks and return periods. A regional flood frequency curve was developed to enhance the robustness of estimates, particularly for rare events.

Task 4 Vulnerability Viewer: Implemented in ArcGIS Experience Builder on Horizons' systems, the viewer has been developed as Minimum Viable Product to visualise the results of the vulnerability study. Future development options are described in Final Report 3 – Recommendations Report.

Task 5 Lower Manawatu Model Report: The report details how the model was constructed using TUFLOW HPC, incorporating high-resolution LiDAR terrain data, recent watercourse surveys, and updated hydrological inputs from NIWA. It simulates five flood scenarios, including present-day and climate change-adjusted events for 50-, 100-, and 200-year return periods. The model includes 29 inflow points and a tidal boundary at Foxton, and it represents key flood control infrastructure such as the Moutoa Gates, stopbanks, floodgates, and spillways. Flood risk was assessed across nine key areas, including Feilding, Palmerston North, and the Oroua and Moutoa floodplains. The results show how flood extents and depths vary significantly with event severity and climate change, with notable vulnerabilities in urban and rural floodplains. The model also highlights areas where overtopping of stopbanks and infrastructure failures could lead to widespread inundation.

Task 6 Moutoa Gates Model Report: The Moutoa Gates model report presents a detailed hydraulic modelling study to support operational upgrades of the Moutoa sluice gates. The model evaluates how different gate operation scenarios during high-flow events affect flood risk in the Lower Manawatū catchment. The study found that scenarios with reduced gate openings, such as Scenario G (three gates fully closed), significantly increased flood extents and depths in Floodplain South and East, with depths exceeding 2 meters. Conversely, scenarios with greater gate openings, like Scenario F, showed minimal increases in flood extent and depth. The model also identified 13 locations of stopbank overtopping downstream of the gates, with overtopping depths ranging from 10 to 40 cm.

Final Deliverables: The final deliverables have been split into a series of reports and appendices. These consolidate all findings from the project, demonstrating the vulnerability results and providing detailed recommendations for improving flood risk management.

- Final Report 1 – Regional Summary Report
- Appendix A – This letter of completion
- Appendix B – Task 3-5 Vulnerability Assessment Methodology. This appendix outlines the methodology used for the vulnerability assessment, including the integration of hazard layers, exposure layers, and vulnerability models.
- Appendix C – Methodology for Separating Fluvial and Pluvial Flooding Memo. This memo outlines the methodologies used to differentiate between fluvial and pluvial flooding, including GIS exercises and hydrological modelling.
- Final Report 2 – District Summary Report
- Final Report 3 – Recommendations Report

We are confident that the comprehensive analysis and recommendations provided in these reports will significantly contribute to the effective management of flood risks in the region. Should you have any questions or require further information, please do not hesitate to contact us.

Thank you for the opportunity to work on this important project. We look forward to the possibility of collaborating with you on future initiatives.

Regards,

Richard Woods
Project Director | Service Line Leader Risk & Resilience

APPENDIX B – REGIONAL FLOOD MODELLING FOR HORIZONS FLOOD VULNERABILITY ASSESSMENT (ESNZ)

NIWA
Taihoro Nukurangi

Regional flood modelling for Horizons Flood Vulnerability Assessment

Prepared for Horizons Regional Council

June 2025

Climate, Freshwater & Ocean Science

Prepared by:
Alice Harang, Rose Pearson, Emily Lane, Shailesh Singh

For any information regarding this report please contact:
Alice Harang
Hydrodynamic Scientist
Environmental Hazards
+64 22 099 17 84
Alice.harang@niwa.co.nz

National Institute of Water & Atmospheric Research Ltd
PO Box 8602
Riccarton
Christchurch 8440

Phone +64 3 348 8987

NIWA CLIENT REPORT No: 2025133CH
Report date: June 2025
NIWA Project: WSP25502

Revision	Description	Date
Version 1.0	Final version sent to client for review	22 May 2025
Version 1.1	Final version sent to client	27 June 2025

Quality Assurance Statement		
	Reviewed by:	Gu Stecca
	Formatting checked by:	Rachel Wright
	Approved for release by:	Charles Pearson

© All rights reserved. This publication may not be reproduced or copied in any form without the permission of the copyright owner(s). Such permission is only to be given in accordance with the terms of the client's contract with NIWA. This copyright extends to all forms of copying and any storage of material in any kind of information retrieval system.

Whilst NIWA has used all reasonable endeavours to ensure that the information contained in this document is accurate, NIWA does not give any express or implied warranty as to the completeness of the information contained herein, or that it will be suitable for any purpose(s) other than those specifically contemplated during the project or agreed by NIWA and the client.

Contents

Executive summary **5**

1 Introduction **6**

2 Methodology **8**

2.1 Flood modelling domains identification and specification 8

2.2 DEMs 12

2.3 Design Storms 16

2.4 Hydrological modelling 18

2.5 Hydrodynamic modelling 19

2.6 Climate change methodology 21

3 Results **26**

3.1 List of scenarios 26

3.2 Water depth maps 27

3.3 Contrasting the stopbanks-up and stopbank-down scenarios 29

3.4 Sea level rise (SLR) influence 30

3.5 Limitations 31

4 Conclusion **34**

5 Acknowledgements **35**

6 Glossary of abbreviations and terms **36**

7 References **37**

Appendix A List of files provided **38**

Appendix B Extension: 0.2% and 0.1% AEP modelling **40**

Tables

Table 2-1: List of inundation domain model locations. 11

Table 2-2: Percentage change factors to project rainfall depths derived from the current climate to a future climate that is 1 degree warmer. 17

Table 2-2: Increases in apparent ARI due to climate change. 23

Table A-1: List of scenarios explored for each domain. 38

Table B-1: List of scenarios explored for each domain, including the extension. 40

Figures

Figure 2-1: Overall methodology from Mā te Haumaru ō te wai to generate floods maps from Design Storms. 8
Figure 2-2: Horizons regional modelling domains. 9
Figure 2-3: Ākitio domain. 10
Figure 2-4: Method for DEM and roughness generation by GeoFabrics. 12
Figure 2-5: Data used for DEM generation. 13
Figure 2-6: Surface elevation along the Mangatainoka River, upstream of Mangamaire, at intersection of SH2 with Pukewahi road (Upper Manawatū Domain). 14
Figure 2-7: Roughness length map in the Upper Manawatū Domain, on Mangatainoka River, upstream of Mangamaire, at intersection of SH2 with Pukewahi road. 14
Figure 2-8: DEM for the upper bank of the Whanganui River mouth. 16
Figure 2-9: Sample design storm for 200-year ARI and 54-hour duration event in the Whanganui catchment. 18
Figure 2-10: Target refinement map generated for the Manawatū domain, 200-year ARI, current conditions. 20
Figure 2-11: Example mapping for lower ARI events under climate change. 22
Figure 2-12: Global surface temperature changes 1950-2100 as a difference to the 1850-1900 period for different SSP scenarios. 25
Figure 3-1: Overview of the flood maps. 27
Figure 3-2: Flood extent for the design storm scenario for the lower Rangitīkei domain. 28
Figure 3-3: Flood extent for the design storm scenarios for the lower Rangitīkei domain, zoomed into the Ohakea-Bulls area. 29
Figure 3-4: Flood extent with stopbank and without stopbanks for the lower Rangitīkei area. 30
Figure 3-5: Inundation extend with (white) and without (black) sea level rise for the 200-year +3˚C scenario. Herbertville, Wainui-Herbertville domain. 31
Figure 3-6: Inundation extend with (white) and without (black) sea level rise for the 200-year +3˚C scenario. Manawatū river mouth. 31

Executive summary

NIWA undertook a regional modelling study for Horizons Regional Council as part of a Flood Vulnerability Study in conjunction with WSP New Zealand Ltd. Twelve inundation domains cover the floodplains and river corridors in the Horizons Region. The upper catchments of the inundation domains are modelled using a hydrological model while the flood inundation in the inundation domains is modelled using a 2D hydrodynamic model. For each inundation domain, flood inundation due to 20-, 50-, 100-, 200-year rainfall design storms are modelled. Climate change scenarios for the 200-year rainfall design storm of +1˚C, +2˚C, +3˚C and +3˚C with Sea Level Rise were also modelled (the latter only for coastal flood inundation domains). For inundation domains with stopbanks, additional stopbanks-down scenarios (i.e., scenarios where the stopbanks have been removed) were modelled. Additional modelling of the 500- and 1000-year rainfall design storm for actual and climate change configurations were completed for the stopbank up scenario as an extension. This report outlines the methodology used in the regional modelling study and gives an overview of the results that were provided to Horizons Regional Council and used in the risk analysis.

1 Introduction

NIWA and WSP New Zealand Ltd are undertaking a joint study to contribute to the Horizons Regional Council's (Horizons) flood vulnerability assessment project. The study includes a region-wide assessment of the risks and vulnerabilities of the different towns in the region. As part of this study NIWA undertook a region-wide flood inundation assessment for the Horizons Region. Region-wide flood inundation hazard was modelled due to design rainstorms with Annual Exceedance Probabilities (AEP) of 5%, 2%, 1% and 0.5%, which correspond to Annual Return Intervals (ARIs, colloquially know as Return Periods) of 20-, 50-, 100- and 200-years. For the 0.5% AEP event, climate change scenarios corresponding to +1˚C, +2˚C and +3˚C over the current climate were also modelled (note that the recent epoch is already 1˚C above pre-industrial levels so these correspond to +2˚C, +3˚C and +4˚C above pre-industrial temperatures). For locations with stopbanks, additional stopbanks-down scenarios (i.e., scenarios where the stopbanks have been removed) were also modelled. These results were used in the risk assessment work and provided to Horizons.

This report outlines the methodology used in the modelling including the specifications of the flood domains where hydrodynamic modelling was undertaken, the creation of the Digital Elevation Models (DEMs), the design storms, the hydrological modelling in the upper catchments, the hydrodynamic modelling in the flood domains and the climate change methodology. Example results are given for the different Average Recurrence Intervals (ARIs), climate change warming increments, stopbanks up and down and sea level rise. The limitations of the regional-scale modelling are also discussed.

The results from this region-wide flood inundation assessment were used to calculate the vulnerability of the Horizons communities. The methodology for this flood vulnerability assessment is detailed in the Vulnerability Assessment Methodology - Appendix A of the Final Report, which outlines the approach used to assess community vulnerability. The Final Report further discusses the interpretation of these vulnerability results, placing them in the context of each communities' risk levels and the performance of flood protection schemes under various modelled scenarios. This comprehensive analysis helps explain the implications for community safety and the effectiveness of existing flood mitigation measures.

WSP's report on the Current State Analysis of Horizons Flood Vulnerability Assessment (Ashcroft et al. 2025) proposes a hydraulic model methodology framework which assesses modelling on a four-level scale from A to D (Level D being the highest). Table 1-1 presents the levels this modelling attains for each of the criteria presented in Table 4 of that report. While some of the criteria are level B/C, other criteria are only at level A giving it an overall level of A. The main reason behind this is because this is a regional model, it is not validated or calibrated to the same level that a local- or catchment-scale model would be. Not all flood structures are fully represented and there may be some artifacts in the DEM and roughness maps. These results should, however, give a good indication of the scope of the problem, where the highest levels of risk are likely to be and where further work (further LiDAR acquisition, higher level modelling etc.) is warranted to better characterise the flood hazard and vulnerability.

Additional modelling covering design rainstorms of 0.2% and 0.1% AEP (or 500- and 1000-year return periods) for current climate and climate change scenarios corresponding to +1˚C, +2˚C and +3˚C over the current climate for stopbank up scenarios only were undertaken as a variation on the contract. Details about these scenarios are presented in Appendix B.

Table 1-1: Flood model level assessed against individual criteria. Criteria taken from Table 4, WSP Client Report, Horizons Flood Vulnerability Assessment Current State Analysis (Ashcroft et al. 2025).

Criteria	Level	Comment
Data Methodology	B/C	Report describes data and sources. Some data review, some limitations noted considering quality and sources of data.
Asset Surveying	B	Existing surveys of flood stopbanks were used but these weren't comprehensive.
Channel Surveying	B	Some cross-section data and river bathymetry estimation algorithms in addition to LiDAR used to characterise river channels. DEM hydraulically conditions to enforce downward flow.
Hydrological Modelling	B/C	Spatially and temporally varying design rainfalls used with TopNet hydrological model in upper catchments.
Flood Events and Climate Change	B/C	Design Rainfall AEPs from 0.1% to 5% modelled with lower AEP events also including Climate Change in terms of temperature increments.
Terrain	B	LiDAR-defined DEM prioritised over DSM where available.
Land Cover	B/C	Spatially varying roughness length defined from LiDAR data where available. A single roughness value is used where only the DSM was available.
Cell Size/Resolution	B/C	Adaptive grid with highest resolution of 8 m.
Structures	A/B	Flood stopbanks enforced (or removed) according to Horizons database, completed by the New Zealand Inventory of Stopbanks (NZIS). Other structures not included. No operational structures included.
Stormwater Network	A	No stormwater network included.
Sensitivity Testing	A/B	Not specifically undertaken in this study but basic sensitivity testing undertaken for locations outside Horizons Region.
Validation and Calibration	A	Limited comparison undertaken for Horizons locations. Overall national-scale methodology has been validated against events in case study locations (Waikanae, Tairāwhiti, Hawkes Bay).
Outputs	B/C	Maps of flood extents, depths, elevations, depth times velocity and rise rates for multiple AEP and Climate Change scenarios.

2 Methodology

The methodology used for the Horizons Regional Council regional flood modelling follows that developed under the MBIE-funded Endeavour Programme Mā te Haumaru ō ngā puna wai ō Rākaihautū ka ora mō ake tonu[1]. This method consists of a cascade of models forced by design storms of different intensities, which allows for a consistent method at regional level and between gauged and ungauged catchments. The different steps of this method are presented in Figure 2-1 and will be described in the following sections. These different steps are integrated in a semi-automatic workflow managed by the open-source scheduler 'cylc' (Oliver et al. 2018).

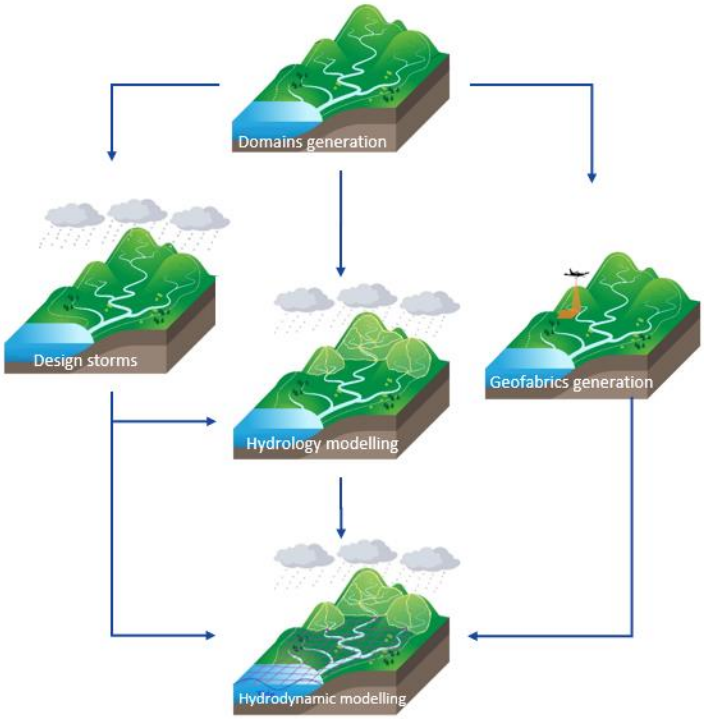


Figure 2-1: Overall methodology from Mā te Haumaru ō te wai to generate floods maps from Design Storms.

2.1 Flood modelling domains identification and specification

The first step of the workflow is the identification of flood modelling domains, carried out as a three-step procedure, resulting in the domains presented on Figure 2-2. Further information is given below but the basic steps are:

1. Specification of catchments based on identification of floodplains of interest,
2. Identification of flood inundation domain in catchment,
3. Identification of injection points where rivers flow into the flood inundation domain.

First, based on the topography and hydrology of the region, floodplains were roughly identified as the computational units where related or connected flood events can be observed. These domains were named after a major river or township in the domain. They consist of either a river floodplain (e.g., Ākitio Domain), different major rivers that share a floodplain (e.g., Turakina domain also containing the Whangaehu River), or a floodplain associated with a section of the river catchment

[1] http://niwa.co.nz/flood-resilience

(e.g., Upper Manawatū Domain associated with the Upper Manawatū Catchment, before the Manawatū Gorge, and lower Manawatū Domain associated with the lower part of the catchment). From these floodplains, we used a GIS-python tool in conjunction with the river network REC2.5[2], to identify the full catchment feeding this floodplain. The catchment is the hydrological domain associated with a given flood inundation domain where we ran the NIWA hydrological software for each scenario.

As a second step, including information from LINZ national databases, the flood inundation domains were identified along the river network from the mouth including catchment units having a maximum slope of less than 3% or minimum building and population density above a threshold. As this flood modelling requires high resolution ground elevation data and roughness data, the computational domains were also initially restricted to area where LiDAR data was available. As Horizons provided some DEMs (Digital Elevation Models) and a DSM (Digital Surface Model) covering the entire region, and after discussing the limitation of this type of data compared to LiDAR data, the restriction requiring LiDAR availability was relaxed. Following discussion with Horizons, we also included main transport infrastructure corridors in our modelling domains. Finally, a 500 m buffer was added to these domains for modelling purposes.

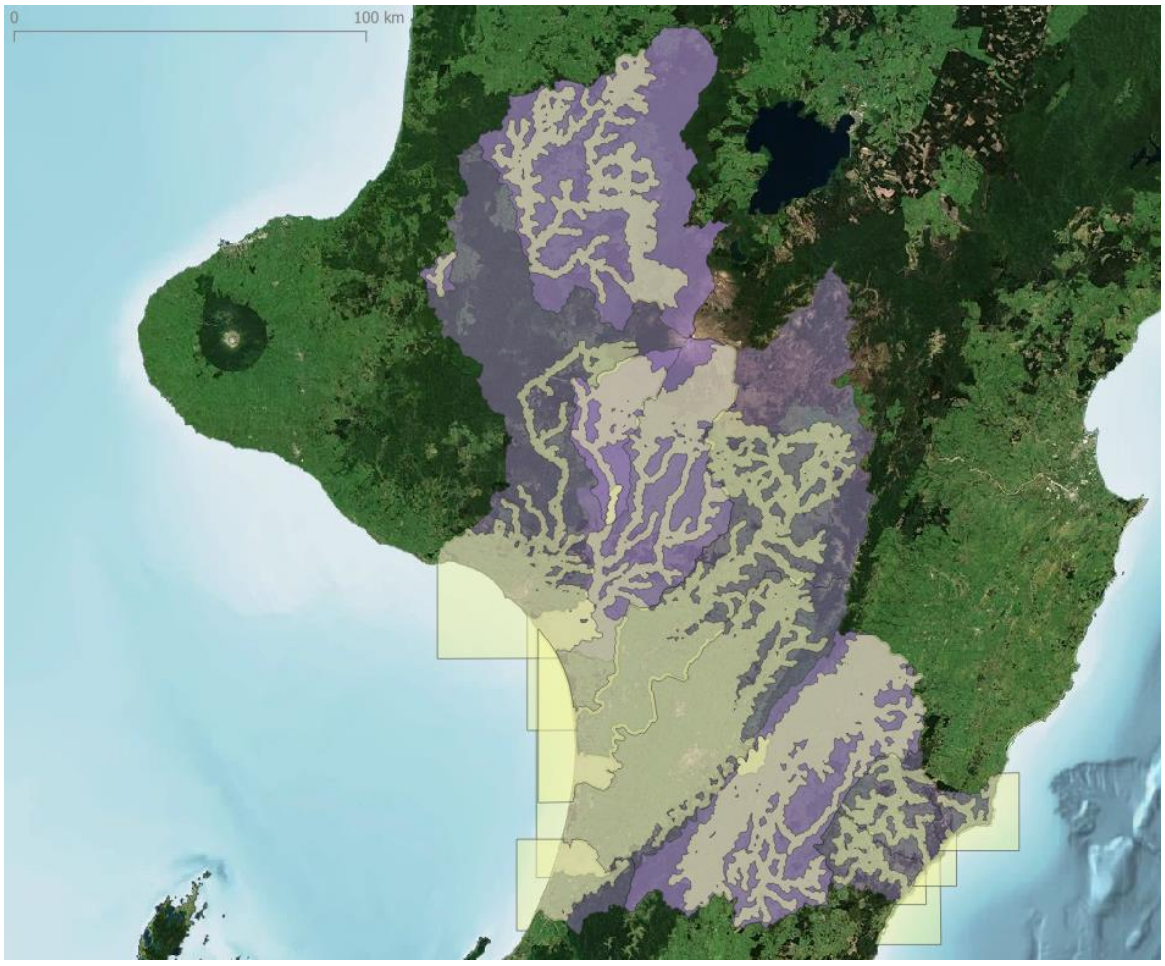


Figure 2-2: Horizons regional modelling domains. Domains where flood inundation modelling was undertaken (yellow), Catchments that feed these domains modelled by hydrological modelling (purple).

[2] https://niwa.co.nz/freshwater/river-environment-classification-2

As a last step, the injections points were identified as the intersections between the river network (at Strahler order 1, i.e., the complete network including the smallest river reaches) and the computational domain boundary. These injection points correspond to the location of the inlets where the flow hydrographs resulting from hydrological simulations are injected into the inundation model domains (see Figure 2-3).

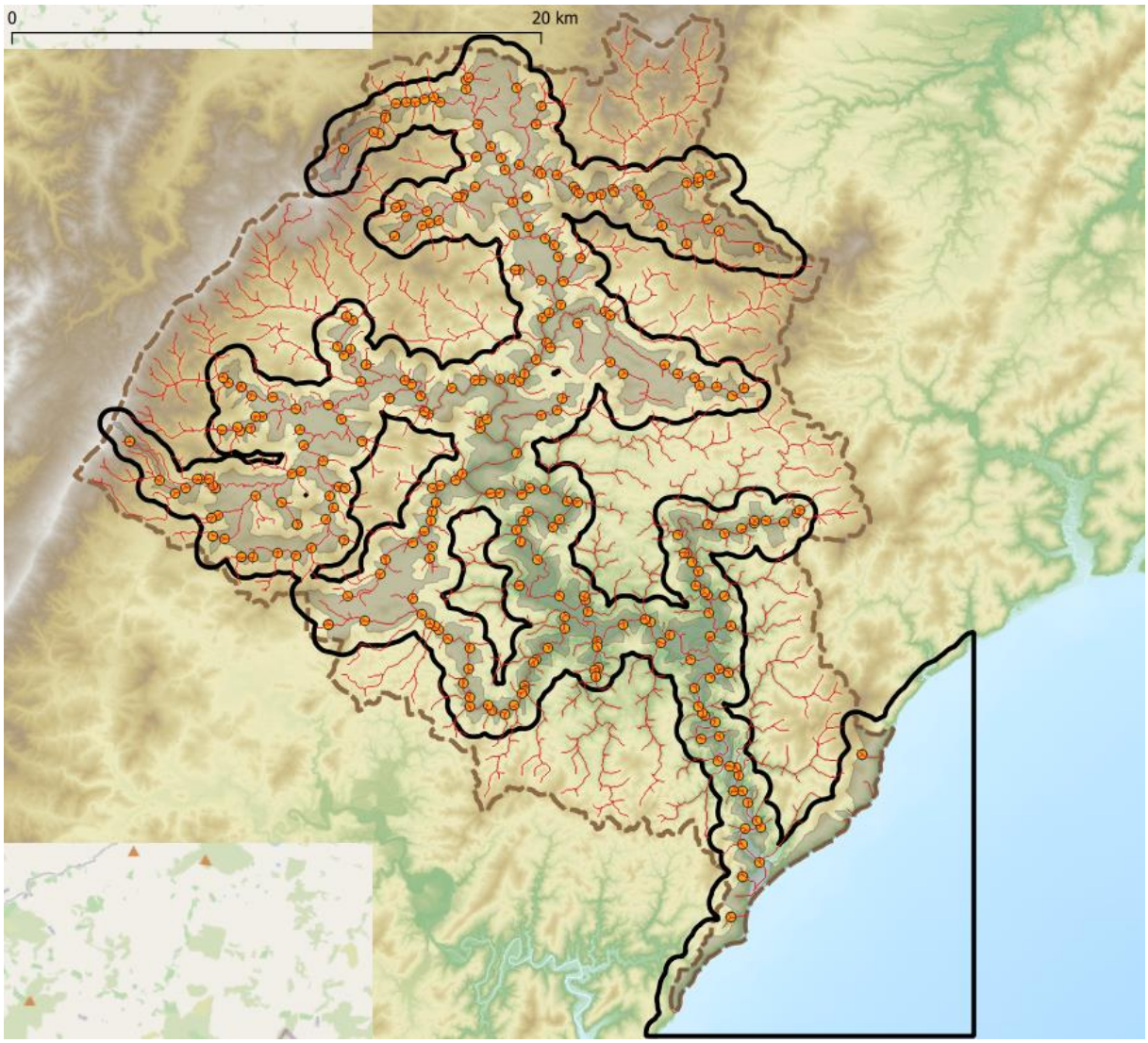


Figure 2-3: Ākitio domain. The domain for inundation modelling is within the boundary indicated by the black line and was generated as a buffer around the initially identified catchment units. The latter are the core of the domain and are indicated by greyed areas. Injection points (orange dots) are located at each intersection between a river or stream (red lines) from REC2.5 and the core of the domain. The extent of the full catchment or hydrological domain (for TopNet model) is indicated by the dashed brown line. The DEM (see later, in section 2.2) is visible in the background.

Table 2-1 lists the different inundation domains modelled through this study. The catchment area includes both the floodplain and the catchment area upstream of it. It is the area computed with the hydrological model. The computational area is the area of the inundation model for each domain (and it includes a sea corner for coastal domains). Finally, some catchments include or overlap with other computational domains. For example, the Whanganui catchment (as defined for this study), includes the Whanganui domain, but also the Whangamōmona, Taumarunui, Ohakune and most of the Turakina domain, as the Turakina River mouth is included in the domain as the Eastern boundary

of the Whanganui floodplain. This overlap occurs because, on flood plains, flooding often spills beyond the bounds of one river into another. By overlapping the domains, we can capture flooding from multiple rivers. Without this, flooding that would naturally flow out onto the flood plain might build up against the edge of the computational domain, leading to it being artificially high. To avoid confusion, the results have been postprocessed so that for overlapping locations, the maximum inundation for a given AEP and temperature increment is given rather than the results for a single rainfall design storm event. Where the rectangular raster overlaps other domains the results from all flooded areas within the rectangle are given. The other information in this table are catchment properties, relating to scenarios explored for the different domains. Storm duration is the length of design storm chosen for each domain and is related to the size of the catchment and its time of concentration. The lower boundary of the catchment determines the model boundary condition; an outflow boundary condition is used for inland models and a tidal boundary (potentially including a different sea level rise on the east and the west coast) for the other models. For these coastal models, the tidal amplitude corresponding to Mean High Water Spring (MHWS) tide is also given. For all models with stopbanks, flood maps with stopbanks down are also produced (see Section 3.1 for more details). Finally, the overlapping computational models are listed in the last column.

Table 2-1: List of inundation domain model locations. Catchment properties are also given for each location.

Computational domains	Storm duration (h)	Catchment area (km²)	Computational area (km²) (including sea corner)	Lower boundary (MHWS tidal amplitude in metres is given for coastal locations)	Stopbanks	Overlapping computational domains
Ākitio	24	598	416	East Coast (1.836)	no	Aohanga Wainui-Herbertville
Manawatū	60	6088	3079	West Coast (2.236)	yes	Rangitīkei Upper Manawatū Ōhau-Levin
Aohanga (Previously known as Owahanga)	6	415	247	East Coast (1.831)	no	Ākitio
Ohakune	12	705	447	Inland	no[3]	Turakina Whanganui
Ōhau-Levin	12	421	514	West Coast (2.312)	yes	Manawatū
Rangitīkei	42	4058	2533	West Coast (2.451)	yes	Manawatū Turakina
Taumarunui	12	3813	1441	Inland	yes	
Turakina	60	3153	1903	West Coast (2.591)	yes	Rangitīkei Whanganui Ohakune
Upper Manawatū	60	3190	2357	Inland	yes	Manawatū
Wainui-Herbertville	6	195	340	East Coast	no	Ākitio

[3] Ohakune contains small flow retention structures but not identified as flood protection structures but detention embarkment (from Horizons Stopbanks database).

Computational domains	Storm duration (h)	Catchment area (km²)	Computational area (km²) (including sea corner)	Lower boundary (MHWS tidal amplitude in metres is given for coastal locations)	Stopbanks	Overlapping computational domains
				(1.817)		
Whangamōmona	6	76	40	Inland	no	
Whanganui	54	10525	1835	West Coast (2.761)	yes	Turakina Ohakune

2.2 DEMs

For each of the floodplains (inundation domains) identified for flood modelling, a two-dimensional digital elevation model (DEM) and a roughness map were created. Using a similar method to that for the national flood assessment project, hydrologically conditioned DEMs and roughness maps were generated for the entire region as a tile set of grids with a square mesh with a resolution of 8 m. These tiles were produced semi-automatically using the software tool GeoFabrics[4] (Pearson et al. 2023) and stored in a NetCDF file. This method provides a consistent and repeatable approach for combining multiple LiDAR, DEM datasets and ocean contours and applying hydrological conditioning. Figure 2-4 shows the process graphically.

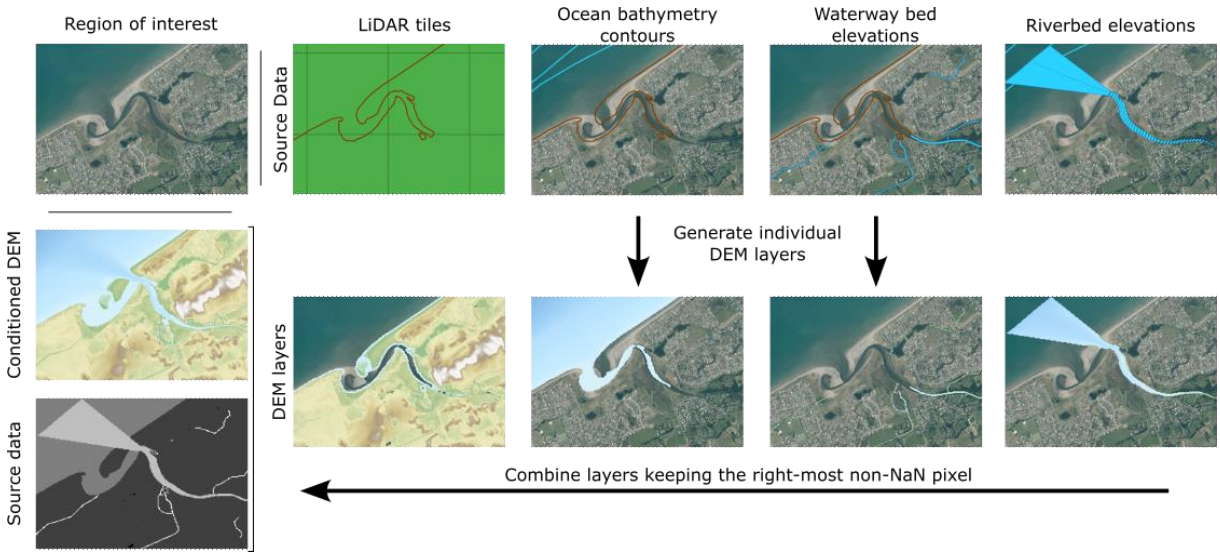


Figure 2-4: Method for DEM and roughness generation by GeoFabrics.

These tiles contain four variables: elevation above NZVD2016, roughness length (Zo), a data source classification, and a LiDAR source classification. At each floodplain the tiles needed to cover that domain were stitched together to generate the DEM and roughness map needed for flood modelling.

DEMs were generated using a combination of LiDAR data, which capture the above-ground surface elevation, and regional topographical datasets. In the case of rivers partially or totally submerged during the LiDAR survey, only the water surface elevation is recorded by the LiDAR, and the river

[4] https://github.com/rosepearson/GeoFabrics

bathymetry of the main riverbed is not captured. To deal with this problem, the Geofabrics framework applied hydraulic conditioning to the DEM, allowing the digging of rivers. Starting from the river mouth backward, the river-bed shape was derived from estimating the river cross-section necessary to allow the free discharge of a 2.33-year ARI event.

Specifically for this project, the method for generating these maps was adapted to the data available. For the elevation information, the priority was given to LiDAR data where it was available (as of December 2024), with a preference given to the more recent surveys (see Figure 2-5). Where no recent LiDAR was available in the Manawatū coastal area, the GtManawatu DEM, provided by Horizons and projected onto NZTM2000/NZVD2016 was used. Finally, where no recent LiDAR was available and outside of the region covered by the GtManawatu DEM, the digital surface model DSM provided by Horizons and projected onto NZTM2000/NZVD2016 was used.

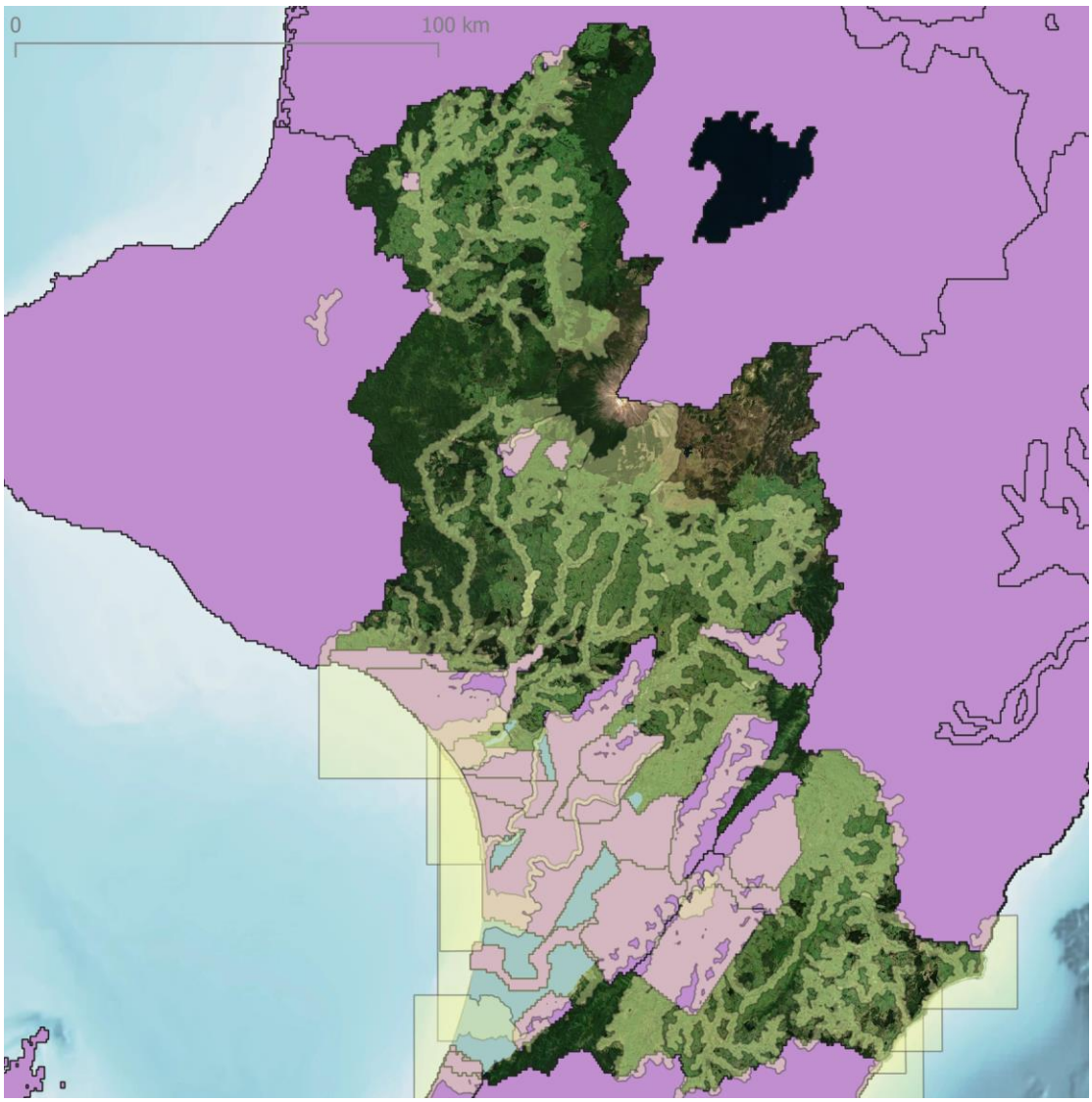


Figure 2-5: Data used for DEM generation. Purple: LiDAR available in 12/24, Blue: GtManawatu DEM, Background: DSM. Transparent yellow overlay: computational domains.

For hydrological conditioning, the OpenStreetMap (OSM) dataset was used to condition the waterways. The river mouths of the Whanganui, Whangaehu and Turakina were opened using an estimated mean annual flood flow. We also carried out complementary manual hydraulic

conditioning of the lower part of the Ākitio, Manawatū, Aohanga, Ōhau-Levin, Rangitīkei, Turakina and Whanganui Rivers, placing the riverbed below the free surface at a depth determined using the cross-section data where available. Figure 2-6 presents an example of a DEM created using LiDAR data, DSM and hydrological conditioning.

The roughness coefficient was estimated from LiDAR where available using the mean elevation of the non-noise LiDAR returns above the ground and the standard deviation of the LiDAR point cloud. Where LiDAR was not available, a default Zo=0.004 value was used (see Figure 2-7).

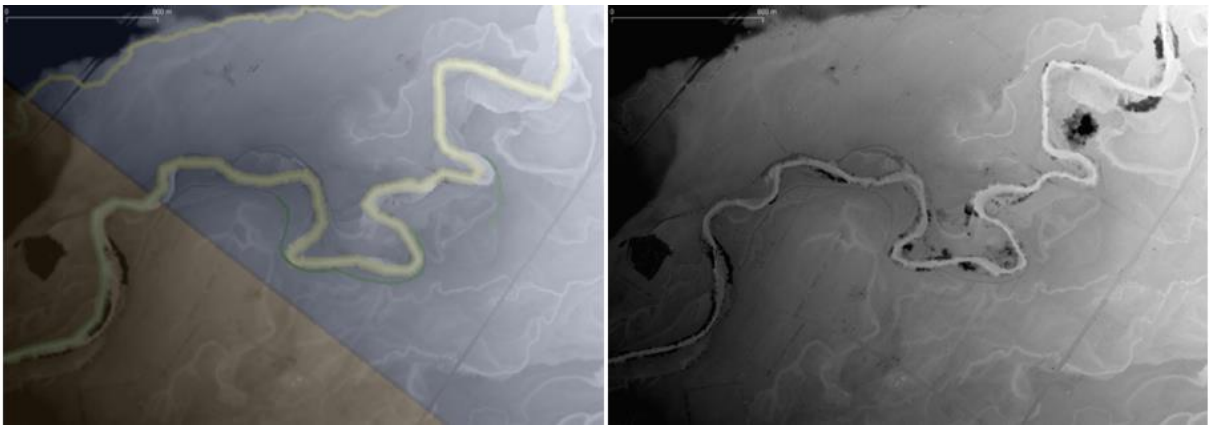


Figure 2-6: Surface elevation along the Mangatainoka River, upstream of Mangamaire, at intersection of SH2 with Pukewahi road (Upper Manawatū Domain). Left: DEM at 8 m resolution used for this study with blue: LiDAR data, orange: DSM data, yellow: river conditioning: green: stopbank enforcement. Right: DSM data at 1 m resolution: dark patch corresponds to vegetation and behave as flow obstacles. Colour bar ranges from 160 m (white) to 180 m (black).

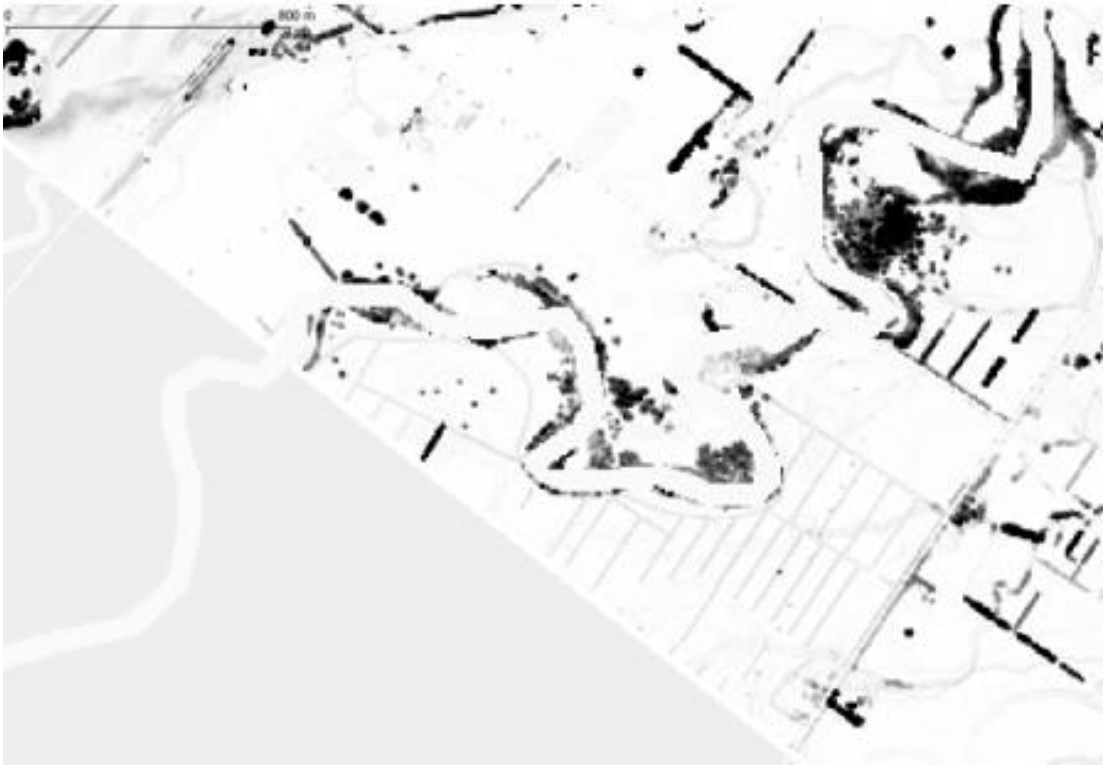


Figure 2-7: Roughness length map in the Upper Manawatū Domain, on Mangatainoka River, upstream of Mangamaire, at intersection of SH2 with Pukewahi road. Left bottom corner: default value where no LiDAR is

available; top right side: roughness extracted from LiDAR. Default value is implemented on rivers and water ways. Colour bar ranges from 1E-5 m (white) to 0.2 m (black).

Two sets of DEMs were created, one for the stopbank-up scenarios (where the stopbanks are included as they currently exist), and one for the stopbanks-down scenarios (where the stopbanks are removed to model residual risk) (see Figure 2-8). To identify the stopbanks, three datasets were combined and clipped to avoid overlaps: New Zealand Inventory of Stopbanks (NZIS), the Horizons stopbank dataset with no elevation (i.e., stopbank location only) and the Horizons Palmerston dataset with elevation (i.e., stopbank location and crest elevation). Precedence was given to the Horizons Palmerston dataset with elevation where it existed. The Horizons stopbank dataset with no elevation was given the second highest level of precedence. We included the features labelled Stopbank, Flood Walls, Detention Embankment, Flow Diversion Structure, Portable Flood Barrier, Guidebank, Property Mitigation Bund in the provided "RiverManagementAssetPolylineExport.shp" file. The NZIS dataset was included in areas where it included stop banks not otherwise represented in the other two datasets.
For the stopbanks-up DEMs, the stopbanks representation was enforced during the conditioning by locally modifying the DEMs at stopbank locations to correctly represent the crest heigh. Where crest heights were measured these were used directly; where no crest heights existed, the 1 m DEM of the area was generated blending the LiDAR data and the Horizons 1m DEM and used to identify the crest height.

For the stopbanks-down simulations, a separate set of DEM tiles were developed by removing the elevation data along each stopbank (as defined in the stopbank line files) and linearly interpolating to fill the gap. The combined stopbank line files were also used to control the generation of the computational grid for hydrodynamic modelling (see Section 2.5) These DEMs were created only for the domains where official stopbanks currently exist (see Table 2-1). The Ohakune Domain includes some small infrastructure but was not included in the list of domains that feature stopbanks as these were not considered flood protection but “detention embarkments” (in rural area) in Horizons Stopbanks database; only a stopbank up scenario was produced for this domain.

Figure 2-8: DEM for the upper bank of the Whanganui River mouth. Top panel: Aerial photo of the area with the location of the stopbanks highlighted as a red line; Middle panel: DEM with enforced stopbanks for the stopbanks-up configuration, Bottom panel: DEM with removed stopbanks for the stopbanks-down configuration.

2.3 Design Storms

Design storms were created for each catchment using NIWA's High Intensity Rainfall Design System - HIRDSv4[5] (Carey-Smith et al. 2018). This dataset gives gridded depth-duration-frequency (DDF) or intensity-duration-frequency (IDF) results across New Zealand for the current climate (based on observations).

For this study, an updated version of HIRDS was used based on research undertaken as part of the Mā te Haumaru ō te Wai Flood Resilience Endeavour programme. The main improvement is in the interpolation process that creates nationwide gridded estimates from gauge-specific extreme value parameters. Here, instead of elevation being used to guide the interpolation, as was done in HIRDSv4, the median annual maxima derived from NIWA's NZ Reanalysis project (NZRA) was used (Pirooz et al. 2023). NZRA is a full reanalysis weather model with a grid length of 1.5 km that is very close to completion. While still undergoing testing, the use of NZRA median annual maxima appears to provide more realistic estimates of rainfall depth than using topography alone, particularly in complex terrain.

To create the design storms, rainfall depths encompassing each catchment were extracted from HIRDS using the catchment boundary to delineate the size of the storm. To convert point rainfall depths (as provided by HIRDS) to areal depths, the catchment area was used to derive an areal

[5] See https://hirds.niwa.co.nz/

reduction factor. This reduction factor was applied to the total storm rainfall to account for the fact that rainfall extremes are calculated at point locations, but when larger areas are considered the storm intensity will be smaller than the point value for the same ARI. The total storm rainfall was then disaggregated to hourly resolution to emulate the typical temporal variation through the storm duration. Both the hyetographs used for temporal disaggregation and the areal reduction factors used follow the recommendations from Carey-Smith et al. (2018).

The effect of climate change on each design storm was included by incorporating two distinct changes. Firstly, the total rainfall volume was adjusted using temperature dependent multipliers derived from regional climate modelling performed over New Zealand. These factors, which are defined as the percentage increase in rainfall per degree of warming, vary as a function of both storm duration and storm return period – see Table 2-2, a reproduction of Table 6 in Carey-Smith et al. (2018). Secondly, the temporal shape of the storm was adjusted based on an analysis of how observed storm shapes change as a function of temperature. This research, which was done as part of the Mā te Haumaru ō te Wai Flood Resilience Endeavour programme, found that the most intense part of a rainstorm (in terms of time-period, relative to the total storm depth) becomes more intense with increasing temperature. In other words, the 'peakiness' of extreme rain events is expected to become peakier as the background temperature increases.

For each catchment, storms of multiple durations (6 hours through to 72 hours at six hourly increments) were modelled using the hydrological model (see details below) and the duration that gave the largest peak flow was used for inundation modelling (Duration values are presented in Table 2-1). For each flood domain, the same duration was used to define the 20-year, 50-year, 100-year and 200-year design rainstorm. Figure 2-9 shows an example 200-year design rainstorm of 54 hours duration for Whanganui.

Table 2-2: Percentage change factors to project rainfall depths derived from the current climate to a future climate that is 1 degree warmer. Reproduction of Table 6 in Carey-Smith et al. (2018).

DURATION/ARI	2 YR	5 YR	10 YR	20 YR	30 YR	40 YR	50 YR	60 YR	80 YR	100 YR
1 HOUR	12.2	12.8	13.1	13.3	13.4	13.4	13.5	13.5	13.6	13.6
2 HOURS	11.7	12.3	12.6	12.8	12.9	12.9	13.0	13.0	13.1	13.1
6 HOURS	9.8	10.5	10.8	11.1	11.2	11.3	11.3	11.4	11.4	11.5
12 HOURS	8.5	9.2	9.5	9.7	9.8	9.9	9.9	10.0	10.0	10.1
24 HOURS	7.2	7.8	8.1	8.2	8.3	8.4	8.4	8.5	8.5	8.6
48 HOURS	6.1	6.7	7.0	7.2	7.3	7.3	7.4	7.4	7.5	7.5
72 HOURS	5.5	6.2	6.5	6.6	6.7	6.8	6.8	6.9	6.9	6.9
96 HOURS	5.1	5.7	6.0	6.2	6.3	6.3	6.4	6.4	6.4	6.5
120 HOURS	4.8	5.4	5.7	5.8	5.9	6.0	6.0	6.0	6.1	6.1

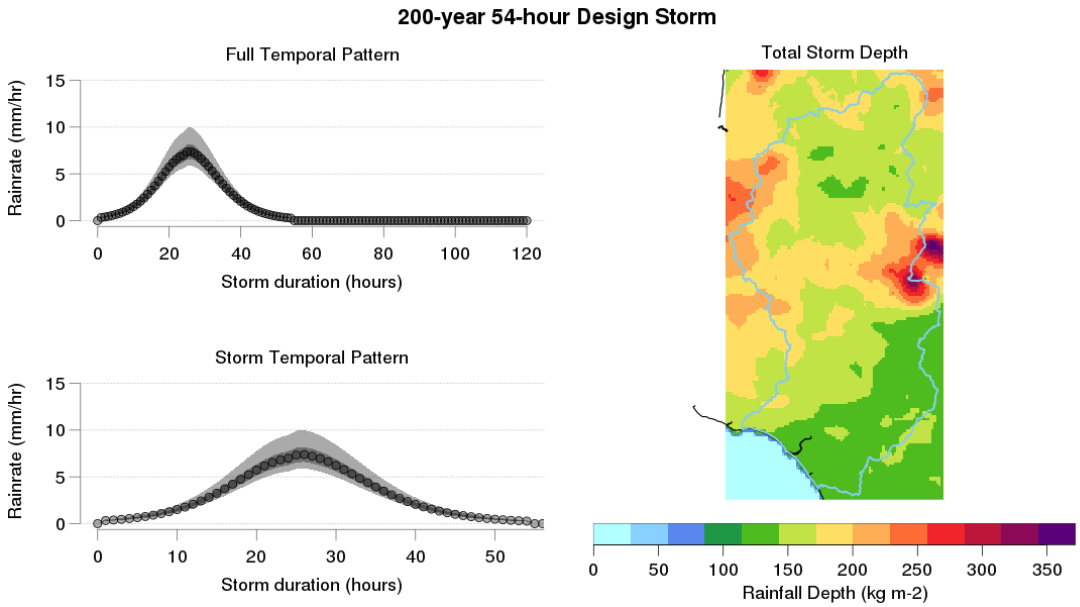


Figure 2-9: Sample design storm for 200-year ARI and 54-hour duration event in the Whanganui catchment. The left-hand-side shows the temporal rainfall pattern (grey shows the variation over the catchment) and the right-hand-side shows the spatial pattern of the total rainfall depth.

2.4 Hydrological modelling

The flood flows were modelled over the entire Manawatū-Whanganui region using the sub-catchment based hydrological model, TopNet (Clark et al. 2008; McMillan et al. 2016). The model combines a water balance model within each catchment with a kinematic wave routing algorithm through the river network (REC2.5). The Ki version of TopNet was used for this study, research suggests this version captures flood flows better than other uncalibrated model versions. Note that as TopNet is based on a network of sub-catchments (represented by the red lines in Figure 2-3), the results assume that all the water stays in the river channel and follows the path of the river network, so it does not capture out-of-banks flow or flow paths on floodplains that break the standard river network. Antecedent conditions at the start of the simulation were chosen as average flows. These flows were generated by forcing TopNet using 20 years of historical VCSN (Virtual Climate Station Network) data, a daily rainfall interpolation of observed data on a 0.1 degrees regular grid. The results from this were used to calculated percentile flow values at each outflow river reach (i.e., the reaches where the river flows into the sea). The 50th percentile flow for the main river reach for each domain was identified and the day that this occurred was used as the hot start for the hydrological simulation. This ensures that the entire catchment has physically realistic starting states. TopNet was then forced with the design storm rainfall, which produced hydrographs for each sub-catchment over the event. These hydrographs were outputted at the previously identified injection points (see Figure 2-3) and, together with tidal information and rainfall over the floodplain domains, were used to force the flood inundation models.

2.5 Hydrodynamic modelling

Hydrodynamic modelling was carried out using the BG-Flood software (Bosserelle et al. 2021). BG-Flood is an open-source 2D numerical solver of the Shallow Water Equations for modelling hydrodynamic systems. The source code, test cases and details regarding the evolution of the solver are available on the dedicated GitHub platform (https://github.com/CyprienBosserelle/BG_Flood). The solver can be applied to a variety of physical processes ranging from river hydrodynamics and floods modelling to storm surges and tsunami modelling.

The solver is optimised to work on GPU devices to exploit their inherent parallel computing capabilities and fast computing resources. BG-Flood uses an adaptative mesh generation method based on a block-uniform quadtree system, allowing cost-effective management of the computational time by locally adjusting the mesh size in prescribed locations to meet the level of refinement specified by the user. It is designed to run on UNIX based systems especially supercomputers such as New Zealand eScience Infrastructure (NeSI) but can also be used on Windows machines possessing a NVIDIA GPU.

To solve freshwater flood inundation, BG-Flood requires a DEM that represents the topography of the floodplain and a roughness map to represent land cover. For this work roughness was expressed in terms of the roughness length Zo to be used in a suitable logarithmic formulation of bottom friction (Smart et al. 2004). This is an alternative to the more commonly used Manning equation. We prefer the above logarithmic law as it more accurately captures the dependence of the friction slope on the water depth across the entire range of flow depths.

The model is built within the boundaries of the inundation domain and applies a spatially and temporally varying rainfall design storm discussed in Section 2.3. It is also forced by a time-varying hydrograph at each flow injection point (see Figure 2-3), computed through hydrological modelling as discussed in Section 2.4. The ocean boundary of the domain is forced by the local time-varying sea level corresponding to a mean high water springs tide (MHWS), phased with the peak of the flood at the largest river mouth of the domain. For each coastal domain, a point offshore from the domain was selected and a MHWS tidal cycle was extracted at this point from the NIWA tidal model[6]. Thus, appropriate values for MHWS were used for each different domain. See Table 2-1 for MHWS amplitudes used for specific domains.

The grid resolution is a critical parameter for the simulation that drives both the results numerical accuracy and the simulation time. While rapid estimates of the hydrodynamics within the floodplains can be obtained on a coarse grid, such results possess a high level of numerical errors introduced by the rough interpolation of the topography, staircasing of boundaries, and numerical discretisation errors. On a fine grid, the numerical errors are significantly reduced at the expense of increased computational time. An appropriate compromise between accuracy and computational time must be found. The solution to this is to refine the domain only around the boundaries of permanent flow paths (i.e., critically, around the stopbanks) and in general where flooding is expected while leaving the rest of the domain at a coarser resolution for the sake of computational speed. Critically, BG-Flood can operate with grids that feature local refinements at locations of interest.

To achieve this, first, a coarse resolution model with a uniform grid spacing is calculated over the entire domain, for fluvial flooding. The results from this coarse modelling are then used to develop targeted grid refinement in locations of interest using the adaptative mesh method implemented in

[6] https://tides.niwa.co.nz/

BG-Flood. Other information such as the locations of stopbanks and river and streams (both generated in Section 2.2) are also used to identify where high-resolution modelling is needed. Figure 2-10 shows an example of a refinement grid developed for the Manawatū domain. This grid is used to set the resolution of the adaptive grid used in the higher resolution modelling. The high-resolution target will be imposed, then the resolution will transition progressively to lower resolutions (or other levels imposed on the map). The map presenting a "minimum" resolution of the final model.

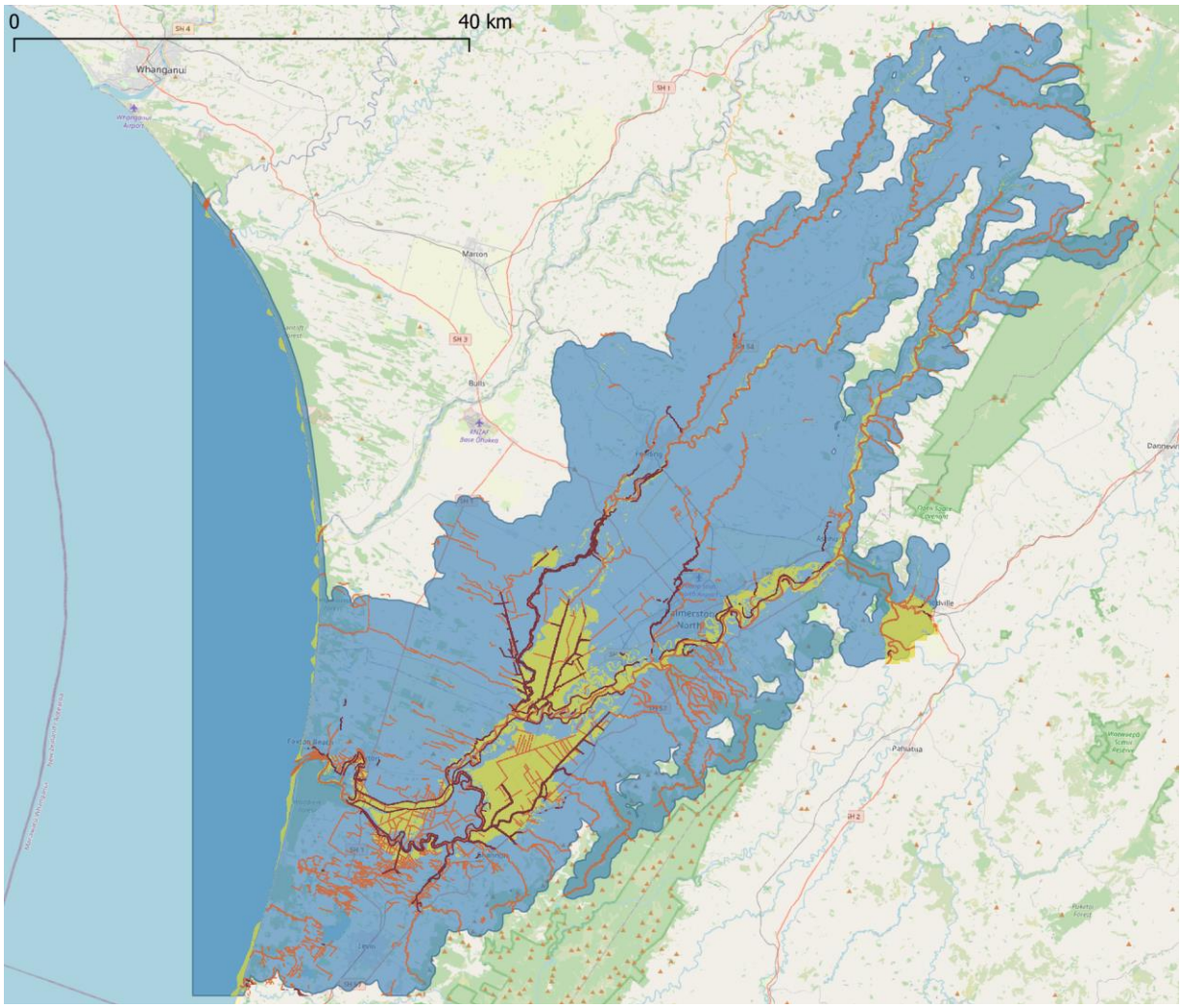


Figure 2-10: Target refinement map generated for the Manawatū domain, 200-year ARI, current conditions. Red, orange and yellow correspond to an 8 m resolution target due to stopbank, rivers and streams or expected flooded area respectively. Blue area: minimum resolution of 64 m.

Finally, the BG-Flood model produces time-varying maps of water elevation, velocity and water depth, as well as specific risk assessment variables such as the product of water depth and velocity. The chosen time resolution was one hour. The maximum water depth, mean water depth rising rate up to a depth 1.2 m, and the maximum value of the product of depth and velocity at each location throughout the simulation are then extracted and projected on an 8 m grid for use in the risk assessment model.

2.6 Climate change methodology

Climate change scenarios were modelled for the 200-year design storm inundation for +1˚C, +2˚C, +3˚C above current climate (which correspond to +2˚C, +3˚C, +4˚C above the pre-industrial climate, respectively). For coastal locations, we also modelled the 200-year +3˚C design storm scenario with sea level rise (SLR) as a sensitivity test to see how much this affected the inland flooding results.

Climate change flood inundation scenarios were not modelled for design storms with lower ARIs. Instead, we provide indicative mappings between these lower ARIs with climate change and the higher ARIs (including the 200-year climate change scenarios) in Table 2-3. These mappings were calculated using three proxies, namely (i) by comparing the change in the peak flow of the largest river within the domain at the outflow to the sea; (ii) by comparing the change in the maximum rainfall in the design storm; and (iii) by comparing the total rainfall in the design storm. The ranges given in Table 2-3 represent the spread of the three methods. For climate change scenarios that map onto ARIs larger than a 200-year event, the mapping gives the 200-year ARI plus warming equivalent.

Figure 2-Figure 2-11 shows the example for the Whanganui catchment. Based on the three proxies (peak flow, maximum rainfall and total rainfall) curves are developed for the different ARIs under warming conditions. Using the peak flow as a proxy, the 20-year event with one degree of additional warming maps on to a 134-year event; using maximum rainfall, the 20-year event maps onto a 200-year event with 0.1˚C additional warming; and using total rainfall, it maps onto a 150-year event. Thus, the range given in Table 2-3 is from a 134-year event to a 200-year event with 0.1˚C additional warming.

These climate change models based on temperature increases can be correlated to a given Shared Socio-Economic Pathway (SSP) scenario and time-period as required. For example, for the map of the 200-year event with +1˚C and for the SSP3-7.0 scenario, this scenario is projected to reach 2˚C above the pre-industrial climate around 2045 and so that is when that map would be valid as the 200-year event. Conversely, if one wanted the 200-year event for SSP5-8.5 for the end of the century, the average expected temperature increase is 3.1˚C above current climate and so the 200-year +3˚C map would be the appropriate one to use.

To evaluate the impact of sea level rise on flood maps for the climate change scenarios, a complementary 200-year, +3 ˚C above sea level was run in the stopbanks-up and stopbanks-down configuration, by adding a 1.5m of sea level on top of the MHWS for the on the Pacific side (East Coast on Table 2-1) and a 1.1m of sea level rise on top of the MHWS for the Tasman Sea catchments (West Coast on Table 2-1). These values were selected by considering the global sea level rise associated with SSP scenarios for four degrees above pre-industrial levels as well as the expected ground deformation. Because this was a sensitivity test on how the sea level rise affects freshwater flooding, we used the largest relative sea level rise (i.e., including both global sea level rise and vertical land movement) expected for each of the two Horizons coasts.

The method used to calculate the sea level rise increments used was based on global temperature increases for different SSP scenarios taken from Figure SPM.8 in (IPCC 2021). Under SSP3-7.0, three additional degrees of warming is expected to be reached around 2105 with a commensurate sea level rise of 0.92 m. Under SSP5-8.5 it is expected to be reached in 2080 with a commensurate sea level rise of 0.55 m. Vertical land movement estimates were taken from NZSearise[7]. On the East Coast of the Horizons region all coastal regions are sinking, with the fastest rate of movement being -

[7] https://www.searise.nz/

7.2 mm/year. This gives an extra 57.6 cm between now and 2105. Adding these together gives a maximum relative sea level rise of 1.5 m for three degrees of additional warming on the east coast of Horizons Region. For the west coast of the Horizons Region the coastal areas are neutral to sinking with a maximum rate of movement being -2.5 mm/year. This is equivalent to an extra 20 cm between now and 2105. So, for the west coast catchments we used a relative sea level rise of 1.1 m.

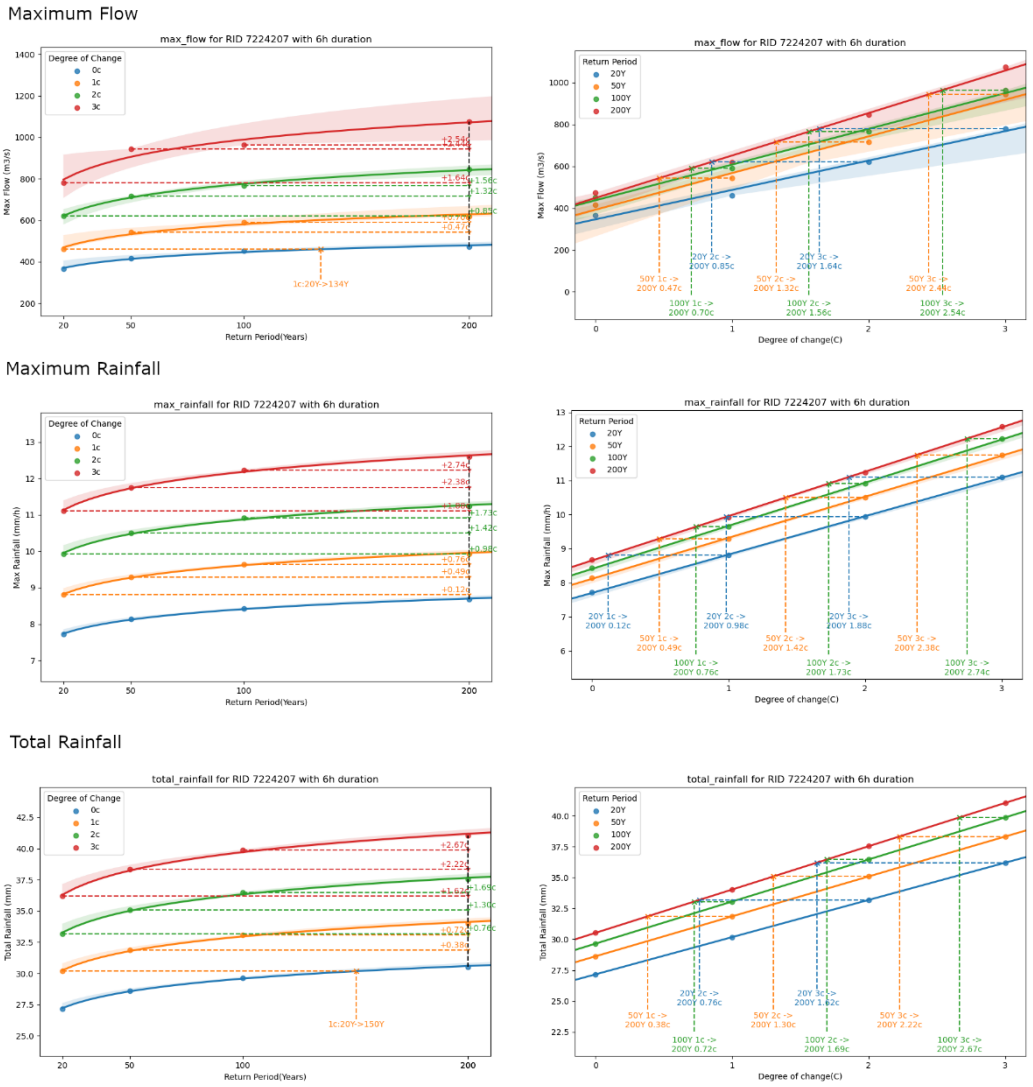


Figure 2-11: Example mapping for lower ARI events under climate change. These are the mapping for the Whanganui catchment. The top row uses maximum flow as the proxy; the middle row, maximum rainfall; and the bottom row, total rainfall. The left-hand column maps the lower ARIs plus warming to higher ARIs. Where the higher ARI is greater than a 200-year rainfall event the right-hand column maps to 200-year plus warming events.

Table 2-3: Increases in apparent ARI due to climate change. The mapping for 20-year, 50-year and 100-year rainfall events under climate change warming to equivalent higher ARIs and 200-year events plus climate change were calculated by three metrics and this table gives the range.

Location	ARI	+1˚C	+2˚C	+3˚C
Ākitio	20-year	33-year to 39-year	58-year to 78-year	84-year to 161-year
	50-year	81-year to 110-year	177-year to 200-year+0.2˚C	200-year+0.6˚C to 200-year+1˚C
	100-year	200-year to 200-year+0.2˚C	200-year+0.8˚C to 200-year+1.1˚C	200-year+1.6˚C to 200-year+2˚C
Ōhau-Levin	20-year	41-year to 49-year	83-year to 125-year	169-year to 200-year
	50-year	114-year to 141-year	200-year+0.3˚C to 200-year+0.6˚C	200-year+1.1˚C to 200-year+1.5˚C
	100-year	200-year+0.2˚C to 200-year+0.4˚C	200-year+1.1˚C to 200-year+1.3˚C	200-year+2.1˚C to 200-year+2.3˚C
Whanganui	20-year	134-year to 200-year+0.1˚C	200-year+0.8˚C to 200-year+1˚C	200-year+1.6˚C to 200-year+1.9˚C
	50-year	200-year+-.4˚C to 200-year+0.5˚C	200-year+1.3˚C to 200-year+1.4˚C	200-year+2.2˚C to 200-year+2.4˚C
	100-year	200-year+0.7˚C to 200-year+0.8˚C	200-year+1.6˚C to 200-year+1.7˚C	200-year+2.5˚C to 200-year+2.7˚C
Upper Manawatū	20-year	38-year to 50-year	78-year to 130-year	177-year to 200-year+0.5˚C
	50-year	98-year to 145-year	200-year+0.3˚C to 200-year+0.6˚C	200-year+1˚C to 200-year+1.5˚C
	100-year	200-year+0.2˚C to 200-year+0.4˚C	200-year+1˚C to 200-year+1.3˚C	200-year+2.1˚C to 200-year+2.3˚C
Taumarunui	20-year	47-year to 58-year	108-year to 176-year	200-year+0.2˚C to 200-year+0.7˚C
	50-year	131-year to 168-year	200-year+0.5˚C to 200-year+0.8˚C	200-year+1.3˚C to 200-year+1.6˚C
	100-year	200-year+0.3˚C to 200-year+0.5˚C	200-year+1.3˚C to 200-year+1.4˚C	200-year+2.2˚C to 200-year+2.4˚C
Manawatū	20-year	51-year to 65-year	130-year to 200-year+0.1˚C	200-year+0.4˚C to 200-year+0.9˚C
	50-year	147-year to 193-year	200-year+0.6˚C to 200-year+0.9˚C	200-year+1.4˚C to 200-year+1.8˚C
	100-year	200-year+0.4˚C to 200-year+0.5˚C	200-year+1.2˚C to 200-year+1.5˚C	200-year+2.2˚C to 200-year+2.4˚C
Whangamōmona	20-year	34-year to 39-year	57-year to 77-year	95-year to 154-year
	50-year	90-year to 105-year	166-year to 200-year+0.2˚C	200-year+0.5˚C to 200-year+1˚C
	100-year	199-year to 200-year+0.2˚C	200-year+0.9˚C to 200-year+1.1˚C	200-year+1.7˚C to 200-year+2˚C
Wainui-Herbertville	20-year	33-year to 38-year	55-year to 73-year	90-year to 143-year
	50-year	91-year to 106-year	166-year to 200-year+0.3˚C	200-year+0.5˚C to 200-year+1˚C

Location	ARI	+1˚C	+2˚C	+3˚C
	100-year	200-year to 200-year+0.2˚C	200-year+0.9˚C to 200-year+1.1˚C	200-year+1.8˚C to 200-year+1˚C
Ohakune	20-year	36-year to 42-year	63-year to 87-year	110-year to 188-year
	50-year	96-year to 115-year	187-year to 200-year+0.3˚C	200-year+0.6˚C to 200-year+1.1˚C
	100-year	200-year to 200-year+0.2˚C	200-year+1˚C to 200-year+1.1˚C	200-year+1.9˚C to 200-year+2.1˚C
Turakina	20-year	36-year to 46-year	73-year to 106-year	139-year to 200-year+0.2˚C
	50-year	104-year to 134-year	200-year+0.1˚C to 200-year+0.4˚C	200-year+0.9˚C to 200-year+1.3˚C
	100-year	200-year+0.1˚C to 200-year+0.4˚C	200-year+1˚C to 200-year+1.2˚C	200-year+1.9˚C to 200-year+2.2˚C
Aohanga	20-year	32-year to 40-year	60-year to 82-year	103-year to 172-year
	50-year	96-year to 113-year	184-year to 200-year+0.3˚C	200-year+0.7˚C to 200-year+1.1˚C
	100-year	200-year+0.1˚C to 200-year+0.3˚C	200-year+1˚C to 200-year+1.2˚C	200-year+1.7˚C to 200-year+2.1˚C
Rangitīkei	20-year	41-year to 48-year	81-year to 121-year	163-year to 200-year+0.4˚C
	50-year	112-year to 137-year	200-year+0.2˚C to 200-year+0.6˚C	200-year+1˚C to 200-year+1.4˚C
	100-year	200-year+0.2˚C to 200-year+0.4˚C	200-year+1.1˚C to 200-year+1.3˚C	200-year+1.9˚C to 200-year+2.2˚C

2.6.1 Use of HIRDS v4 (Climate Change temperature increments) with SSP/RCP scenarios

Climate change is accounted for in HIRDS v4 (Carey-Smith et al. 2018) in terms of temperature increments. Often future climate change projections are given in terms of the Shared Socio-economic Pathway (SSP) or the Representative Concentration Pathway (RCP) (IPCC 2021). The SSP or RCP is a projection of the future that accounts for increases in atmospheric CO_2. These pathways chart how atmospheric CO_2 levels are expected to change over time and using Earth Systems Models (ESM), the changes in global temperature based on the atmospheric CO_2 are also mapped. Variation in the different ESM models lead to variations in the temperature projections meaning that for each future time and SSP or RCP scenario there will be a range of possible temperature increases. Figure 2-12 shows the projected temperature increases based on different SSP scenarios (reproduced from IPCC 2021).

There are two ways that that the modelling can be connected to the SSP/RCP scenarios depending on whether you are starting from the modelling with a given temperature increment or whether you are starting from a future scenario.

Current climate is already around 1˚C above preindustrial. If you are starting from the modelling, and are interested in when a simulation for a given temperature increment and AEP is valid (e.g., 0.5% AEP +1˚C), the +1˚C scenario is equivalent to 2˚C above pre-industrial which could be reached between approximately 2040 to 2060 (earlier for SSP5-8.5, later for SSP3-7.0, later still for SSP2-4.5 and this level of warming may not be reached in scenarios SSP1-2.6 and SSP1-1.9). So, the 0.5% AEP +1˚C simulation represents the 0.5% AEP expected around that

timeframe. Likewise, the earliest the +2˚C simulations are likely to be valid for is around 2060, but if we are on SSP2-4.5 it may not be reached until after 2100.

The other way this information can be used is for a given SSP and timeframe. Say for 2100 for SSP3-7.0, Figure 2-12 shows that the expected temperature increase is +3˚C. The shaded colour shows that the "most likely" range for the temperature increase is from +2˚C to +4˚C above current climate.

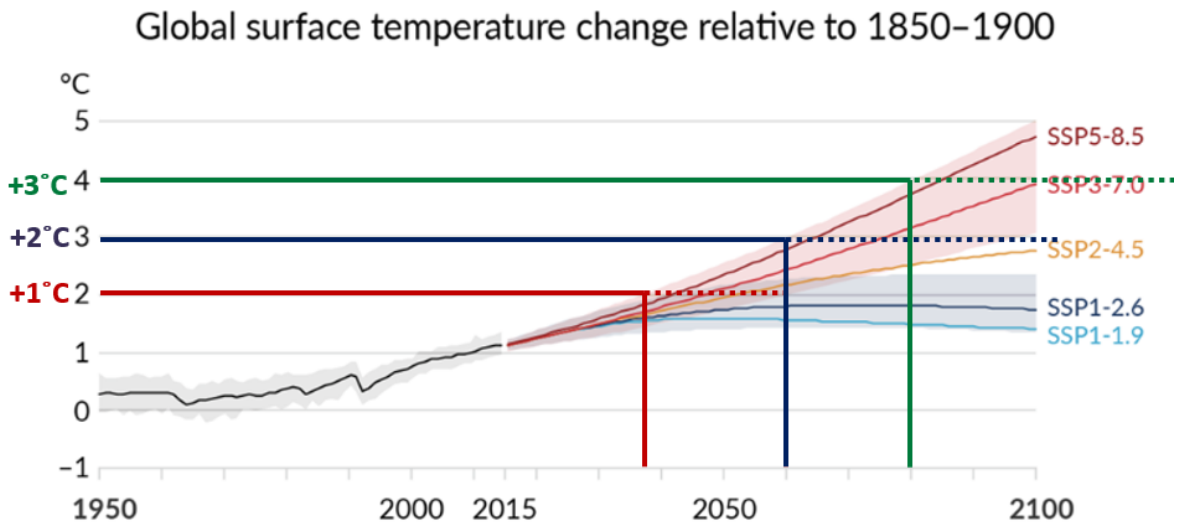


Figure 2-12: Global surface temperature changes 1950-2100 as a difference to the 1850-1900 period for different SSP scenarios. Shaded colours represent the "very likely" range for scenarios SSP3-7.0 (red) and SSP1-2.6 (blue/grey). The current epoch is around 1C above 1850-1900 (pre-industrial period) so the red, navy and green thick lines show when +1˚C, +2˚C, +3˚C above current climate could occur. Underlying figure is Figure SPM.8 panel (a) from the IPCC 6th Assessment Report WGI Summary for Policy Makers.

3 Results

The modelling was undertaken on the high-performance computing facility of NeSI (the New Zealand eScience Infrastructure), on A100 GPUs with runtime durations between 5h to 20h, depending on the domain size and physical duration of the modelled event. Several hundred to fifteen hundred rivers and streams were injected into the flood inundation domains depending on the complexity and size of the domain.

3.1 List of scenarios

3.1.1 Hydrological models

The hydrological model TopNet was used as a step in the generation of inundation maps. It was also used to determine the time of concentration of each catchment (i.e., the duration of the storm that produces the largest discharge) and to generate a mapping of a wide range of climate change scenarios to the scenarios for which the inundation maps were generated (see Section 2.6). This method is used for larger exploration of the parameters as the hydrological model and design storm generator are less computationally demanding. For the 12 domains presented in Section 2.1, we simulated the 20-, 50-, 100- and 200-year ARI design storm events for all durations from 6h to 72h with a 6h increment and for actual climate conditions, +1˚, +2˚, +3˚ Celsius above current climate conditions, which results in 2,112 models.

3.1.2 Inundation models

The full workflow presented in Section 1 was used to produce a set of flood maps. For the 12 domains presented in Section 2.1, we simulated a 20-, 50-, 100-, 200-year ARI design storm event for actual climate conditions. We also simulated a 200-year ARI design storm event for +1˚, +2˚, +3˚ Celsius above actual climate conditions. For all these design storms scenarios, we model the inundation with the actual stopbanks, but also a stopbanks-down configuration (see Section 2.2). Even though the effect of sea level rise is out of the scope for this study, we simulated scenarios for all the coastal domains for the 200-year ARI rain storm with +3˚ Celsius above current climate conditions, with a realistic to large sea level rise (see Section 2.6). This aims to evaluate the maximum inland influence of sea level rise for climate change scenarios. This represents 146 inundation models. See Figure 3-1 for an overview of the flood maps.

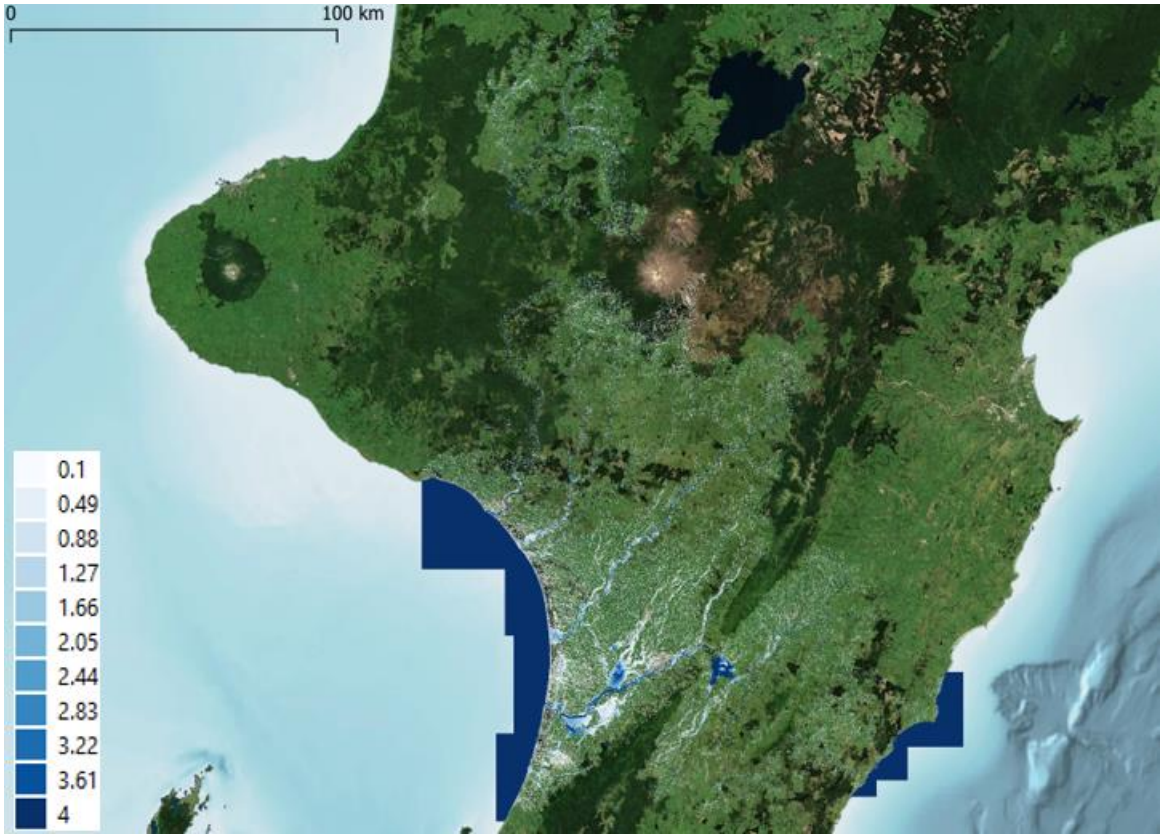


Figure 3-1: Overview of the flood maps. Maximum water depth for the 200-year ARI scenario, current climate conditions for all the computational domains.

For the Manawatū domain (lower Manawatū), the maximum discharge in the Manawatū Gorge was initially around 3400 m^3s^{-1}, lower than what was observed in the Upper Manawatū domain, where 3900 m^3s^{-1} was observed. During the generation of the design storm for each domain, a reduction factor is applied, function of the area of the catchment. For the Manawatū domain, the full area of the Manawatū catchment is used, producing a larger reduction factor than for the Upper_Manawatū domian, where only the area above the gorge is considered. Which then explain a lower storm intensity in the Manawatū domain and lower discharge through the Manawatū gorge in this domain. The Manawatū domain model has been modified to increase the river injections above the Manawatū Gorge to reach a similar discharge of 3900 m^3s^{-1} as observed in the Upper Manawatū model and similar to the value calculated in the flood statistical analysis associated to this study (see Singh, 2025).

3.2 Water depth maps

During the simulation, different 2D variables are saved in a NetCDF file at regular time steps of one hour. Some variables such as the water elevation above NZVD2016 (m); the water depth (m); the velocity vector (m s^{-1}) are exported as snapshots at these output times; other variables are computed as the maximum values between the beginning of the simulation and the current output step. To the latter category belong the maximum of water elevation above NZVD2016 (m); the maximum of water depth(m); and the maximum of water depth times velocity(m^2s^{-1}). For conciseness and as needed for the risk assessment, maximum values at the end of the simulations have been extracted, especially for maximum water depth, maximum water depth times velocity and maximum water elevation. Using the time evolution of the water depth every hour, we also extracted the rising rate for each

grid cell for the first 1.2 m of inundation. The different flood maps generated are listed in Appendix A.

Figure 3-2 shows sample results of the flood extents for difference scenarios for the lower Rangitīkei domain and Figure 3-3 shows a zoom-in around the Ohakea-Bulls area.

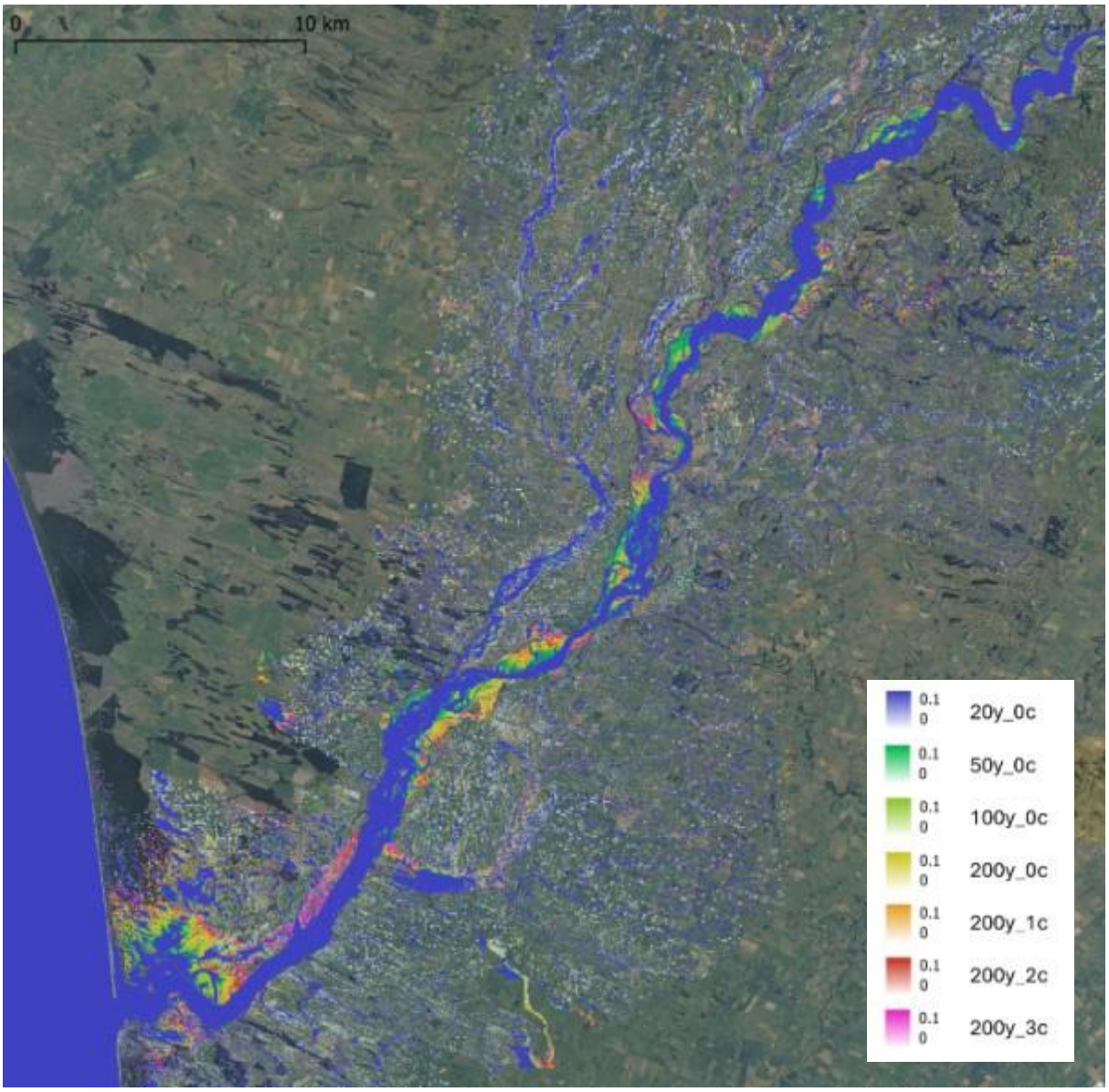


Figure 3-2: Flood extent for the design storm scenario for the lower Rangitīkei domain. Areas are considered as flooded if the local value of the maximum water depth exceeds 0.1 m. Each colour represents a scenario from 20-year ARI for current climate conditions in blue, through 200-year ARI for current climate conditions in yellow to 200-year ARI +3˚C climate change conditions in purple. The figure refers to the stopbanks-up configuration.

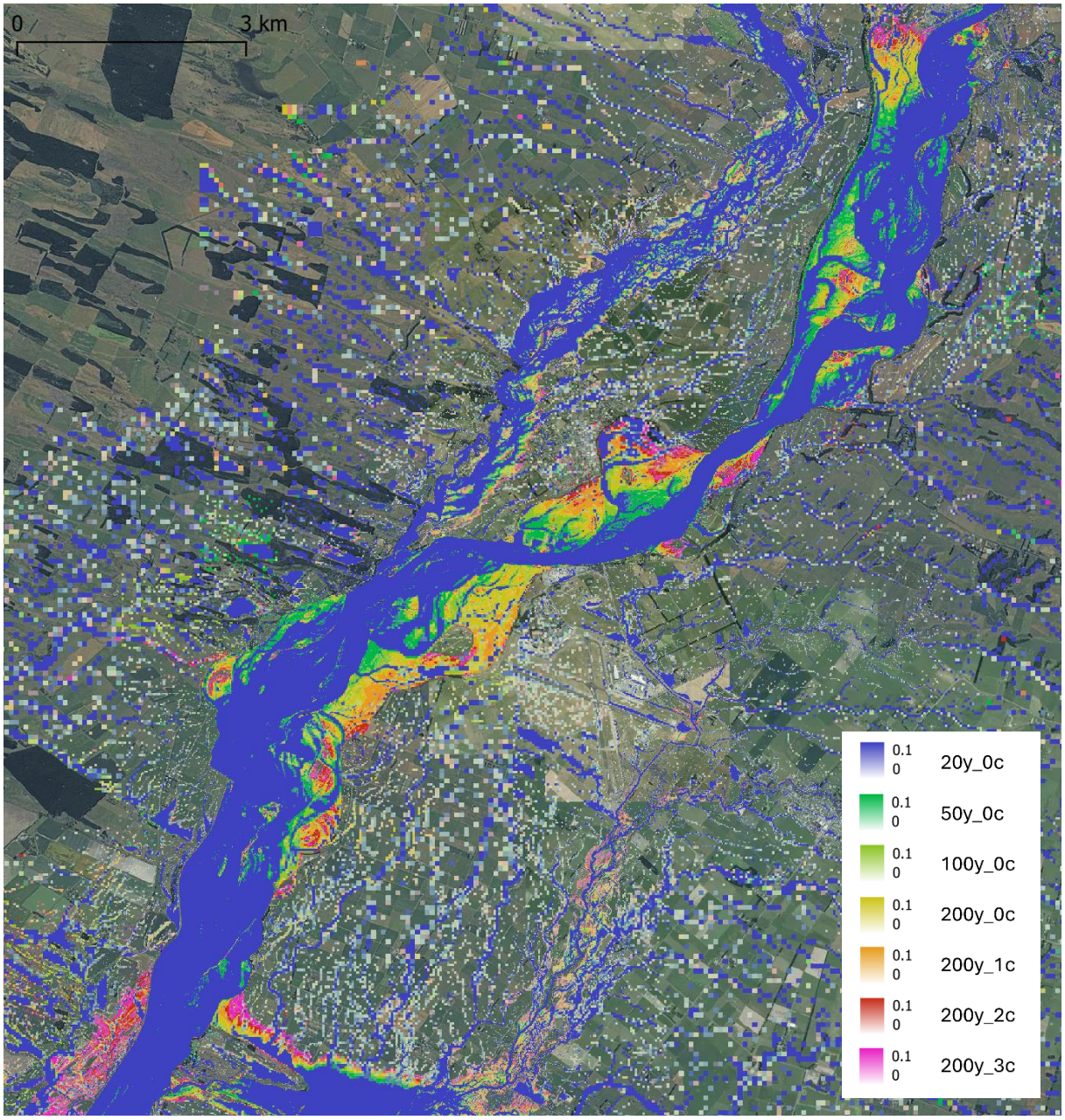


Figure 3-3: Flood extent for the design storm scenarios for the lower Rangitīkei domain, zoomed into the Ohakea-Bulls area. Areas are considered as flooded if the local value of the maximum water depth exceeds 0.1 m. Each colour represents a scenario from 20-year ARI for current climate conditions in blue, through 200-year ARI for current climate conditions in yellow to 200-year ARI +3˚C climate change conditions in purple. The figure refers to the stopbanks-up configuration.

3.3 Contrasting the stopbanks-up and stopbank-down scenarios

As explained in Section 3.1.1, for each design storm scenario, we modelled the flood with and without stopbanks. The method used to remove the stopbanks is to use the stopbanks database and remove all the elevation along these lines (see Section 2.2 for more details). We are then removing all the stopbanks at the same time. This can inform on residual risk but may likely underestimate flooding resulting from a stopbank breach. Figure 3-4 is an example of the results obtained for the Rangitīkei catchment, for different ARI and climate change scenarios.

Figure 3-4: Flood extent with stopbank and without stopbanks for the lower Rangitīkei area. Left: 20-year ARI in current climate conditions with (blue) and without stopbanks (white). Centre: adding to the left map a 200-year ARI in current climate conditions with (yellow) and without stopbanks (white). Right: adding to the centre map a 200-year ARI + 3˚C of climate change warming with (purple) and without (white) stopbanks.

3.4 Sea level rise (SLR) influence

In order to evaluate the influence of sea level rise on the results, we also considered sea level rise for the most extreme scenario explored (see Section 2.6). For all the domains, the influence of the sea level rise is concentrated in the coastal area. For the East Coast catchments, with a 1.5 m increase of SLR, most of the effect was confined to a 250 m-wide band along the coastline, and to small streams up to 2 km inland (see Figure 3-5). For the West Coast catchments, a 1.1 m increase of sea level rise resulted in a slightly larger extent of the flood on the coast and in main river mouths. We observed an increased flooding by back water effect in the Manawatū River mouth up to 5 km inland (see Figure 3-6) and up to 10 km inland on the Whanganui River. Finally, the influence of sea level rise on these 200-year ARI design rainstorm flood is very limited in the coastal area (in the first hundreds to thousands of metres from the shoreline) and the flooding is largely resulting from fresh water, fluvial and pluvial flooding.

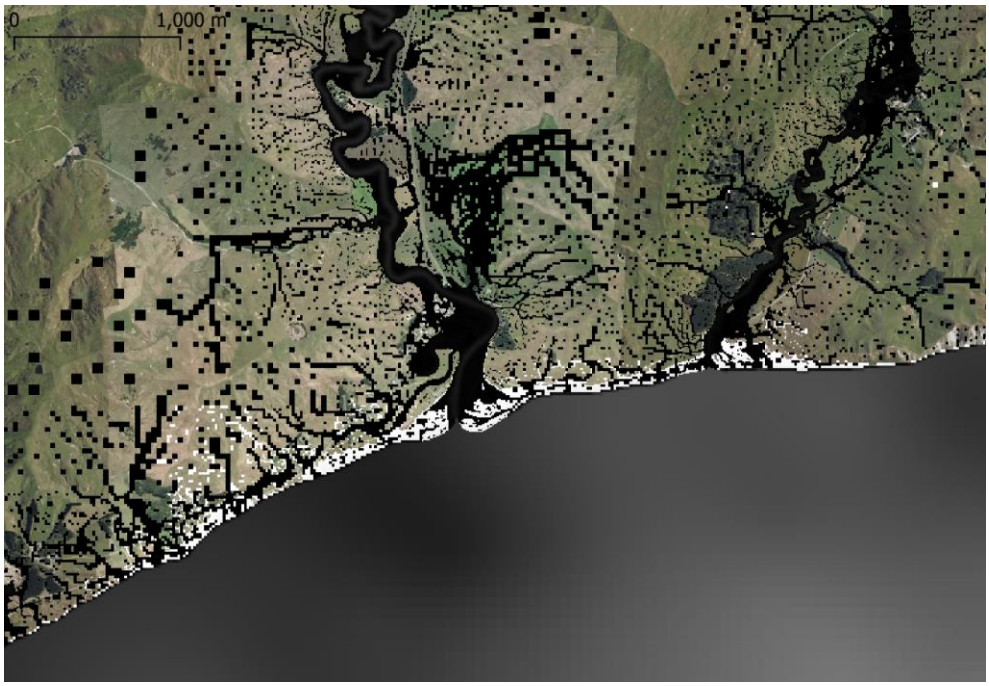


Figure 3-5: Inundation extend with (white) and without (black) sea level rise for the 200-year +3˚C scenario. Herbertville, Wainui-Herbertville domain.

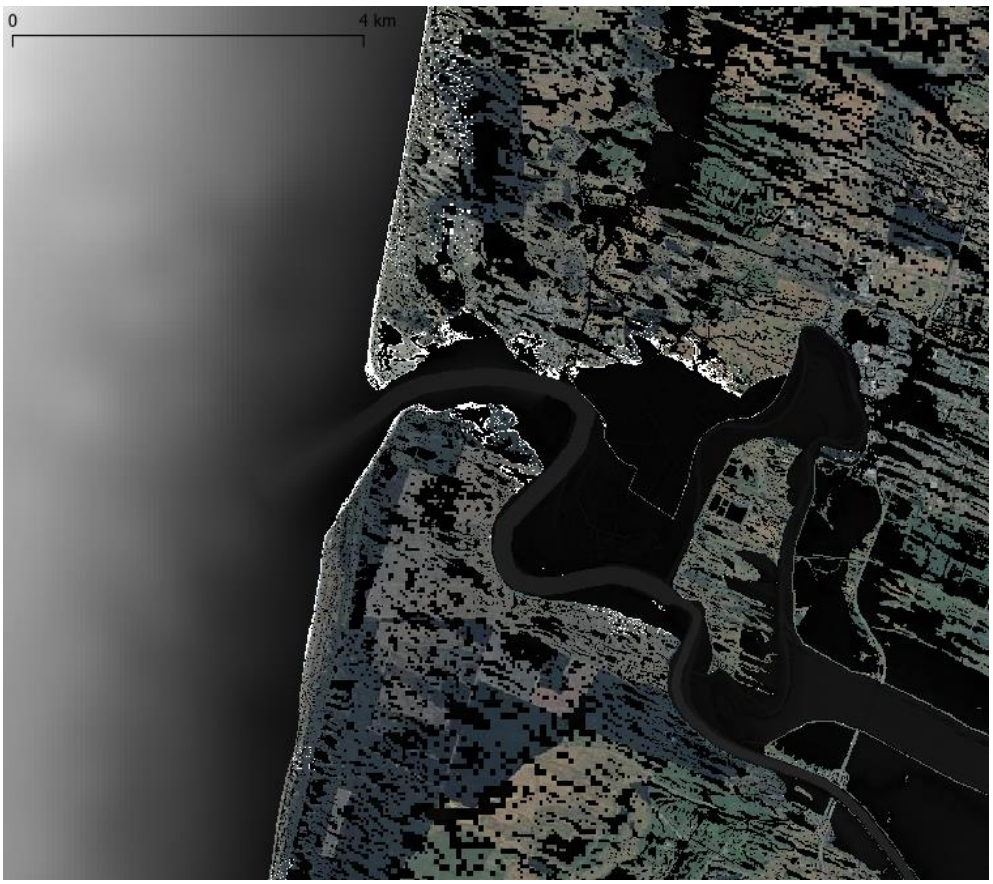


Figure 3-6: Inundation extend with (white) and without (black) sea level rise for the 200-year +3˚C scenario. Manawatū river mouth.

3.5 Limitations

3.5.1 LiDAR data coverage

The availability of LiDAR data is often the first limitation in the type of modelling of this report, especially due to the requirements of a full 2D approach (compared with a 1D or combined 1D-2D methods). The modelling approach used here was developed for the national flood assessment project and initially limited to areas where recent LiDAR was accessible. To increase the coverage, some DEM and DSM data were also used for this regional mapping, creating issues with the vertical projection.

Furthermore, unlike DEMs, DSMs do not represent the ground elevation but the surface elevation. For instance, this implies that DSMs represent treetop elevation instead of ground elevation in areas covered by vegetation. This can create unrealistic obstacles to flow paths. The hydrological conditioning of the DEM and the opening of streams and rivers can remove some obstacles to river flows like overhanging trees, but some unrealistic flow constrictions can persist. As no correction is applied to land DSM, overland flow paths can be affected.

The limitation of the LiDAR coverage and use of complementary input information also impact the definition of the roughness layer. The roughness length, related to the roughness of the ground or

ground cover which affects the speed of water flow, can be related to the above-ground LiDAR point cloud. Other methods relying on national or regional database of land-cover have been tested but do not give the granularity of roughness changes that can be achieved with LiDAR. LiDAR data is then key to the methodology. Therefore, in this work we have chosen the simple approach of assigning a default roughness length where no LiDAR data was available.

3.5.2 Stopbank information

Stopbank information is critical for inundation modelling of area around flood protection infrastructures. Precise locations (and extents) are important to enforce the locations and crest heights of these structures, especially around small streams where the approximate stopbanks position might overlap the stream and cut it off. For larger rivers, the position is less critical, but elevation information can better inform the stopbank enforcement in the model. Lastly, for thin structures such as flood walls, the elevation information is crucial as they can be difficult to detect on LiDAR.

3.5.3 Resolution issues

For this project, an 8m resolution DEM is used. Consequently, any stream with a cross-section narrower than 8 or even 10 m has not been well represented. In the region, we particularly observed for small streams surrounded by flood protections, enforcing the flood protection in the DEM often resulted in blocking the stream flow due to the narrowness of the gap between stopbanks being a similar size to the resolution of the DEM. In these situations, a very small misalignment of the stopbank can also have a similar result and cut off the stream flow.

3.5.4 Flood map refinement and pixelisation

As explain in the methodology, the computational meshes presents different levels of resolution, with high resolution in river and streams, stopbanks and where fluvial flooding is expected from a coarse model. This might result in large pixels in places where there wasn't flooding in the coarse resolution model (such as small tributaries) or pluvial flooding if the pixels are discontinuous.

There are methods that can be used to interpolate coarse flooding down to a finer resolution, but these methods can be misleading because the results visually suggest an accuracy that may not be warranted. We would rather show the results at the resolution of the modelling because that way the user can see the inherent uncertainty in the results. If some of these specific places show a high risk (a combination of high hazard and assets of interest), the model refinement map can be modified to ensure high resolution in this area of interest, and the final high-resolution modelling redone.

Similarly, rain-on-grid modelling can generate isolated pixels of flooding that could be "cleaned" by methods based on water depth threshold and flooded area. However, they can be misleading too, as results are sensitive to the parameters chosen and should be adapted to the specific use of the flood maps. Again, for this report, the raw modelling results have been presented rather than post processing them.

3.5.5 River and river mouth bathymetry

Finally, the river bathymetry cannot be extracted from the type of LiDAR (red LiDAR) available for the region. Manual 'digging' of the lower part of the river informed by cross-section data has been applied so as to ensure that the river bathymetry is represented at least approximately. The use of the cross-sections to generate a realistic river bathymetry was out of the scope of this work. Some

river mouths have been dug out using the method implemented in GeoFabrics, which can be further improved if cross sections are available in the river mouth area.

3.5.6 A semi-automatic workflow

Finally, these maps have been generated by a semi-automatic workflow. Even if some tests and modifications have been implemented for this project, any manual fix to the models or DEMs was out of the scope of this project. Some avenues to improve these models would be to manually realign some stopbanks or push them further from small streams for example. The intersection between stopbanks and streams can also be refined by considering these as gates open or closed during a flood event. Finally, culverts were extracted from OpenStreetMaps database, and some might be missing in the region.

3.6 Use of this data and recommendations

This regional modelling is not validated or calibrated to the same level that a local- or catchment-scale model would be. While some of the criteria are level B/C, other criteria are only at level A giving it an overall level of A. Not all flood structures are fully represented and there may be some artifacts in the DEM and roughness maps. The resolution of 8 m means that smaller river channels may not be fully resolved. These flood model outputs do, however, give a good indication of the scope of the flood hazard and risk that Horizons faces and how this is likely to change under climate change. Their use is appropriate to understand aggregated risk in terms of the order of magnitude of the problem. Additionally, these flood outputs can be used as a screening tool to identify where the highest levels of risk are likely to be and where further work (further LiDAR acquisition, higher level modelling etc.) is warranted to better characterise the flood hazard, risk and vulnerability.

The main recommendations from this report for future work are:

- **Pluvial vs Fluvial flooding**: run fluvial only model around identified towns/areas of interest to differentiate between the two flooding mechanisms
- **Improvements to inputs**: work with Horizons to identify best places to improve input data (e.g., LiDAR coverage, stopbank locations and elevations). Models could be rerun incorporating this improved information and potentially at a higher resolution (e.g., 4 m)
- **Residual Risk**: Identify locations where stopbanks are overtopped in scenarios. From these select stopbank breach scenarios of interest to model assuming that overtopping could cause failure of stopbanks
- **Extra-tropical Cyclone Scenarios**: Develop an extra-tropical cyclone scenario and model this to understand the possible impacts of a direct impact on Horizons Region by an extra-tropical cyclone.
- **Bridge Heights**: Compare flood maximum elevation levels to bridge heights to estimate at what AEP individual bridges could become too dangerous for people to use.
- **Differences in Regional Model**: Case studies to understand differences between regional modelling and higher-level local modelling.

4 Conclusion

NIWA and WSP New Zealand Ltd are collaborating to inform the Horizons Regional Council's flood vulnerability assessment. As part of this project, NIWA provided a region-wide flood hazard assessment to contribute to the regional flood risk assessment. A set of inundation flood maps were developed using a cascade of tools, following a semi-automated procedure named 'workflow'. Workflow comprises identification of the flood modelling domain, creation of the DEM, identification of design storms, hydrological and hydrodynamic modelling, and climate change analysis.

Twelve domains were identified and for each of these we generated a hydrologically conditioned DEM and a roughness map using available LiDAR data, local DEMs, DSM, ocean contours, OpenStreetMap data and other national or global databases. For each of the 12 domains identified, design storms were created with 5%, 2%, 1% and 0.5% annual exceedance probability (AEP) or 20-, 50-, 100-, 200-year ARIs for current climate conditions, and 0.5% AEP or 200-year ARI rainfall design storms climate change scenarios corresponding to +1˚C , +2˚C , +3˚C global mean temperature increase above actual conditions (or +2˚C, +3˚C and +4˚C above pre-industrial temperatures). In the upper part of the catchment, where the slopes are excessive for hydrodynamic flood modelling, we applied the TopNet hydrological model to calculate the flow discharge to be applied at the injection point of the rivers in the floodplains. In the hydrodynamic modelling domains located in the floodplains we performed a flood modelling exercise using the 2D hydrodynamic software, BG_Flood.

After a first coarse mapping of the flood, a mesh was generated, with local refinements down to 8 m resolution in areas expected to be flooded and around strategic locations such as flood defence structures or streams. The flood models were forced by hydrographs at the river injection points calculated by the hydrological model, the rain on the floodplain and an MHWS (mean high water spring) tide at the coast. The tide was phased with the peak of the flood. For the domains containing flood defence structures, a set of simulation with these structures removed (named stopbanks-down simulations) was produced. Finally, as the climate change scenarios explored did not include sea level rise, coastal domains have been tested with sea level rise for the 200-year ARI rainfall design storm with +3˚C of climate change. The influence of sea level rise was very limited in the coastal zone, most of the flooding during these storm events originated from fresh water.

Some limitations have been observed, related to the use of complementary data where no LiDAR was available, the model resolution compared to stream section especially when surrounded by stopbanks, gate modelling and some feature misalignment or missing (most can be fixed manually but this work was out of the scope of the study). For all the scenarios presented previously, 146 models were created to generate a set of flood maps. The maximum water depth along the flood, the maximum water elevation and the maximum water depth times velocity have been extracted along with the water rising rate to inform the regional flood risk assessment.

5 Acknowledgements

This study builds upon the workflow and tools developed for the MBIE-funded Endeavour Programme Mā te Haumaru ō ngā puna wai ō Rākaihautū ka ora mō ake tonu. We would like to thank the programme team for their contributions. Special thanks to Yinjing Lin for mapping the climate scenarios based on hydrological results. This project was also developed in collaboration with the WSP team, whose support was central, particularly in reprojecting the Manawatū DEM. We gratefully acknowledge the Horizons Regional Council for their insightful discussions and the provision of essential data, which were critical for the creation of these maps. We also thank Trevor Carey-Smith for his contributions to the design storm generation and Céline Cattoën-Gilbert for her work on the hydrological model. Finally, the author(s) acknowledge the use of the New Zealand eScience Infrastructure (NeSI) high-performance computing facilities for this research. These national facilities are provided by NeSI and funded jointly by NeSI's collaborator institutions and the Ministry of Business, Innovation & Employment's Research Infrastructure programme.

6 Glossary of abbreviations and terms

AEP	Annual Exceedance Probability
ARI	Annual Return Interval (also known as Return Period)
DDF	Depth-Duration-Frequency
DEM	Digital Elevation Model
DSM	Digital Surface Model
GIS	Geographical Information System
GPU	Graphical Processing Unit
HIRDS	High Intensity Rainfall Design System
IDF	Intensity-Duration-Frequency
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection And Ranging
LINZ	Land Information New Zealand
MHWS	Mean High Water Spring
NeSI	National e-Science Infrastructure
netCDF	Type of data file
NZIS	New Zealand Inventory of Stopbanks
NZRA	New Zealand ReAnalysis
NZTM	New Zealand Transverse Mercator
NZVD2016	New Zealand Vertical Datum 2016
OSM	Open Street Maps
REC	River Environment Classification
RPC	Representative Concentration Pathway
SLR	Sea Level Rise
SSP	Shared Socio-Economic Pathway
VCSN	Virtual Climate Station Network

7 References

Ashcroft, K., Barnhill, D., Hodgson, E. (2025) Horizons Flood Vulnerability Assessment. Current State Analysis. WSP Client Report prepared for Horizons Regional Council

Bosserelle, C., Lane, E.M., Harang, A. (2021) BG-Flood: A GPU adaptive, open-source, general inundation hazard model. *Australasian Coasts and Ports*, Christchurch.

Carey-Smith, T., Henderson, R., Singh, S. (2018) High intensity rainfall design system: Version 4. *NIWA Client Report*, 2018022CH: 73.

Clark, M.R., Martinez, G., McMillan, H.K., Jackson, B., Gupta, H.V., Goodrich, D.C., Srinivasan, M.S., Schmidt, J., Woods, R.A. (2008) A national hydrological model for New Zealand. *AGU Fall Meeting*, San Francisco, December 2008.

IPCC (2021) Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: 3-32. 10.1017/9781009157896.001

McMillan, H.K., Booker, D.J., Cattoën, C. (2016) Validation of a national hydrological model. *Journal of Hydrology*, 541, Part B: 800-815. http://dx.doi.org/10.1016/j.jhydrol.2016.07.043

Oliver, H.J., Shin, M., Sanders, O. (2018) Cylc: A Workflow Engine for Cycling Systems. *Journal of Open Source Software*, 3(27). 10.21105/joss.00737

Pearson, R.A., Smart, G., Wilkins, M., Lane, E., Harang, A., Bosserelle, C., Cattoën, C., Measures, R. (2023) GeoFabrics 1.0.0: an open-source Python package for automatic hydrological conditioning of digital elevation models for flood modelling. *Environmental Modelling & Software*, 170: article no. 105842. https://doi.org/10.1016/j.envsoft.2023.105842

Pirooz, A., Moore, S., Carey-Smith, T., Turner, R., Su, C.-H. (2023) The New Zealand Reanalysis (NZRA): development and preliminary evaluation. *Weather & Climate*, 42(1): 58-74. https://www.metsoc.org.nz/resources/Documents/weather_and_climate/Vol_42_pdfs/Vol_42_Pirooz_et_al.pdf

Singh, S. (2025) Appendices to Flood Frequency in Horizons Region Report of March 2025. *NIWA Client Report*, 2025162CH.

Smart, G., Aberle, J., Duncan, M., Walsh, J. (2004) Measurement and analysis of alluvial bed roughness. *Journal of Hydraulic Research*, 42(3): 227-237. 10.1080/00221686.2004.9728388

Appendix A List of files provided

The delivered set of inundation maps consists of 2D maps, saved in .tiff format, on an 8 m x 8 m resolution grid, in a NZTM2000/NZVD2016 datum. The stopbank down configuration only applied to domains containing stopbanks, and the sea level rise (SLR) configuration only applied to coastal domains (summarised in Table A-1: List of scenarios explored for each domain.. The stopbank up and stopbank down scenarios were applied to 7 different design storm intensities corresponding to: 20-, 50-, 100-, 200-year return period in actual conditions and 200-year return period for +1˚, +2˚, +3˚ C above actual conditions. Only the 200-year return period +3˚C above actual conditions was applied to the sea level rise configurations.

Table A-1: List of scenarios explored for each domain.

	Stopbank up *20,50,100,200-year +0˚C* *200-year +1˚,2˚,3˚C*	**Stopbank up + SLR** *200-year +3˚C*	**Stopbank down** *20,50,100,200-year +0˚C* *200-year +1˚,2˚,3˚C*	**Stopbank down + SLR** *200-year +3˚C*
Ākitio	✓	✓	X	X
Manawatū	✓	✓	✓	✓
Aohanga	✓	✓	X	X
Ohakune	✓	X	X	X
Ōhau-Levin	✓	✓	✓	✓
Rangitīkei	✓	✓	✓	✓
Taumarunui	✓	X	✓	X
Turakina	✓	✓	✓	✓
Upper Manawatū	✓	X	✓	X
Wainui-Herbertville	✓	✓	X	X
Whangamōmona	✓	X	X	X
Whanganui	✓	✓	✓	✓

For each of these scenarios, different fields extracted from computational results were:

- Maximum_Water_Depth (m) calculated at each time step in the simulation (and not from hourly snapshots outputs), reprojected on an 8 m x 8 m grid.
- Maximum_Elevation (m): maximum of water surface elevation, calculated at each time step in the simulation (and not from hourly snapshots outputs), reprojected on an 8 m x 8 m grid.
- Maximum_Depth_times_Velocity (m^2s^{-1}): maximum of water depth times water velocity (amplitude) calculated at each time step in the simulation (and not from hourly snapshot outputs), reprojected on an 8 m x 8 m grid. This is a specific variable output for risk assessment.

- Rising_Rate_to_1.2m (mh^{-1}): water rising rate up to 1.2 m, calculated from the 1-hour snapshot outputs (water depth field h(m)), reprojected on an 8 m x 8 m grid. This is a specific variable output used to assess risk to people.

All filenames follow a similar structure, for example:

"Akitio_20y_0c_Inundation_Floodmap_Maximum_Elevation.tif", which begins with the domain name "Akitio", then the design storm characteristics "20y_0c" for 20-year return period and 0˚C of climate change above actual conditions, and then the field "Maximum_Elevation" for maximum of water surface elevation.

For the results where sea level rise was added to the tide forcing, "SLR" is added at the end of the file name and "StopbanksDown" for the configurations were stopbanks have been removed from the DEM (the default configuration being the DEM including the stopbanks).

As some flood plains can be connected during large flood events by rivers or stream flowing to adjacent basins, some computational domains overlap. To clarify the results, the maximum for all domain is shown on the output maps.

By default, "Nan" (not a number) values are allocated to area in the domain where there is no water or that are outside of the computational domain. For the Maximum_Water_Depth and the Maximum_Depth_times_Velocity, a "filled" version of the output is provided, with "0" in the computational domain where there is not water (i.e. it is not flooded) but is in the computational domain.

The input files used to model these scenarios will also be provided to Horizons separately to this report.

Appendix B Extension: 0.2% and 0.1% AEP modelling

As a variation on the contract, design storm of 0.2% and 0.1% AEP (or 500- and 1000-years return periods) have been added to the list of scenarios, for actual and climate change scenarios corresponding to +1˚C, +2˚C and +3˚C over the current climate. For these scenarios, only the stopbank up configuration has been modelled so far. The method the generate these flood maps is the same as the method described in this report. Note that the design storms based on HIRDv4 were initially only designed for return periods up to 250-years (mainly limited by the quantity of observations available in New Zealand). These results from HIRDS have been extrapolated in this study for the creation of 500-year and 1000-year events, increasing the uncertainty around their intensity.

Table B-1 presents the all the scenarios for which flood maps were generated in this study.

Table B-1: List of scenarios explored for each domain, including the variation.

	Stopbank up *20,50,100,200-year +0˚C* *200-year +1˚,2˚,3˚C*	**Stopbank up + SLR** *200-year +3˚C*	**Stopbank down** *20,50,100,200-year +0˚C* *200-year +1˚,2˚,3˚C*	**Stopbank down + SLR** *200-year +3˚C*	**Stopbank up** *500-year +0˚,1˚,2˚,3˚C*	**Stopbank up** *1000-year +0˚,1˚,2˚,3˚C*
Ākitio	✓	✓	X	X	✓	✓
Manawatū	✓	✓	✓	✓	✓	✓
Aohanga	✓	✓	X	X	✓	✓
Ohakune	✓	X	X	X	✓	✓
Ōhau-Levin	✓	✓	✓	✓	✓	✓
Rangitīkei	✓	✓	✓	✓	✓	✓
Taumarunui	✓	X	✓	X	✓	✓
Turakina	✓	✓	✓	✓	✓	✓
Upper Manawatū	✓	X	✓	X	✓	✓
Wainui-Herbertville	✓	✓	X	X	✓	✓
Whangamōmona	✓	X	X	X	✓	✓
Whanganui	✓	✓	✓	✓	✓	✓

The outputs for the additional modelling are provided in a similar format to the other maps.

APPENDIX C – VULNERABILITY ASSESSMENT METHODOLOGY (ESNZ)

10th February 2026

Richard Woods
WSP
Auckland

Dear Richard

NIWA has undertaken a flood risk analysis for the Horizons Region Flood Vulnerability Project. The following letter report summarises the flood risk analysis methodology. Here, we describe the flood risk model framework, input data and risk metrics. Limitations with model input data used in the risk analysis are identified.

Thank you again for the opportunity to work with WSP on the Horizons Region Flood Vulnerability Project, and we look forward to working together in future. Any questions arising from the flood risk analysis can be directed to Ryan Paulik and Luisa Hosse.

Yours sincerely

Ryan Paulik

Dr Ryan Paulik
Natural Hazard Risk Scientist
National Institute of Water and Atmospheric Research

Methods

Flood risk model framework

Fluvial[1] and pluvial[2] flooding risk was evaluated using RiskScape software (Paulik et al. 2022). RiskScape is open-source software with a flexible modelling engine for multi-hazard risk analysis that is centred on a well-established conceptual framework for risk quantification:

$$\mathrm{R} = f_C(H_i, E, V_i) \quad (1)$$

where risk (*R*) is a function (f_C) of the consequences from a hazard event (*H*) impacting an exposed element (*E*). Tangible (i.e., monetary) and intangible (i.e., non-monetary) consequences are determined from the element's vulnerability (*V*) to an impact in response to hazard events (*i*). If *V* is not known or understood, element *E* exposure to *H* can be represented as:

$$\mathrm{R} = f_C(H_i, E) \quad (2)$$

Model input data representing *H, E* and f_C are described in the following sections, along with risk metric calculations used in the flood risk analysis.

[1] Flood inundation from a riverine source.

[2] Flood inundation directly from a rainfall source.

Several impact types for the flood risk analysis were identified during Horizons Region Flood Vulnerability Project scoping. These include:

- Flood hazard exposure i.e., whether or not an element comes into contact with flood water.
- Direct economic loss i.e., monetary loss arising from damage caused when an element (people or residential buildings) comes into contact with flood water.
- Human safety threat i.e., the potential level of threat to human life when people come into contact with flood water.

Impact types for the Horizons Region Flood Vulnerability Project focused on residential buildings and their usually-resident population. The specific impact types in this study can be classified as tangible (i.e., monetary) and intangible (i.e., non-monetary) as follows:

- Tangible:
    - Building repair cost (NZD)
    - Human life cost (NZD)
- Intangible:
    - Human safety threat level

Input data: Hazard layers (H)
Fluvial-pluvial hazard layers developed by NIWA and WSP are summarised in Table 1. Fluvial-pluvial flooding was simulated for 20-, 50-, 100-, and 200-year annual recurrence intervals (ARI) under present-day climate conditions. In addition, 200-year ARI flooding was simulated under 1°C, 2°C, and 3°C increases in temperature above present-day climate conditions, along with 1.1 m or 1.5 m sea level rise. 'Stopbanks present' and 'stopbanks removed' scenarios were simulated for seven locations (Table 1). Flood hazard intensities represented by water depth (m), flow velocity (m/s), and water rise rate (m/hr), were simulated on an 8 m grid.

Table 1 Summary of fluvial-pluvial flood hazard scenarios.

Locations	Fluvial-Pluvial Flooding Scenario								
	ARI 20 + 0˚C	ARI 50 + 0˚C	ARI 100 + 0˚C	ARI 200 + 0˚C	ARI 200 + 1˚C	ARI 200 + 2˚C	ARI 200 + 3˚C	ARI 200yrs - 3˚C + SLR	Stopbanks
Akitio - 24								+1.5 m SLR	Not Considered
Manawatu - 60								+1.1 m SLR	Stopbanks up & down
Owahanga - 6								+1.5 m SLR	Not Considered
Ohakune - 12								+0 m SLR	Not Considered
Ohau-Levin - 12								+1.1 m SLR	Stopbanks up & down
Rangitikei - 42								+1.1 m SLR	Stopbanks up & down
Taumarunui - 12								+0 m SLR	Stopbanks up & down
Turakina - 60								+1.1 m SLR	Stopbanks up & down
Upper_Manawatū - 60								+0 m SLR	Stopbanks up & down
Wainui_Herbertville - 6								+1.5 m SLR	Not Considered
Whangamomona - 6								+0 m SLR	Not Considered
Whanganui - 54								+1.1 m SLR	Stopbanks up & down

Input data: Exposure layers (E)
Exposure data and attributes used to evaluate flood risk are summarised in Table 2. Exposures in the present risk analysis focused only on residential buildings and their usually-resident population. Spatial data representing these elements were derived from national 'object-level' (i.e., individual building objects) databases developed by GNS Science and NIWA. Residential buildings represented as polygons (Land Information New Zealand 2024a), were derived from Scheele et al. (2023) and Paulik et al. (2023), and included several modelled attributes such as floor area, floor height, replacement cost (NZD 2024), along with zoning, actual property use, improvements value (NZD 2024) attributes from the New Zealand

property rating valuation dataset (Land Information New Zealand 2024b). Replacement cost (NZD 2024) was selected for use in this study.

Usually-resident populations for each residential building polygon was extracted from a New Zealand population model developed by Scheele et al. (2021). The model downscales 2018 Statistical Area 2 (SA2) census population and demographic information to residential buildings within the corresponding SA2 boundary. Only the usually-resident population (i.e., 'n_individuals') was used in this study for simulating flood risk to people.

Table 2 Summary of exposure layers used for buildings and population.

Element	Geometry	Attribute Fields and Data Types	Source
Buildings; Population	Polygons	floor_area: integer, floor_height: floating, replacement_cost: integer, use_category: text, zoning: text, actual_property_use: text, improvements_value: floating;	Land Information New Zealand (2024a,b), Paulik et al. (2023), Scheele et al (2023)

Input data: Vulnerability models (V)

Vulnerability models, presented in Table 3, were used to calculate flood hazard exposure or impacts for residential buildings and their usually-resident population. Building and population flood hazard exposure was determined when water depth exceeds 0.2 m at a residential building location. Physical building damage was evaluated using a machine-learning (ML) algorithm (Extreme Gradient Boosting (XGBoost)) trained on 1,833 residential building damage samples from New Zealand flood events. (Paulik et al. 2024; Paulik & Horspool 2024). The ML algorithm was trained using water depth (above ground, above floor height) and building area as explanatory variables to predict building damage response. The trained ML algorithm estimated physical building structure damage, expressed as a damage ratio (i.e., 'cost-to-repair' / 'cost-to-replace'). This enabled the direct economic loss to be computed as the monetary repair cost required to reinstate the building to its pre-damaged replacement value.

Table 3 Summary of vulnerability models used for buildings and population.

Element	Vulnerability Model	Source	Equation
Population	Binary function; human safety threat matrix; bivariate damage function; unit loss method	RiskScape; Cox et al. 2010; Jonkman et al. 2008	4-12
Buildings	Binary function; human safety threat matrix, multivariable damage function, unit loss method	RiskScape; Paulik et al. (2024)	3-12

The human safety threat to usually-resident populations at building locations was determined using the safety classifications by Cox et al. (2010). The authors established several safety threat levels based on the potential for a person to become unstable and entrained in flood waters under water depth and flow velocity (i.e., depth-velocity product) conditions. Here, we used the 'adult' safety threat threshold as a conservative measure for human safety threat.

Physical damage to usually-resident populations in contact with flood waters was evaluated using bivariate damage functions developed by Jonkman et al. (2008). The authors analysed the conditions causing human fatalities from historic global flood events, and proposed several bivariate damage functions to estimate fatalities based on different zones of flood hazard intensities. These zones are summarised and associated damage functions are summarised in Table 4. The 'Zones with Rapidly Rising Waters' were determined when water rise rate (m/hr) exceeds 0.5 m/hr up to 1.2 m water depth i.e., conditions where an adult's safety threat is determined to be 'extreme' (Cox et al. 2010). We used a 1.2 m water depth threshold instead of the 1.5 m suggested by the authors to account for New Zealand buildings being less likely to provide shelter in upper floors than buildings in the study area. Damage functions calculate a

fatality ratio (0 to 1). People located in the 'breach zone' are assigned a ratio of 1, due to the low survival rate of people exposed to the hazard intensities.

Table 4 Summary of damage functions use to estimate human fatalities (after Jonkman et al (2008). *wd* = water depth, *v* = flow velocity, F_D = fatality ratio.

Zone	Description	Damage Function
Breach Zone	Due to the inflow through the breach in a flood defence, high flow velocities generally occur behind the breach.	$wd \cdot v \geq 7\ \mathrm{m^2/s}$ and $v \geq 2\ \mathrm{m/s}$
Zones with Rapidly Rising Waters	Due to the rapid rising of the water, people are not able to reach shelter on higher grounds or higher floors of buildings.	$F_D(wd) = \Phi_N\left(\frac{\ln(wd) - \mu_N}{\sigma_N}\right)$ $\mu_N = 1.46, \sigma_N = 0.28$
Remaining Zone	In this zone, the flood conditions are more slow-onset, offering better possibilities to find shelter.	$F_D(wd) = \Phi_N\left(\frac{\ln(wd) - \mu_N}{\sigma_N}\right)$ $\mu_N = 7.60 \quad \sigma_N = 2.75$

Risk metrics (exposure, impact) (R)

Risk metrics calculated for residential buildings and their usually-resident population are summarised in Table 5. Exposure or impact risk is determined from the flood scenario annual recurrence interval. Risk metrics represent categorical[3] and continuous[4] data values, requiring different approaches described in the following section to calculate the metric for a flood scenario and its expected probability of occurrence in a single-year.

Table 5: Summary of flood risk metrics for buildings and population.

Metric/Field Label	Elements	Description
Water_Depth	buildings	Modelled maximum water depth above ground in meters at an exposed building.
Building_Exposure	buildings	Building exposed to modelled maximum water depth above ground >0.05 m expressed as a boolean (i.e., 1 = true, 0 = false).
Building_Repair_Cost; Life_Cost	buildings, population	Building damage occurs when modelled maximum water depth above ground >0.2 m for 100% of the building outline area. Modelled monetary damage costs expressed as New Zealand dollars (2024).
Annual_Building_Repair_Cost; Annual_Life_Cost	buildings, population	Expected average annualised loss (AAL) from modelled monetary damage costs expressed as New Zealand dollars (2024).
Safety_Threat_Level	population	Modelled human safety threat level at an exposed building.

Exposure and impact risk metric calculation

Flood waters present ($\mathrm{F_P}$) at building locations was determined when:

$$\mathrm{F_P} = \begin{cases} 1, \text{ if } WD \geq 0.05\ \mathrm{m} \\ 0, \text{if } WD < 0.05\ \mathrm{m} \end{cases} \quad (3)$$

where, water depth (WD) exceeds a limiting depth of 0.05 m. Building-specific floor height information was not available for this study therefore, 0.2 m is a proxy floor height based on a conservative assumption that buildings were constructed with a 'slab on grade' foundation. Potential flood water above floor level ($\mathrm{F_{ABF}}$) was further calculated when:

[3] Categorical data is qualitative data that can be grouped into categories rather than being measured numerically.

[4] Continuous data is quantitative data that can take any numerical value within a range, including fractions and decimals.

$$\mathrm{F_{ABF}} = \begin{cases} 1, \text{ if } 0.2\text{ m} \leq WD \\ 0, \text{if } WD < 0.2\text{ m} \end{cases} \quad (4)$$

The indicator value (i.e., 1) for both $\mathrm{F_P}$ and $\mathrm{F_{ABF}}$ can be used to enumerate the number of buildings, number of people etc. exposed to flood waters. $\mathrm{F_{ABF}}$ of 100% was used as the limiting WD for further building and population flood risk metric calculation (Table 5).

Human safety threat (HSL) at a building location was calculated using the threat matrix developed by Cox et al. (2010), whereby a depth-velocity product (DV = water depth * flow velocity) determines a relative human safety threat level in flood waters:

$$\mathrm{HSL} = \begin{cases} \text{None, } DV = 0 \\ \text{Low, } DV\ 0 < 0.6 \\ \text{Moderate, } DV\ 0.6 \leq 0.8 \\ \text{Sigificant, } DV\ 0.8 \leq 1.2 \\ \text{Extreme, } DV > 1.2 \end{cases} \quad (5)$$

Building and human direct economic loss (L) were calculated using the unit loss method:

$$\mathrm{L}_B = \sum_{i=1}^{N} H_{Vi}, f_i(WD_{ABFi}, F_{Areai}) \quad (6)$$

where for building *i*, L_B is the monetary loss enumerated from the building replacement cost (E_{UV}) and f_i the damage function that computes a damage ratio (ranging from 0 to 1). f_i represents a damage ratio as a function of the sampled maximum water depth above floor level floor level (WD_{ABF}) and building floor area (F_{Area}). F_{Area} was calculated as the proportional area of flood waters present (F_P) at a building location expressed as a ratio between 0 to 1 (i.e., 0% to 100%). In this study, L_B occurs when WD_{ABF} > 0 m and F_{Area} = 1 (i.e., 100%). Similarly, human direct economic loss was computed as:

$$\mathrm{L}_H = \sum_{i=1}^{N} H_{Vi}, f_i(WD_i, V_i, HSL_i, WR_{Ratei}) \quad (7)$$

where for person *i*, L_B is the monetary loss enumerated from the New Zealand Transport Agency (2025) value of statistical life (H_V) and f_i the damage function that computes a human fatality ratio (ranging from 0 to 1). f_i represents a fatality ratio as a function (Table 4) of the sampled maximum water depth above ground (WD), maximum flow velocity (V), HSL and water rise rate (WR_{Rate}) > 0.5 m/hr. In f_i, the 'Zones with Rapidly Rising Waters' were determined where HSL = Extreme and WR_{Rate} > 0.5 m/hr. A person's E_{UV} was estimated at NZD 12.5 million based on the New Zealand Transport Agency (2025) value of statistical life.

Exceedance probability exposure (EPE) and loss (EPL) were calculated by converting the period (*T*) flood scenario ARI (λ) to an annual probability of occurrence (P) for each flood scenario using a Poisson model ($P = 1 - \exp(-\lambda * T)$), with P used to calculate EPE for the respective independent variables as follows:

$$\mathrm{EPE}_{F_P} = \sum_{i=1}^{N} F_{Pi}\,(P) \quad (8)$$

$$\mathrm{EPE}_{F_{ABF}} = \sum_{i=1}^{N} F_{ABFi}\,(P) \quad (9)$$

$$\mathrm{EPE}_{HSL} = \sum_{i=1}^{N} HSL_i\,(P) \quad (10)$$

$$\mathrm{EPL} = \sum_{i=1}^{N} L_i(P) \quad (11)$$

where *N* is the sum of independent variables F_P, F_{ABF}, HSL $(i.e., None\ to\ Extreme\ (Eq.5)$ or L for element *i* (i.e., building or person) exposed by a hazard event with annual probability of occurrence P. Here, a hypothetical curve is formed between $L_i(P)$ and EPL, with a positive monotonic trend expected in response to decreasing P. The average annual loss (AAL) was estimated by solving the integral for 'the area under the curve':

$$\mathrm{AAL} = \int_{P_{\min}}^{P_{\max}} EPL(P) \quad (12)$$

where $P_{\max}$ and $P_{\min}$ represent respectively the highest and lowest hazard event annual probability of occurrence. $\mathrm{EPL}(P)$ denote the building or population monetary loss enumeration for hazard events with the annual probability of occurrence P. Using the trapezoidal Riemann sum approach, AAL was computed by solving the integral in Equation 12.

Limitations

The following limitations of the flood risk analysis are identified, and can be considered for future methodological improvement:

- Spatial and temporal distribution of usually-resident populations. Usually-resident populations are located at residential buildings, and are assumed to occupy buildings during exposure to flooding. This represents a 'worst case' scenario as persons at a location are exposed to the highest hazard intensities. Populations are highly dynamic and temporally change location over different time periods (e.g. hours, days, months). Populations also evacuate to safe areas during flood events, usually reducing the number of people directly exposed to flood waters.

- Usually-resident population demographic information. A person's characteristics (e.g. age, income etc.) can influence their ability to safely evacuate from flooding hazards and recovery from economic losses. Vulnerable groups, including the elderly, young children, low-income households, and individuals with disabilities, may face greater challenges in responding to evacuation orders, accessing emergency services, and rebuilding their lives after a flood event. Including usually-resident population demographic characteristics will support more accurate evaluation of human safety threat and can broaden the evaluation of direct and indirect social and economic consequences (e.g., temporal population displacement, indirect heath impacts).

- Non-residential buildings. Buildings are a high-proportion of fixed-asset wealth in New Zealand, and the Horizons region. While limiting the flood risk analysis to residential buildings was a pragmatic decision based on exposure and vulnerability input data availability, direct economic loss from building damage is underestimated. Inclusion of non-residential buildings would support more accurate evaluation of building direct economic losses, and facilitate the evaluation of indirect

economic loss caused by disruption to building services (e.g., temporal population or business displacement).

- Infrastructure and primary production exposure. Similar to non-residential buildings exclusion, direct and indirect damage to infrastructure and primary production sectors can comprise a large proportion of economic losses in a flood event. This is particularly the case for rural areas, where production and capital assets represent a high proportion of asset wealth, and infrastructure networks are critical for primary sector economic activities. Extending the risk model present to include these sectors will afford a more inclusive representation of direct economic losses, and support methods to evaluate indirect economic losses cause by disruption to infrastructure network services and primary production.

References

Cox, R. J., Shand, T. D., & Blacka, M. J. (2010). Australian Rainfall and Runoff revision project 10: appropriate safety criteria for people. Water Resources Laboratory, University of New South Wales, 978, 085825-9454.

Jonkman, S. N., Vrijling, J. K., & Vrouwenvelder, A. C. W. M. (2008). Methods for the estimation of loss of life due to floods: a literature review and a proposal for a new method. Natural Hazards, 46, 353-389.

Land Information New Zealand (2025a). NZ Building Outlines. Accessed at: https://data.linz.govt.nz/layer/101290-nz-building-outlines/ (26 November 2024).

Land Information New Zealand (2025b). NZ Property Hybrid (pilot). Accessed at: https://data.linz.govt.nz/layer/115113-nz-property-hybrid-pilot/ (26 November 2024).

New Zealand Transport Agency (2025). Monetised benefits and costs manual – volume 1: procedures. Accessed at: https://www.nzta.govt.nz/resources/monetised-benefits-and-costs-manual/ (26 May 2025).

Paulik, R., Horspool, N., Woods, R., Griffiths, N., Beale, T., Magill, C., ... & Garlick, R. (2022). RiskScape: a flexible multi-hazard risk modelling engine. Natural Hazards, 119(2), 1073-1090.

Paulik, R., Zorn, C., & Wotherspoon, L. (2024). Residential building and sub-building level flood damage analysis using simple and complex models. Natural Hazards, 120(14), 13493-13512.

Paulik, R., Zorn, C., Wotherspoon, L., & Sturman, J. (2023). Modelling national residential building exposure to flooding hazards. International Journal of Disaster Risk Reduction, 94, 103826.

Scheele, F. R., Benson, A., & Horspool, N. A. (2021). Development of population models for risk assessment in New Zealand (GNS Science Report 2021/48, 24 p.). Lower Hutt, New Zealand: GNS Science. https://doi.org/10.21420/TVF3-3871

Scheele, F. R., Syed, Y., Hayes, J. L., Paulik, R., & Inglis, S. (2023). Building inventory and vulnerability functions for risk modelling in New Zealand (GNS Science Report 2023/08, 42 p.). Lower Hutt, New Zealand: GNS Science. https://doi.org/10.21420/G34N-V958

APPENDIX D – FLOOD HAZARD CLASSIFICATION TABLES AND VULNERABILITY RESULTS LETTER REPORT 2

23 January 2025

Horizons Regional Council
15 Victoria Avenue
Palmerston North Central
Palmerston North 4410

Flood Hazard Classification Tables and Vulnerability Results

1-E0315.00

Dear Julia,

Following Stage 1 the flood vulnerability assessment conducted for Horizons Regional Council by WSP New Zealand Ltd (WSP) and Earth Sciences New Zealand (ESNZ), recommendations were made to enhance the results and their applicability for improving flood risk management throughout the region. This included updating the parameters used for the risk assessment (Table 1) and expanding building types beyond residential to also include commercial/industrial, rural and other buildings.

This letter report provides the updated tabulated results from the modelling and a description of considerations for results interpretation. Full reporting and analysis of the vulnerability assessment results will follow in updated Regional and District Summary reports.

Table 1: Model Parameters Selection for Risk Assessment

Parameter	Value
Scenarios	1. 5% AEP current climate (defences up and down) 2. 2% AEP current climate (defences up and down) 3. 1% AEP current climate (defences up and down) 4. 0.5% AEP current climate (defences up and down) 5. 0.5 % AEP for +1˚ C of climate change (defences up and down) 6. 0.5 % AEP for +2˚ C of climate change (defences up and down) 7. 0.5 % AEP for +3˚ C of climate change (defences up and down) 8. 0.2% AEP current climate (defences up) 9. 0.1% AEP current climate (defences up) 10. 0.5% AEP +3˚ C of climate change with sea level rise (defences up)
Floor Level	For Exposure: 50mm For Reinstatement Cost: 200mm
Exposure Ratio	For Exposure: 50% For Reinstatement Cost: 50%
Primary vs Secondary Structures	Exclude all structures less than or equal to 10 m^2. Where there is one structure per property parcel: • That structure is counted as the primary structure, do not consider the size of the structure. Where there are multiple structures per property parcel: • If structure(s) are between 10.1 m^2 and 70 m^2 (inclusive of these values) then count as secondary. If structure(s) are greater than or equal to 70.1 m^2 count as primary.

Results

Appendix D1

Flood classification results are provided in a series of tables, which can be found in Appendix D1-1 to D1-18. The results are tabulated and present flood hazard metrics at two geographic levels: town/settlement and district. Each table focuses on a specific dimension of impact:

- **Flood Extent Depth Classifications:** Area and depth of modelled flooding for towns/settlements and districts.
- **Flood Extent by Property Use Type:** Total and percentage of hectares flooded by property use type at both levels.
- **Population and Buildings:** Counts of population and buildings by type, including those exposed to flooding, and exposure percentages.
- **Building Impacts:** Reinstatement values and quantified building reinstatement costs for all flood scenarios.
- **Human Safety:** Estimated number of fatalities, life costs and human safety threat level for all flood scenarios.

The full list of tables that can be viewed within Appendix D1 are listed in Table 2.

Table 2: Summary of Tables within Appendix D1

Appendix Number	Table Name	Page Number
Appendix D1.1	Area of town/settlement and depth of modelled flooding by area	1
Appendix D1.2	Area of district and depth of modelled flooding by area	35
Appendix D1.3	Total hectares of property use type flooded for town/settlement	52
Appendix D1.4	Percentage of hectares of property use type flooded for town/settlement	170
Appendix D1.5	Total hectares of property use type for district flooded for town/settlement	288
Appendix D1.6	Percentage of hectares of property use type flooded for district	322
Appendix D1.7	Total count of resident population and number of buildings by building type, for each town/settlement	356
Appendix D1.8	Total counts of population exposed, number of fatalities, buildings affected by flooding, by building type, for each town/settlement	358
Appendix D1.9	Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement	392
Appendix D1.10	Total reinstatement cost of the buildings, by building type, for each town/settlement	426
Appendix D1.11	Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement	428
Appendix D1.12	Total count of resident population and number of buildings by building type, for each District in the Horizons Region	462
Appendix D1.13	Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each district in the Horizons Region	463
Appendix D1.14	Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District	480

Appendix D1.15	Total reinstatement cost of the buildings, by building type, for each District in the Horizons Region	497
Appendix D1.16	Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region	498
Appendix D1.17	Threat to human safety for each district in the Horizons Region	507
Appendix D1.18	Threat to human safety for each town/settlement in the Horizons Region	516

Appendix D2

Tables in Appendix D2 are the updated regional results (Table 3), which have been reported on in Section 3, Horizons Region Results, of the Flood Vulnerability Assessment Report. Each table compares conditions under the current climate (0°C) and projected climate warming scenarios (1°C, 2°C, and 3°C), with flood defences either Up or Down.

Table 3:Summary of Tables within Appendix D2

Appendix Number	Table Name	Page Number
Appendix D2.1	Horizons Regional Summary By District – Current Climate (0°C) and Existing Flood Defences Up	1
Appendix D2.2	Horizons Regional Summary By District – With Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	2
Appendix D2.3	Horizons Regional Summary By District – Current Climate (0°C) and Existing Flood Defences Down	3
Appendix D2.4	Horizons Regional Summary By District – With Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	4

Appendix D3

Tables in Appendix D3 are the updated district results (Table 4), which have been reported on in Section 4, District Results, of the Flood Vulnerability Assessment Report. Each table compares conditions under the current climate (0°C) and projected climate warming scenarios (1°C, 2°C, and 3°C), with flood defences either Up or Down.

Table 4: Summary of Tables within Appendix D3

Appendix Number	Table Name	Page Number
Appendix D3.1	Palmerston North City Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	1
Appendix D3.2	Palmerston North City Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	2
Appendix D3.3	Palmerston North City Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	3
Appendix D3.4	Palmerston North City Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	4
Appendix D3.5	Whanganui District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	5
Appendix D3.6	Whanganui District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	6
Appendix D3.7	Whanganui District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	7

Appendix D3.8	Whanganui District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	8
Appendix D3.9	Horowhenua District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	9
Appendix D3.10	Horowhenua District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	11
Appendix D3.11	Horowhenua District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	13
Appendix D3.12	Horowhenua District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	15
Appendix D3.13	Manawatū District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	17
Appendix D3.14	Manawatū District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	19
Appendix D3.15	Manawatū District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	21
Appendix D3.16	Manawatū District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	23
Appendix D3.17	Tararua District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	25
Appendix D3.18	Tararua District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	27
Appendix D3.19	Tararua District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	29
Appendix D3.20	Tararua District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	31
Appendix D3.21	Rangitīkei District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	33
Appendix D3.22	Rangitīkei District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	35
Appendix D3.23	Rangitīkei District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	37
Appendix D3.24	Rangitīkei District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	39
Appendix D3.25	Ruapehu District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Up	41
Appendix D3.26	Ruapehu District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Up	43
Appendix D3.27	Ruapehu District Vulnerability Assessment Results by Town/Settlement – No Climate Warming (0°C) and Existing Flood Defences Down	45
Appendix D3.28	Ruapehu District Vulnerability Assessment Results by Town/Settlement – 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Flood Defences Down	47

Vulnerability Assessment Results Interpretation

We have identified that careful interpretation of some results is required to ensure results are effectively understood and used in the correct context. Comparisons between Appendix D1 and Appendix D2/D3 tables should be undertaken in context of the respective geospatial processing and sampling methods. To provide context, this section details some of these nuances.

Building & Population Counts

We have verified the total number of building results in Table D1.7.1 of Appendix D1 for each town/settlement using geospatial sampling methods. The variability between population and number of buildings will be described in the regional report. Table D1.7.1 of Appendix D1 shows 47,822 buildings in Palmerston North with an exposed population of 60,795 comparatively, Whanganui has 34,005 buildings with an exposed population of 32,904. These numbers have been verified and, to provide Horizons comfort, we are documenting how the population is attributed in the building model as well as how these results relate to census population counts.

If required, we can make the lead researcher that developed the building/population model available to explain how these numbers are derived and relate to census population counts.

Building Exposure Results

Lower Exposure for some Lower Frequency AEPs
During risk results verification, we identified a few instances, including, Taihape and Longburn, where the building exposure results are lower for the 0.1% and 0.2% AEP scenarios than the 0.5% AEP. Upon investigation, it was identified that ESNZ's flood model was producing higher resolution flood hazard outputs for the lower frequency AEPs, resulting in more-pixelated, larger flood extents for the more frequent scenarios. Figure 1 shows the decrease in numbers for Taihape. Figure 2 shows the 5% AEP flood scenario (black) and the 0.1% AEP flood scenario (blue) demonstrating the higher resolution output for 0.1% AEP. This difference is due to the modelling methodology employed by ESNZ where the model automatically processes at a higher resolution in areas where more flooding is present. This results in larger, pixelated areas of pluvial flooding in the more frequent AEPs and odd-looking exposure results in a few small towns/settlements.

ESNZ notes "*the difference in resolution between the different scenarios is expected given the methodology used. As the flooding extent increases, larger areas will be modelled at higher resolution (and their neighbouring ones will be modelled also as resolution increases and decreases continuously). In this case, we observe only spotting due to rain-on-grid in the lower intensity scenarios up to continuous waterways and larger flooded areas for larger intensities, triggering the increase in resolution. These large coarse resolution spots will cover a larger area but associated with smaller water depths. The increase in cost and buildings affected is then a combination of the modelling methodology and risk assessment methodology.*"

We welcome a discussion with Horizons on this issue to discuss this nuance of the regional flood hazard model and whether there are solutions for some towns/settlements that you wish to be applied.

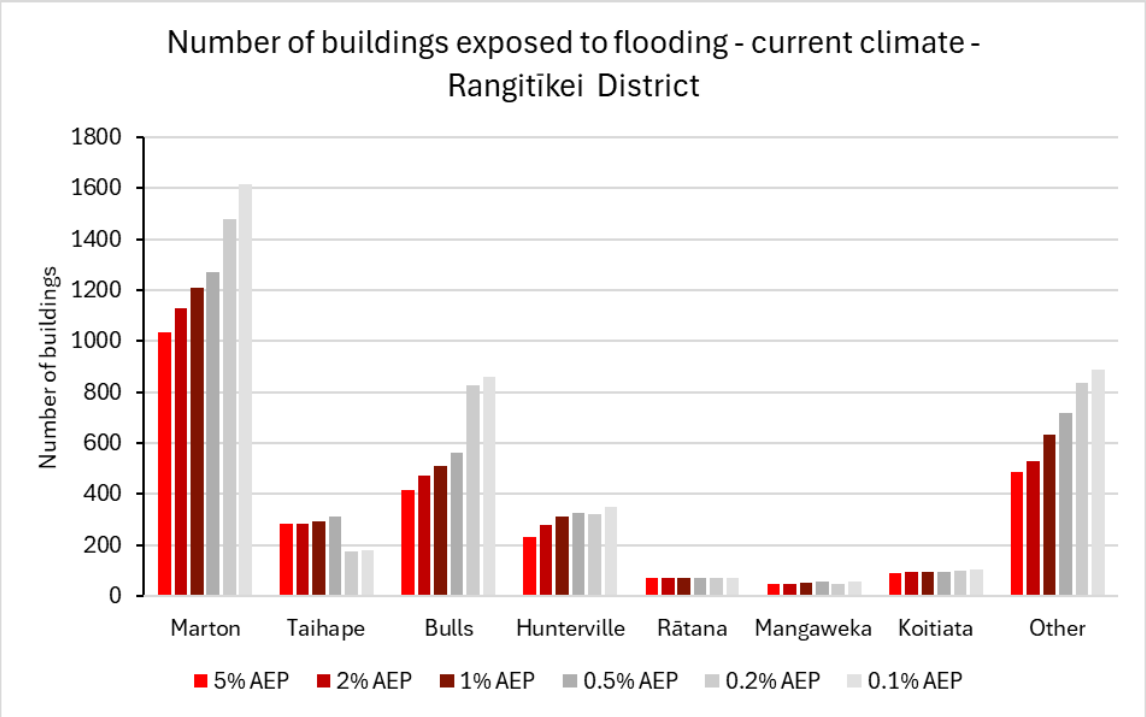


Figure 1: Figure showing building exposure results for Rangitīkei District including the decrease in exposure for lower frequency AEPs in Taihape.

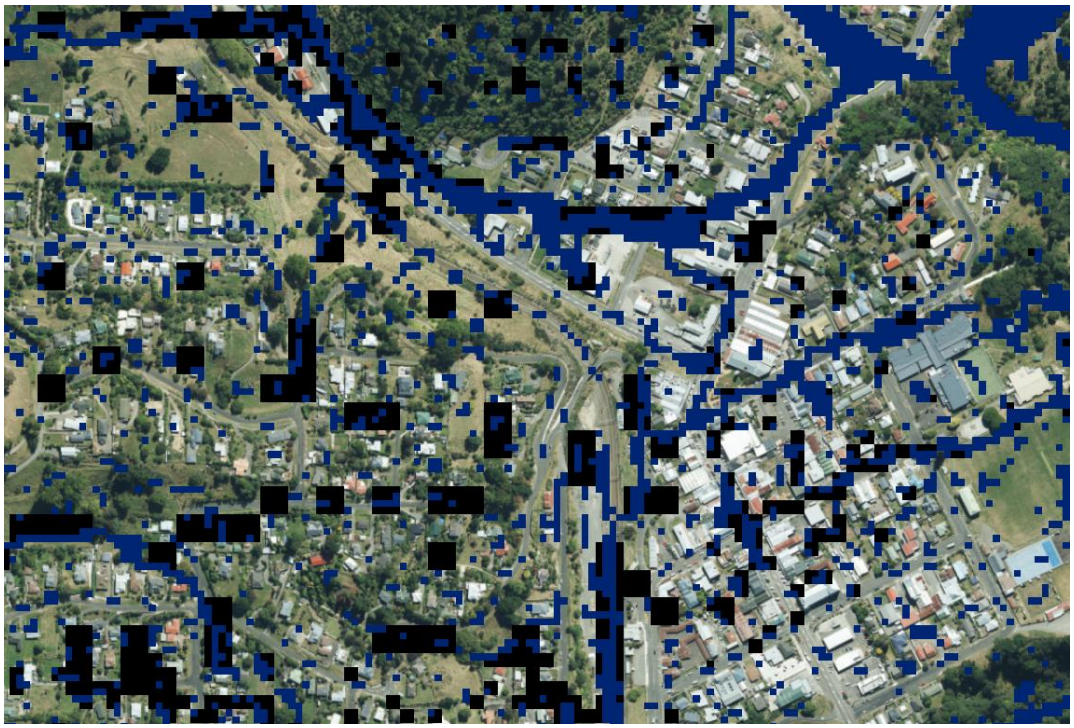


Figure 2: Figure showing the resolution of the 5% AEP flood scenario in black and the 0.1% AEP flood scenario in blue. The larger pixels in the 5% AEP demonstrate the lower resolution pluvial flood output compared to the 0.1% AEP higher resolution (smaller cells) output.

Building Exposure Rounding

For some towns/settlements that have very few exposed buildings (typically less than 5) some results may increase or decrease due to rounding of the flood modelling methodology. In this instance, when presented on graphs some of the higher frequency AEPs may provide results that are greater than lower frequency scenarios.

Halcombe Building Anomaly

While compiling risk results for Halcombe, we identified an anomaly where one building was included in the Rangitīkei District (pink area) totals, while the remaining buildings were counted under Manawatū District (blue area). Figure 3 shows the building, outlined in the red circle, is located within the Rangitīkei District, but is located within the Halcombe town/settlement (east of the black solid line) as the Halcombe polygon includes parts of both districts. We interpret this to be a result of the coarse resolution boundary (light blue line) between the two districts. After consultation with Horizons, we have reassigned this building to the Manawatū District results for consistency.

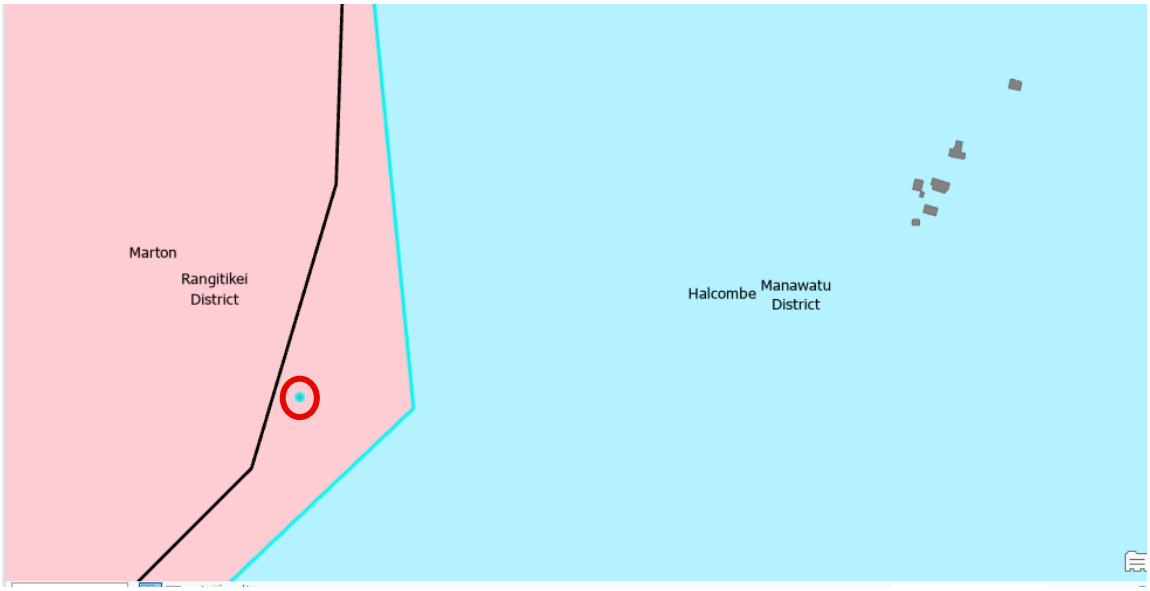


Figure 3: Example of Halcombe town/area overlapping Rangitīkei and Manawatū Districts, with one building assigned to Rangitīkei.

Town/Settlement Cross Boundaries with Districts

Within the region, some towns and settlements span multiple district boundaries. For example, as shown in Ashhurst (outlined in blue) overlaps the Manawatū, Palmerston North, and Tararua Districts (Figure 4), resulting in buildings being allocated across all three districts. Therefore, in Appendix C Ashhurst is included in all three of these district results. To address this, we have included a notation in the district tables to guide readers to the combined risk results for these towns/settlements, where data would otherwise appear split across multiple districts.

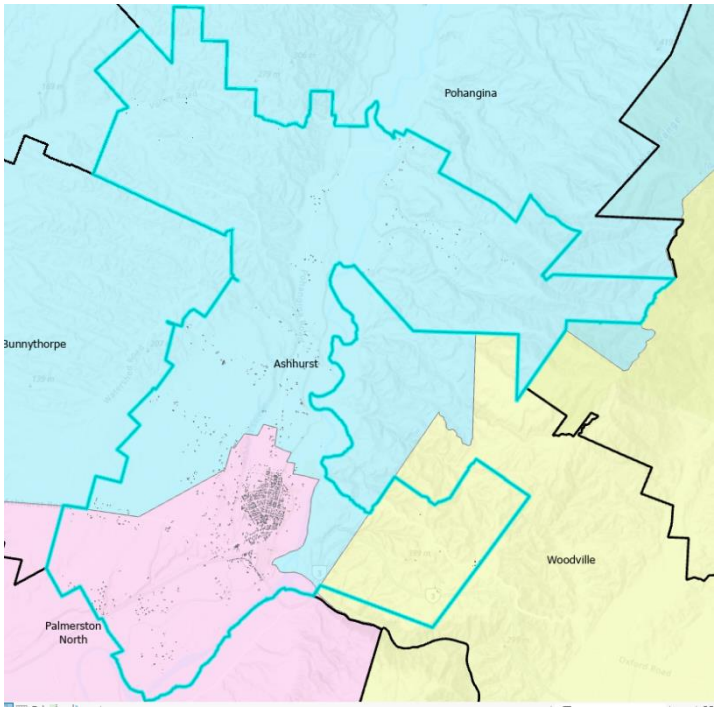


Figure 4: Example of Ashhurst town/settlement overlapping multiple district boundaries.

Reporting of Fatalities

The method used to quantify fatalities uses a fatality ratio derived from a fatality curve. This approach derives ratios that are decimals and therefore, fatality results are reported as decimals. As partial fatalities appear unrealistic, ESNZ and WSP propose to round the fatalities to the nearest whole number, except if the fatalities are between 0 and 1. For those results, we propose to report fatalities as "0 to 1" to indicate that there is still a non-zero probability of fatalities. This approach would maintain consistency with the Life Cost results. The Life Cost is greater than zero for most towns/communities, even when the Fatalities number is close to zero. Results would look inconsistent if the Fatalities were zero but there was a Fatality Cost, even though it is an accurate sum.

Exclusions

Any reporting for buildings or people located in Stratford, Waitomo, and Taupō Districts has been excluded from results presented in this letter report.

Yours sincerely,
Richard Woods
Service Line Lead Risk & Resilience

APPENDIX D1 (APPENDIX A) – NEW TABLES

Table D1.1.1: Area of town/settlement and depth of modelled flooding by area for 5% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,263.5	703.9	414.1	146	231.9	35.7	255.8
Palmerston North	23,773.1	1,661.1	988.2	610.9	299	290.1	107.4	353.9
Feilding	9,478.4	1,008.1	444.1	282.5	137.3	98	36.2	5.4
Marton	27,551.2	2,562.2	1,087.6	516.7	221.9	175.8	87.2	86.7
Ohakune	9,662.1	805.2	348	163.8	62.5	47.9	14.4	8.9
Longburn	1,453.9	210.2	148.9	65.9	31.5	45.5	29.7	56.8
Kairanga	6,934.0	1,315	889.8	430.5	212.6	148.3	9.8	3
Levin	10,346.0	1,602.4	280.4	170.3	85.5	50.5	5.4	1
Woodville	11,941.0	689.7	327.9	235.5	170.3	298.7	291.2	1,609
Foxton	13,738.4	2,285.3	1,109	688	223.2	388.3	268.9	266.6
Foxton Beach	1,761.7	176.4	163.3	269.3	101.6	84.2	17.6	79.6
Taumarunui	12,934.8	369.6	204.4	123.7	62.8	84.3	58.7	195.7
Dannevirke	36,922.8	2,699.6	903.3	512	246.4	248.6	131.1	244.8
Bulls	9,716.2	1,344.9	744.9	414.1	160.7	115.6	61.4	61.3
Tangimoana	8,493.8	1,277.4	580.7	303	154.8	130.1	33.5	14.5
Hunterville	53,017.8	1,765	845.7	399.7	162.4	143.7	89.9	173.5
Shannon	11,244.3	531	486.8	381.1	137.3	43	10.6	9.5
Koitiata	1,142.3	136.8	97.8	55	12.2	10.3	5.6	16.4
Ōhau	2,452.0	290.5	167.8	82.5	27.6	24.2	3.4	3.8
Hokio Beach	3,921.6	457	437	230.4	77.2	75.9	1.5	3.6
Bunnythorpe	9,427.8	764.7	392.4	265.9	103.9	56.3	10.1	1.1
Eketāhuna	40,805.7	2,360.2	1,055.7	496.8	218.5	222.6	86.5	48.7
Mangaweka	27,305.0	781.9	356.6	171.5	88	98	52.5	221.7
Ōwhango	15,158.8	410.9	177.8	86.3	37.5	36.9	19.9	51.5
Ōhura	34,144.7	870.9	455.8	212.2	102.2	118.5	95.6	110.7
Pohangina	28,253.8	1,126.8	700.6	397.2	193.6	210.7	54	21.1
Pongaroa	58,991.3	1,512.2	649.1	256.3	130.8	162.4	106.2	92.4
Mangamutu	1,588.8	113.1	82.7	57	34.9	31.7	11	2.9
Pahiatua	56,689.3	2,244.2	1,264	662.2	296.4	338	203.9	232.7
Ashhurst	10,701.0	728.8	432.1	235.8	88.3	96.3	53.7	90.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	181.4	151.7	59.7	28.4	17.7	0	-
Taihape	69,461.7	2,076.5	1,079.9	473.2	185	185.2	100	170.3
Waitārere Beach	185.9	12.8	11.3	7.9	1.6	0.2	-	-
Raetihi	30,488.4	885.1	371.4	174.9	67.7	57.8	23	44.9
Manakau	5,986.2	496.6	246.1	149.7	58.6	20.7	1.7	0
Sanson	4,281.9	274.3	177.5	107	44.2	26.4	8.5	14
Linton	10,279.8	636.3	374.4	209.2	81.3	105.5	28	19.2
Ohakea	2,524.8	392.1	124.7	47.1	10.9	3.4	1.6	3
Norsewood	5,570.8	491.3	158.3	64.9	28.3	27	13.5	11.4
Tokomaru	7,107.1	409.3	259.2	241.6	156.3	59.4	9.9	3
Waiouru	3,136.5	193.1	78.3	30.6	8.9	6.8	3.4	1.5
National Park	9,073.6	343	148.2	73.5	29	22.3	11.1	9.2
Waikawa Beach	383.6	44	28.2	11.7	3.2	2.8	0.6	-
Mangatainoka	2,981.3	157.4	113.2	82.3	52.6	86.5	93.4	539.1
Ormondville	17,722.6	744.6	279.9	172.6	73.4	95.6	61.2	97.7
Rongotea	10,355.3	1,150.6	541.6	356.2	186	147.9	20.1	10
Rātana	2,717.0	256.5	166.1	93.1	30.7	25.3	8.5	20.7
Halcombe	20,806.9	1,413.6	971.3	752.1	350.5	266.6	158.5	109.3
Kimbolton	9,574.4	421.4	234.2	136.7	56.6	45.5	18.7	11.7
Rangataua	2,715.2	196.9	57.3	32.9	11	6.6	1.1	0.3
Raurimu	2,929.2	154.6	67	35.4	17.1	15.5	6.8	9.3
Kai Iwi	8,441.7	326.9	249.4	155.8	62.3	58.3	25.9	26.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.2: Area of town/settlement and depth of modelled flooding by area for 5% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,269.5	698	403	140.4	231.1	35.3	255.6
Palmerston North	23,773.1	1,669.8	989.6	608.1	297.4	289.9	125.9	341.1
Feilding	9,478.4	1,130.1	507.5	277	133.7	100.3	34.9	4.4
Marton	27,551.2	2,561.8	1,107.5	543.4	233.1	162.3	84.7	84
Ohakune	9,662.1	805.2	348	163.8	62.5	47.9	14.4	8.9
Longburn	1,453.9	280.1	192.4	76.2	44.8	61.9	33.2	55.7
Kairanga	6,934.0	1,108.1	1,036.2	515.8	275.6	357.7	349.7	107.5
Levin	10,346.0	1,602.4	279.9	170.1	85.5	50.5	5.4	1
Woodville	11,941.0	705.7	331.2	239.5	168	295.7	291.7	1,609.8
Foxton	13,738.4	2,314.7	1,156.6	748.1	359	382.5	63.9	151.7
Foxton Beach	1,761.7	207.9	210.5	220.5	63.8	49.4	13.5	79.1
Taumarunui	12,934.8	369.8	204.2	121.6	62.2	84.2	58.7	195.7
Dannevirke	36,922.8	2,697.5	913.6	517.2	247.6	248.7	131.2	244.9
Bulls	9,716.2	1,344.5	768.4	469.7	181.5	117.7	61.2	56.5
Tangimoana	8,493.8	1,287.7	592.4	347	161	79.1	26.3	6.9
Hunterville	53,017.8	1,796.5	869	415.6	170.6	142.3	85.8	161.6
Shannon	11,244.3	480.3	425.9	465.2	245.7	69.2	7.6	8.2
Koitiata	1,142.3	137.1	97.7	55	12.1	10.5	5.7	16.5
Ōhau	2,452.0	285.7	173.5	85.8	26.4	21	3.9	2.2
Hokio Beach	3,921.6	457	437	230.4	77.3	75.9	1.5	3.6
Bunnythorpe	9,427.8	768	405	261.1	103.3	56.3	9.9	1.1
Eketāhuna	40,805.7	2,361.9	1,055.4	496.7	218.6	222.8	86.4	48.7
Mangaweka	27,305.0	781	356.6	171.6	88	98	52.5	221.7
Ōwhango	15,158.8	410.9	177.8	86.3	37.5	36.9	19.9	51.4
Ōhura	34,144.7	871.2	455.7	212.2	102.2	118.5	95.6	110.7
Pohangina	28,253.8	1,126.4	701	397.1	193.5	210.7	53.9	21.1
Pongaroa	58,991.3	0.7	0.2	-	-	-	-	-
Mangamutu	1,588.8	111.7	83.7	59.1	36.6	32.5	11.2	2.6
Pahiatua	56,689.3	2,246.4	1,263.2	659	294.7	338	203.5	232.6
Ashhurst	10,701.0	735.6	435.2	239.5	89.8	96.7	58.3	88.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	181.3	151.7	59.6	28.4	17.7	0	-
Taihape	69,461.7	2,076.7	1,079.5	473	185.1	185.1	100.1	170.2
Waitārere Beach	185.9	12.8	11.3	7.9	1.6	0.2	-	-
Raetihi	30,488.4	885.2	371.5	174.9	67.7	57.8	23	44.9
Manakau	5,986.2	496.8	245.5	149.5	58.6	20.7	1.7	0
Sanson	4,281.9	274.3	177.4	107	44.3	26.3	8.5	14
Linton	10,279.8	647.6	454.3	283.3	118.3	113.6	32.3	17.3
Ohakea	2,524.8	395.1	128.4	46.1	10.6	3	1.6	2.9
Norsewood	5,570.8	491.2	158.3	64.9	28.3	27	13.5	11.4
Tokomaru	7,107.1	354.3	266.4	337	208	73.1	10.5	3
Waiouru	3,136.5	193.1	78.3	30.6	8.9	6.8	3.4	1.5
National Park	9,073.6	343	148.2	73.5	29	22.3	11.1	9.2
Waikawa Beach	383.6	44	28.2	11.7	3.2	2.8	0.6	-
Mangatainoka	2,981.3	156.9	113.1	82.6	52.5	86.6	93.4	539
Ormondville	17,722.6	744.1	279.9	172.6	73.4	95.5	61.3	97.7
Rongotea	10,355.3	1,122	683.6	466.2	200.1	240.1	148.1	16.8
Rātana	2,717.0	256.6	166.1	93	30.8	25.4	8.5	20.8
Halcombe	20,806.9	1,417.1	965.7	753.2	337	263.3	158.4	106.3
Kimbolton	9,574.4	421.4	234.1	136.8	56.6	45.5	18.7	11.7
Rangataua	2,715.2	196.9	57.2	32.9	11	6.6	1.1	0.3
Raurimu	2,929.2	154.6	67	35.4	17.1	15.5	6.8	9.3
Kai Iwi	8,441.7	327.1	249.4	155.7	62.4	58.3	25.9	26.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.3: Area of town/settlement and depth of modelled flooding by area for 2% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,299.1	724.8	446.8	159.5	225.5	73.7	280.1
Palmerston North	23,773.1	1,682.4	1,034.2	650.9	333	399.8	161.8	404.5
Feilding	9,478.4	1,074.5	493.6	309.5	153.3	117.5	41.4	12.7
Marton	27,551.2	2,609	1,165.8	595.3	269.7	228.5	96.9	122.3
Ohakune	9,662.1	841.5	369.3	180.2	70.3	57	18.9	12.9
Longburn	1,453.9	212.8	155.3	77.3	24.5	52.2	37.6	68.1
Kairanga	6,934.0	1,238.9	1,062.2	511	234.8	327.4	21.2	3.9
Levin	10,346.0	1,677.9	304.2	179	94.7	65	8.2	1.8
Woodville	11,941.0	689.9	308.6	198.8	139.7	248.5	266	2,002.5
Foxton	13,738.4	2,377.5	1,161.5	668.2	241.6	332.3	314.2	352.3
Foxton Beach	1,761.7	176.3	158.7	211.6	166.9	100.7	20.3	79.1
Taumarunui	12,934.8	372.4	209.5	120.1	73.5	100	72.2	239.1
Dannevirke	36,922.8	2,847.7	927.6	547.9	275.9	280.9	146	294.5
Bulls	9,716.2	1,377.6	754.1	492.3	213.5	155.2	71.7	77.7
Tangimoana	8,493.8	1,326.8	601.8	320.9	160.2	184.3	45.8	21.8
Hunterville	53,017.8	1,835	915.9	440.3	191.5	176.4	101.6	221.2
Shannon	11,244.3	512.5	511.4	435.6	182	58	11.8	10.3
Koitiata	1,142.3	145	103.4	67.9	13.6	12	7.2	18.9
Ōhau	2,452.0	290.6	185.4	97.7	34.1	31	6.1	4.7
Hokio Beach	3,921.6	451.1	452.2	254.4	82.5	93.3	4.2	2.9
Bunnythorpe	9,427.8	803.5	388.4	272.9	119.5	71.3	15.5	1.6
Eketāhuna	40,805.7	2,430.8	1,127	536.1	229.5	239.8	100.7	60.4
Mangaweka	27,305.0	810.2	354.5	174.7	87.5	103	61.5	260
Ōwhango	15,158.8	419	183.4	91.2	40.9	38.2	21.1	59.9
Ōhura	34,144.7	876.6	482.7	235.7	113.1	131.3	99.6	157.1
Pohangina	28,253.8	1,142.2	748.2	466.6	213.5	242.9	72	28.1
Pongaroa	58,991.3	1,580.8	672.8	272.7	138.1	180.5	120.6	150.2
Mangamutu	1,588.8	113.6	87.6	65	38.6	39.9	13.2	13.5
Pahiatua	56,689.3	2,338.8	1,373	737.2	353.1	373.1	227.5	294.1
Ashhurst	10,701.0	746.2	451.7	286.3	127.5	110.9	61.6	104.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	179.7	163	69.1	25.4	25.5	0.1	-
Taihape	69,461.7	2,095.4	1,104.2	504.6	211.8	205	112.5	207.7
Waitārere Beach	185.9	13.1	12.3	9.7	3.3	0.4	-	-
Raetihi	30,488.4	902	390.9	190	75	65.9	28.9	54.3
Manakau	5,986.2	524.4	257.6	177	71.5	32.9	3	0
Sanson	4,281.9	281.5	188	117.5	44	34.8	12.2	17
Linton	10,279.8	649.1	382.2	206.3	78.8	114.7	50.8	26.6
Ohakea	2,524.8	402	122.1	96.3	31.6	8.4	2	3.4
Norsewood	5,570.8	509.4	163	69.2	28.7	28.5	14.2	12.2
Tokomaru	7,107.1	401.6	259.3	245.8	186.2	91.6	12.9	3.6
Waiouru	3,136.5	199.9	80.9	33.9	9.9	7.5	3.6	2.5
National Park	9,073.6	357.7	148.7	78.8	33.4	27.4	11.7	12.4
Waikawa Beach	383.6	43.9	31.1	13.6	4.7	2.5	1.4	-
Mangatainoka	2,981.3	154.3	108.5	82.8	51.7	69.6	72.1	642
Ormondville	17,722.6	767.4	281.8	170.9	81.7	97.8	67.4	117.7
Rongotea	10,355.3	1,195.5	556.9	363.5	199.3	209.1	29.4	11.8
Rātana	2,717.0	260.3	169.9	104.6	37.1	30.8	9.8	24.4
Halcombe	20,806.9	1,432.2	923.1	743	450	343.1	186.5	151.2
Kimbolton	9,574.4	437.5	237	141.8	63.9	58.7	24	17.6
Rangataua	2,715.2	208.6	58.9	34.8	13	8	1.3	0.4
Raurimu	2,929.2	159.6	67.7	38	17.2	16.9	8	11
Kai Iwi	8,441.7	339.4	246	161.2	66.9	62.8	27.6	36.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.4: Area of town/settlement and depth of modelled flooding by area for 2% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,303.8	718	440.8	158	225	73.9	280
Palmerston North	23,773.1	1,698.3	1,089.4	696.2	376.1	450.5	173.9	401.5
Feilding	9,478.4	1,189.1	568.5	305.9	149.4	119.8	40.8	11
Marton	27,551.2	2,599.4	1,180.6	620.1	284.4	222.5	92.7	120.7
Ohakune	9,662.1	841.5	369.3	180.2	70.3	57	18.9	12.9
Longburn	1,453.9	281.9	245.4	114.9	39.9	75.3	41.3	64.1
Kairanga	6,934.0	1,040.6	1,075.5	613.2	279	429	315.4	269.9
Levin	10,346.0	1,678.4	302.8	178.1	94.7	64.9	8.2	1.8
Woodville	11,941.0	701.7	312.4	204.8	139.2	245.8	266.4	2,002.6
Foxton	13,738.4	2,390.6	1,182.3	770.4	389.2	439.6	121.4	153
Foxton Beach	1,761.7	210.8	208.6	235.5	67.7	50.6	13.3	78.3
Taumarunui	12,934.8	372.1	209.7	117.8	71.7	99.8	72.3	239.1
Dannevirke	36,922.8	2,846	935.3	554.4	276.7	281.4	146.3	294.7
Bulls	9,716.2	1,368.8	766.9	534.1	243.3	159.6	69.5	74.7
Tangimoana	8,493.8	1,336.3	616.3	359.2	182.1	134.8	29	8.6
Hunterville	53,017.8	1,843.8	949.2	464.2	199.2	176.2	97.4	203.8
Shannon	11,244.3	456	386.4	422.3	320.7	203.3	14.5	9
Koitiata	1,142.3	145.3	103.4	69.2	13.6	12	7.3	18.9
Ōhau	2,452.0	290.2	189.6	103.2	31.4	25.9	5.1	3.6
Hokio Beach	3,921.6	451.1	452.2	254.4	82.5	93.3	4.2	2.9
Bunnythorpe	9,427.8	804.2	405	270.7	116.5	71.1	15.4	1.4
Eketāhuna	40,805.7	2,430.5	1,126.8	536.1	229.4	240	100.8	60.4
Mangaweka	27,305.0	810.3	354.7	174.7	87.5	103	61.5	259.9
Ōwhango	15,158.8	419.1	183.4	91.1	41	38.2	21.1	59.9
Ōhura	34,144.7	877.2	482.7	235.7	113.1	131.3	99.6	157.1
Pohangina	28,253.8	1,141.9	748.6	466.4	213.5	242.8	71.9	28.1
Pongaroa	58,991.3	1	0.2	-	-	-	-	-
Mangamutu	1,588.8	110.5	87.8	67.6	41.1	40.9	13.4	13.1
Pahiatua	56,689.3	2,333.7	1,361.8	730	350.2	373.5	227.4	294
Ashhurst	10,701.0	757.3	468.4	317.4	140.8	115	62.5	107.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	179.7	163	69.1	25.4	25.5	0.1	-
Taihape	69,461.7	2,095.2	1,104.1	504.2	212.3	205	112.5	207.7
Waitārere Beach	185.9	13.1	12.3	9.7	3.3	0.4	-	-
Raetihi	30,488.4	901.9	390.9	190	75	65.9	28.9	54.3
Manakau	5,986.2	524.4	257.1	176.6	71.5	32.9	3	0
Sanson	4,281.9	281.5	187.9	117.5	43.9	34.8	12.2	17
Linton	10,279.8	663.7	461.5	309.3	137.4	134.6	42.2	21.5
Ohakea	2,524.8	400.6	127	98.5	26.7	7.2	2.1	3.1
Norsewood	5,570.8	509.4	163	69.2	28.7	28.5	14.1	12.2
Tokomaru	7,107.1	349	245.2	320.1	233.5	147.5	13.8	3.8
Waiouru	3,136.5	199.8	80.9	33.9	9.9	7.5	3.6	2.5
National Park	9,073.6	357.7	148.7	78.8	33.4	27.4	11.7	12.4
Waikawa Beach	383.6	43.9	31.1	13.6	4.7	2.5	1.4	-
Mangatainoka	2,981.3	154.2	108.3	83.1	51.9	69.8	72	642
Ormondville	17,722.6	766.3	281.5	171	81.7	97.8	67.4	117.8
Rongotea	10,355.3	1,163	695.7	505	228.4	254.3	161.1	28.9
Rātana	2,717.0	260.7	170.2	104.7	37.1	30.9	9.8	24.4
Halcombe	20,806.9	1,440.1	927.3	746.2	448.1	325.9	186.1	148.4
Kimbolton	9,574.4	437.5	236.8	141.9	63.9	58.7	24	17.6
Rangataua	2,715.2	208.6	58.9	34.8	13	8	1.3	0.4
Raurimu	2,929.2	159.6	67.8	38	17.2	16.9	8	11
Kai Iwi	8,441.7	339.3	246.1	161.2	66.9	62.8	27.6	36.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.5: Area of town/settlement and depth of modelled flooding by area for 1% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,330.6	739.9	471.8	168.7	183.7	152	294.8
Palmerston North	23,773.1	1,710.1	1,065.9	687.9	355	437.1	217.8	448.7
Feilding	9,478.4	1,111.7	530.3	344.7	174.4	136.7	46.4	18.6
Marton	27,551.2	2,632.8	1,207.4	625.3	315.8	273.7	103.3	147.3
Ohakune	9,662.1	863.5	379.8	197.5	74.9	63.4	22.5	16
Longburn	1,453.9	211.7	164.9	97.4	27.4	68.3	43.6	77.6
Kairanga	6,934.0	1,165.1	1,112.2	613	257.3	368.8	164.4	6.5
Levin	10,346.0	1,724.4	320.2	183.6	101.6	75.9	11.2	2.5
Woodville	11,941.0	685.2	308.3	182.5	123.9	194	232.6	2,245.5
Foxton	13,738.4	2,433	1,173.7	706.3	270.3	337.7	321.5	402
Foxton Beach	1,761.7	179.7	160.4	145.5	230.6	115.9	22.5	79.4
Taumarunui	12,934.8	374.7	208.4	123.3	71.9	110.6	80.1	281.1
Dannevirke	36,922.8	2,946.2	956.8	572.6	296.9	307.5	160.5	333
Bulls	9,716.2	1,396.2	754.4	528.3	260.6	183.8	83.8	90.8
Tangimoana	8,493.8	1,354.8	620.7	353.2	155	224.5	55.2	29.6
Hunterville	53,017.8	1,866.1	960.7	487.8	209.4	205.7	111	258.5
Shannon	11,244.3	504.1	508.3	496.1	207	80.4	13.4	10.7
Koitiata	1,142.3	146.4	123.3	93.7	29.3	13.5	8.4	19.7
Ōhau	2,452.0	288.1	192.6	114	42.9	35.7	10.6	4.9
Hokio Beach	3,921.6	447.8	457.4	273.4	88.8	100	10.2	3.1
Bunnythorpe	9,427.8	831.2	392.7	279.8	121.6	87.6	18.7	3.4
Eketāhuna	40,805.7	2,476.5	1,188.9	566.4	242.5	250.1	112.1	71
Mangaweka	27,305.0	826.3	362	179.9	90.6	106.7	61.4	286.8
Ōwhango	15,158.8	425.7	188.2	92.8	43.6	39.4	21.5	65.2
Ōhura	34,144.7	883.7	505.9	255.8	121.1	141.9	101.8	188.3
Pohangina	28,253.8	1,152	766.3	520.7	234	256.9	86.7	36.4
Pongaroa	58,991.3	1,609.2	699.3	283.9	137.5	178.4	118	211.3
Mangamutu	1,588.8	110.6	86.9	69.1	42.4	45.6	11.1	23
Pahiatua	56,689.3	2,380.9	1,445.6	795.9	379.8	418	238	343.1
Ashhurst	10,701.0	766.6	471.2	305.8	157.3	131.4	67.3	117.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	177.6	169.7	75.8	25.6	30.2	0.2	-
Taihape	69,461.7	2,103.7	1,128.1	528.8	216.2	220.1	125.6	236.1
Waitārere Beach	185.9	14.5	12.7	10.2	5.1	0.8	-	-
Raetihi	30,488.4	908.4	409.6	196.8	82.5	74	33.7	63.4
Manakau	5,986.2	548.2	269.3	192.6	80.8	44.2	4.6	0
Sanson	4,281.9	280.4	191.6	118.5	50.5	40.2	14	20.5
Linton	10,279.8	663.5	385.4	210.3	72.8	109.8	72.9	33.6
Ohakea	2,524.8	416.6	130.3	105.1	56.4	17.7	2.8	3.9
Norsewood	5,570.8	521.6	167.9	70.6	29.3	29.6	14.2	13.3
Tokomaru	7,107.1	398.9	244.9	258.8	193.3	122.6	13.6	4.8
Waiouru	3,136.5	206.6	81	30.6	10.2	8.9	2.9	2.3
National Park	9,073.6	372.5	151	79.4	36.2	29.2	12.9	15.1
Waikawa Beach	383.6	43.5	32.6	15.3	5.6	2.6	1.9	-
Mangatainoka	2,981.3	156.2	106.4	83.4	48.6	69.9	56.8	697.2
Ormondville	17,722.6	781.1	288.7	168.8	88.6	101.4	69.7	132.2
Rongotea	10,355.3	1,234.1	577.9	368.3	210.2	230.4	62.7	14.2
Rātana	2,717.0	261	181.6	130	41	33.7	12.2	27.8
Halcombe	20,806.9	1,445	891.3	723.7	488.3	421.6	193.4	191.4
Kimbolton	9,574.4	434.2	245.7	144.8	68	64.9	28.7	23.6
Rangataua	2,715.2	217.2	60.4	36.1	14.3	8.8	1.7	0.4
Raurimu	2,929.2	162.5	68.1	38.8	18.1	18.6	8.8	13.3
Kai Iwi	8,441.7	351.2	238.1	161.5	71.1	61.8	32.4	42.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.6: Area of town/settlement and depth of modelled flooding by area for 1% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,336.1	732.5	463.4	168.3	184.8	152.1	294.9
Palmerston North	23,773.1	1,704.1	1,149.5	786.8	421.1	522.7	230.3	450.2
Feilding	9,478.4	1,210	614.8	346.6	167.7	138.7	45.4	16.6
Marton	27,551.2	2,617.2	1,204	653.7	335	276.8	98.2	145.6
Ohakune	9,662.1	863.5	379.8	197.5	74.9	63.4	22.5	16
Longburn	1,453.9	258.8	316.5	184	37.7	81.2	47.4	70.3
Kairanga	6,934.0	1,004.2	1,064.4	696.2	284	469	304.5	374
Levin	10,346.0	1,725.1	319.2	181.1	101.3	75.8	11.2	2.5
Woodville	11,941.0	697.3	310.7	188.3	124	191.7	232.5	2,246
Foxton	13,738.4	2,447	1,190.7	807.3	389.6	461	168.1	156.8
Foxton Beach	1,761.7	214	213.1	242.7	71.2	52.6	13.3	78.3
Taumarunui	12,934.8	374.5	207.9	122	68.9	110.1	80.1	281.2
Dannevirke	36,922.8	2,942.9	964.8	578.3	299.1	307.9	160.6	333.3
Bulls	9,716.2	1,385	762.6	558.3	296.1	191.2	81.8	86.7
Tangimoana	8,493.8	1,355.2	637.5	389.6	183.8	181.1	31.4	9.8
Hunterville	53,017.8	1,857	988.8	512.7	217.1	206.8	106.8	239.9
Shannon	11,244.3	430.9	378.9	348.8	208.8	514.6	26.8	10.7
Koitiata	1,142.3	146.2	123.2	93.6	29.1	13.4	8.4	19.7
Ōhau	2,452.0	290.5	196.8	116.8	38.4	30	7.1	3.9
Hokio Beach	3,921.6	447.9	457.4	273.4	88.8	100	10.2	3.1
Bunnythorpe	9,427.8	829.6	412.2	279.8	115.6	87.3	18.7	2.9
Eketāhuna	40,805.7	2,476.7	1,188.2	565.4	242.4	250.2	112.1	71
Mangaweka	27,305.0	826.2	362.1	179.9	90.6	106.7	61.4	286.7
Ōwhango	15,158.8	425.8	188.2	92.8	43.6	39.4	21.5	65.2
Ōhura	34,144.7	883.5	506	255.9	121	141.9	101.8	188.3
Pohangina	28,253.8	1,151.9	766.3	520.5	233.9	256.8	86.6	36.4
Pongaroa	58,991.3	0.9	0.3	-	-	-	-	-
Mangamutu	1,588.8	107	87.4	71.3	43.9	47.6	11.5	22.4
Pahiatua	56,689.3	2,370.6	1,417.2	784.8	372.9	417.6	238.5	342.7
Ashhurst	10,701.0	766.5	481.5	355.4	187.2	141.7	67.7	120.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	177.6	169.7	75.8	25.6	30.2	0.2	-
Taihape	69,461.7	2,103.6	1,128.3	529.3	215.7	220.2	125.6	236.1
Waitārere Beach	185.9	14.5	12.7	10.2	5.1	0.8	-	-
Raetihi	30,488.4	908.5	409.6	196.8	82.5	74	33.7	63.4
Manakau	5,986.2	548.3	269	192	80.8	44.2	4.6	0
Sanson	4,281.9	280.5	191.5	118.4	50.6	40.2	14	20.5
Linton	10,279.8	678.6	470.9	322.1	148.3	158.7	49.7	24.3
Ohakea	2,524.8	403.2	133.5	107.1	50.9	14.2	2.9	3.5
Norsewood	5,570.8	521.7	167.9	70.6	29.3	29.6	14.2	13.3
Tokomaru	7,107.1	340.2	221.8	309.2	198.8	265.7	21.7	6
Waiouru	3,136.5	206.7	81	30.6	10.2	9	2.8	2.3
National Park	9,073.6	372.4	151	79.4	36.2	29.2	12.9	15.1
Waikawa Beach	383.6	43.5	32.6	15.3	5.6	2.6	1.9	-
Mangatainoka	2,981.3	156.1	106.3	83.8	48.7	70.2	56.9	697.1
Ormondville	17,722.6	779.5	288.6	168.9	88.6	101.4	69.7	132.3
Rongotea	10,355.3	1,192.7	708.7	524.3	248.8	264.6	166.1	38.7
Rātana	2,717.0	261.4	181.5	130.1	40.9	33.7	12.2	27.8
Halcombe	20,806.9	1,451.1	897.6	729.1	492.7	397	192.2	188.6
Kimbolton	9,574.4	434.2	245.9	144.8	68	64.9	28.7	23.6
Rangataua	2,715.2	217.2	60.3	36.2	14.3	8.8	1.7	0.4
Raurimu	2,929.2	162.5	68.1	38.7	18.1	18.6	8.8	13.3
Kai Iwi	8,441.7	351.3	238.2	161.5	71.1	61.8	32.4	42.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.7: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,357.4	736.1	478.9	217.7	172.9	173.9	338.6
Palmerston North	23,773.1	1,732.1	1,121.1	745.2	386	462.3	271.7	502.2
Feilding	9,478.4	1,141.6	567.4	374.6	188.6	148.3	50.8	23.6
Marton	27,551.2	2,653.9	1,215	643.7	355.8	332.1	117.3	172.5
Ohakune	9,662.1	888.2	393.8	208.7	81.5	70.6	26.6	18.8
Longburn	1,453.9	264.6	225.6	132	29.1	71.1	52.5	87.1
Kairanga	6,934.0	1,104.4	1,112.9	662.4	320	342.4	344.2	54.3
Levin	10,346.0	1,770.9	335.9	186.3	106.2	85.9	13.7	3.2
Woodville	11,941.0	683.2	314.2	171.3	112.5	168.4	171	2,454.1
Foxton	13,738.4	2,467.3	1,185.2	661.9	342.9	344.7	352.7	457
Foxton Beach	1,761.7	185.2	162.8	130.5	243.2	130.4	23.9	80
Taumarunui	12,934.8	376.8	217.3	124.3	75.3	111.3	85.5	322.7
Dannevirke	36,922.8	3,036.5	973.6	586.5	315.6	336.9	167.8	370.3
Bulls	9,716.2	1,417.3	755.2	547.3	286.1	229	95.5	104.2
Tangimoana	8,493.8	1,362.2	636.2	397.2	156.4	256.9	68.3	37.7
Hunterville	53,017.8	1,888.2	971.5	527.2	226.3	224.5	119.9	295.3
Shannon	11,244.3	474.7	519.6	542.4	228.3	99.7	14.8	10.9
Koitiata	1,142.3	137.7	128.4	113.1	48.7	21.4	9.2	20.8
Ōhau	2,452.0	286.5	195.7	128.8	52.4	41.4	14	5.7
Hokio Beach	3,921.6	440.5	470	294.2	94.9	105.2	14.4	4
Bunnythorpe	9,427.8	848.8	401.3	283.4	129.3	96.2	26.5	4.2
Eketāhuna	40,805.7	2,507.4	1,244.7	597.4	252.9	258.5	121.3	81.8
Mangaweka	27,305.0	843.1	368.3	185.4	92.4	110.3	63.4	306.5
Ōwhango	15,158.8	435.3	190.9	95.7	44.3	40.8	22.3	69.9
Ōhura	34,144.7	887.3	531.1	286.1	133.6	151	105.3	217.3
Pohangina	28,253.8	1,164.7	771.7	566.3	254.2	271.3	100.4	44.3
Pongaroa	58,991.3	1,650.1	710.6	296.6	143.2	183.6	120	252.5
Mangamutu	1,588.8	110.1	86.2	71.5	43.4	51.9	10	30.1
Pahiatua	56,689.3	2,399.1	1,510.1	841.1	412.1	447.2	259.9	392.7
Ashhurst	10,701.0	757.8	485.6	322.8	176.2	156.5	72.1	127.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	176.3	174.8	82.8	26.1	34.2	0.3	-
Taihape	69,461.7	2,126.2	1,137.9	543.4	225.3	233.5	133.1	267.1
Waitārere Beach	185.9	14.4	12.7	11.6	5.7	1.7	-	-
Raetihi	30,488.4	924.6	421.7	204.7	85.3	80	36.8	73.8
Manakau	5,986.2	561.7	275.6	205.8	93.2	55.4	5.9	0.1
Sanson	4,281.9	285.1	188.2	120.9	57.3	41.1	18.9	22.7
Linton	10,279.8	675	392	215.8	72.5	96.2	91.1	42.5
Ohakea	2,524.8	430.4	168.9	104.2	78.9	36.6	3.8	4.2
Norsewood	5,570.8	531.5	172.6	72.5	30.5	30.3	14.6	13.9
Tokomaru	7,107.1	400.2	238.4	242.7	210.2	153.1	15.2	6
Waiouru	3,136.5	210.9	80.9	31.3	10.1	9.1	3.6	2.5
National Park	9,073.6	379.6	152.8	82.4	38.9	31	13.1	16.5
Waikawa Beach	383.6	44.1	32.7	17.2	6.1	3.3	2.3	-
Mangatainoka	2,981.3	155.2	106.3	87.6	48.8	69.8	52.6	735.9
Ormondville	17,722.6	793.4	291.5	172.2	91.5	107	71.5	145.1
Rongotea	10,355.3	1,267.7	609.6	384.6	222.4	242.8	103.9	16
Rātana	2,717.0	254.3	171.5	156.4	56.3	37.3	13.7	31.5
Halcombe	20,806.9	1,460.4	867.7	705.5	489.4	510.2	200.6	238
Kimbolton	9,574.4	439.6	249.9	149.2	69.9	71	31.4	29.6
Rangataua	2,715.2	225.5	61.7	37.2	14.6	10.5	2	0.5
Raurimu	2,929.2	168.7	71.1	39.6	19	19.8	9.1	13.9
Kai Iwi	8,441.7	360.7	233.7	164.7	76.2	61.1	33.1	50.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.8: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,359.7	736.2	475.7	215.9	173.4	175.3	338.5
Palmerston North	23,773.1	1,713.8	1,202.3	870	474.6	569.2	293.8	497.3
Feilding	9,478.4	1,222.9	659.2	378.2	179.8	150.4	49.8	21.4
Marton	27,551.2	2,638.2	1,206.2	649.9	379.2	349.3	112.5	170.9
Ohakune	9,662.1	888.2	393.8	208.7	81.5	70.6	26.6	18.8
Longburn	1,453.9	233.4	340	269.3	48.4	84.9	53.3	76.5
Kairanga	6,934.0	980.6	1,071.1	764	302.5	471.4	334.2	444.7
Levin	10,346.0	1,771.8	335.1	183.4	105.8	85.8	13.7	3.2
Woodville	11,941.0	692.4	316.9	177.7	112	165.2	171.4	2,455.1
Foxton	13,738.4	2,489.1	1,208.8	822.3	403.6	483.8	185.6	158.8
Foxton Beach	1,761.7	218.3	216.9	250.1	69.1	59.4	13.5	78.7
Taumarunui	12,934.8	376	216.2	124.4	72.7	110.6	85.5	322.7
Dannevirke	36,922.8	3,039	980.7	591.4	317.2	337.7	167.9	370.8
Bulls	9,716.2	1,407.1	760.6	574.4	322.1	238.5	94.1	98.7
Tangimoana	8,493.8	1,368.2	641.8	440.5	186.8	223.9	35.6	11.4
Hunterville	53,017.8	1,890.8	1,001.6	552.6	234.2	224.6	116.4	276.2
Shannon	11,244.3	402.1	375.2	384.7	170.8	575.3	90.6	17.7
Koitiata	1,142.3	137.7	128.4	112.7	48.2	20.8	9.2	20.8
Ōhau	2,452.0	291.4	200.9	130.9	45.3	32.7	9.6	4.6
Hokio Beach	3,921.6	440.5	470	294.2	94.9	105.2	14.4	4
Bunnythorpe	9,427.8	845.4	421.3	288.5	122.8	93.9	26.5	3.6
Eketāhuna	40,805.7	2,507.2	1,244.2	597.1	252.8	258.6	121.2	81.8
Mangaweka	27,305.0	843.4	367.9	185.3	92.3	110.3	63.4	306.6
Ōwhango	15,158.8	435.3	190.9	95.7	44.3	40.9	22.3	69.9
Ōhura	34,144.7	887.2	531	286	133.6	151	105.3	217.3
Pohangina	28,253.8	1,163.6	771.8	566	254.2	271.1	100.3	44.2
Pongaroa	58,991.3	0.9	0.3	-	-	-	-	-
Mangamutu	1,588.8	106.4	85.8	72.8	45.9	54.4	10.5	29.6
Pahiatua	56,689.3	2,398.3	1,486.8	822.5	405.1	444.9	260.8	393
Ashhurst	10,701.0	753.6	487.4	372.2	226.3	179.8	72.8	130.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	176.3	174.8	82.8	26.1	34.2	0.3	-
Taihape	69,461.7	2,126.5	1,137.1	543.7	225.3	233	133.5	267.2
Waitārere Beach	185.9	14.4	12.7	11.6	5.7	1.7	-	-
Raetihi	30,488.4	924	421.7	204.7	85.3	80	36.8	73.8
Manakau	5,986.2	561.9	275.5	205.1	93.2	55.4	5.9	0.1
Sanson	4,281.9	285.1	188.1	120.9	57.3	41.1	18.9	22.7
Linton	10,279.8	691	477.3	334.8	149.3	175.2	57.5	27.1
Ohakea	2,524.8	432.9	165.1	108.5	75.4	29.4	3.6	3.9
Norsewood	5,570.8	531.5	172.7	72.5	30.5	30.3	14.6	13.9
Tokomaru	7,107.1	341.8	210.9	284	200.1	297.6	68.2	8.4
Waiouru	3,136.5	210.9	81	31.3	10.1	9.1	3.6	2.5
National Park	9,073.6	379.6	152.8	82.3	38.9	31	13.1	16.5
Waikawa Beach	383.6	44.1	32.7	17.2	6.1	3.3	2.3	-
Mangatainoka	2,981.3	155.4	106.2	87.9	48.9	70	52.7	735.9
Ormondville	17,722.6	792.7	291.7	171.8	91.5	106.9	71.5	145.1
Rongotea	10,355.3	1,211.6	717.7	540.7	265.5	272.5	170.3	46.2
Rātana	2,717.0	254.4	171.7	156.2	56	37.3	13.6	31.5
Halcombe	20,806.9	1,464.5	872.9	714	498	485.2	198.1	235
Kimbolton	9,574.4	441	250.8	149.6	70	71	31.4	29.6
Rangataua	2,715.2	225.5	61.7	37.2	14.6	10.5	2	0.5
Raurimu	2,929.2	168.7	71.1	39.6	19	19.7	9.1	14
Kai Iwi	8,441.7	360.3	234.1	164.6	76.2	61.1	33.1	50.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.9: Area of town/settlement and depth of modelled flooding by area for 0.2% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,370.7	760.2	529.4	260.8	239.1	172.2	399.1
Palmerston North	23,773.1	1,764.9	1,168.1	801.2	418.1	479.9	289.9	533
Feilding	9,478.4	1,168.9	607.7	413.8	205	162.4	58.8	31.3
Marton	27,551.2	2,529.8	1,267	625.5	402.2	498.1	186.5	237.7
Ohakune	9,662.1	906.6	405.5	227.1	87.7	81	30.4	22.8
Longburn	1,453.9	260.7	264.9	167.2	30.6	71.5	55.7	91.3
Kairanga	6,934.0	1,051.7	1,115.6	739.2	313.5	420.9	333.2	211.6
Levin	10,346.0	1,829.3	354.3	190.6	112.3	96.4	17.6	4.5
Woodville	11,941.0	683	326.4	176.3	119.9	142.3	133.4	2,631.9
Foxton	13,738.4	2,601.2	1,347.3	729.5	315.6	400	351.4	476.7
Foxton Beach	1,761.7	189.6	178.9	170.7	207	134.9	15.6	79.3
Taumarunui	12,934.8	371.9	223.8	135.5	72.8	119.7	94.3	370.3
Dannevirke	36,922.8	3,144.7	1,000.1	610.5	336.7	374.8	185.3	413.6
Bulls	9,716.2	1,411.1	799.8	593.9	326.9	355.6	112	154.1
Tangimoana	8,493.8	1,558.5	780.4	478.6	239.3	289.7	172.1	65.8
Hunterville	53,017.8	1,959.2	940.9	485.4	231.6	236.1	125.2	340.8
Shannon	11,244.3	445.6	487.5	595.4	263.2	127.9	16.4	11.3
Koitiata	1,142.3	143	128.1	124	61.6	36	9.6	20.4
Ōhau	2,452.0	289.7	195	146.4	60.8	49.5	17.6	7.3
Hokio Beach	3,921.6	410.6	448.8	379.6	103.8	112.1	19.1	4.1
Bunnythorpe	9,427.8	882.4	415.9	286.7	133.7	107.2	34.6	6.6
Eketāhuna	40,805.7	2,548.2	1,300.7	635.6	260.4	269	129.1	96.6
Mangaweka	27,305.0	793.7	231.4	141.1	87.2	115.4	68.4	336
Ōwhango	15,158.8	441.7	194.9	99.8	46	43.7	23	76.4
Ōhura	34,144.7	888.8	560.1	332	157.3	168.1	110.5	252.2
Pohangina	28,253.8	1,166.2	768.5	622.5	283.7	287.7	117.1	56.1
Pongaroa	58,991.3	1,708.2	730.9	312.6	156.1	192.2	126.7	296.5
Mangamutu	1,588.8	105.6	83	72.9	45.2	63.5	13	37.3
Pahiatua	56,689.3	2,436.7	1,579	888.3	440.8	498	279.8	470
Ashhurst	10,701.0	759	499.1	342.6	197.1	174.2	79.3	134.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	196.4	213.6	98	28.7	38.2	0.4	-
Taihape	69,461.7	1,931.6	626.4	342.8	175.3	205.7	129	339
Waitārere Beach	185.9	14.4	13.9	12.5	6.5	2.3	0	-
Raetihi	30,488.4	934.6	439.8	214.7	92.6	86.6	41.5	87.3
Manakau	5,986.2	567.4	294.4	216.2	109.2	69.3	7.6	0.6
Sanson	4,281.9	303.6	160.4	90.6	41.8	35.5	18.8	29.4
Linton	10,279.8	702.7	402.9	225.3	75.6	97	96	48.2
Ohakea	2,524.8	469.5	271.8	191.4	100.7	113.8	8.7	5.6
Norsewood	5,570.8	545.3	181.1	74.2	31.6	31.5	15.4	14.7
Tokomaru	7,107.1	407.2	238.3	218	196.2	214.6	18.6	7.1
Waiouru	3,136.5	209.6	58.3	24.6	9.6	9.2	3.6	2.7
National Park	9,073.6	389.6	155.7	83.1	43.7	33.8	14.9	20.3
Waikawa Beach	383.6	44	36.9	18.4	6.9	4.6	2.4	0.3
Mangatainoka	2,981.3	154.2	101.5	86.4	57.3	79.7	52	778.5
Ormondville	17,722.6	810.8	290.6	167.4	97.7	111	75.3	159.9
Rongotea	10,355.3	1,316.9	684.5	412.3	209.9	255.6	137.9	18.6
Rātana	2,717.0	249.6	153.6	157.8	75.7	53.5	15.2	34.9
Halcombe	20,806.9	1,508.2	734.3	529.8	376.2	600.7	235	326.7
Kimbolton	9,574.4	459.1	238.8	152.1	70.8	79.5	34.5	34.2
Rangataua	2,715.2	236.1	63.9	38.7	16.1	11.9	2.2	0.7
Raurimu	2,929.2	173	73.6	42	18.6	21.2	11.2	16.2
Kai Iwi	8,441.7	386.1	225.5	153.4	75.1	66.5	35.2	61.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.10: Area of town/settlement and depth of modelled flooding by area for 0.1% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,367.5	750.7	550.8	291.6	267.7	170.1	491.2
Palmerston North	23,773.1	1,770.1	1,198.4	859.8	467.1	523.6	317	577.5
Feilding	9,478.4	1,172	627.7	446.7	217.9	170.2	61.9	36
Marton	27,551.2	2,602.7	1,310.5	625.1	383.5	543.8	219.5	271.3
Ohakune	9,662.1	920.2	406	239.1	92	87.3	34.4	26.2
Longburn	1,453.9	246.3	309.5	222.5	38	67.7	61	98.3
Kairanga	6,934.0	999.9	1,063.7	791	316.9	493.6	319.1	409.3
Levin	10,346.0	1,866.8	366.1	193	116.4	102.9	20.2	5.7
Woodville	11,941.0	684.9	331.6	183.5	116.5	155.7	115.2	2,714
Foxton	13,738.4	2,625	1,367.4	749.1	317.7	404.9	358.4	503.8
Foxton Beach	1,761.7	189.9	186.7	158.8	220	143.6	16.3	79.4
Taumarunui	12,934.8	365.6	220.7	153.4	81.7	117.3	100.4	404.5
Dannevirke	36,922.8	3,209	1,011.1	628.4	349	397.6	200.2	440.5
Bulls	9,716.2	1,422.9	786.9	606.5	335.2	403.2	131.3	169.4
Tangimoana	8,493.8	1,574.6	789	475.3	267.3	302.1	207.3	73.4
Hunterville	53,017.8	2,002.1	975.9	504.5	250.3	247.7	137.2	374.9
Shannon	11,244.3	431.6	460	624.2	291.4	146.8	17.3	11.7
Koitiata	1,142.3	134.5	124	129.5	68.9	50.3	10.2	21.4
Ōhau	2,452.0	293.3	195.7	159.9	63.1	55.7	19.7	8.3
Hokio Beach	3,921.6	394.4	445.7	417.7	109.4	118	22	4.2
Bunnythorpe	9,427.8	904.2	426	286.1	138.2	117.8	38.6	8.1
Eketāhuna	40,805.7	2,568.9	1,337.4	657.9	267.5	277.8	133.3	106.2
Mangaweka	27,305.0	813	234.4	144.3	90	119.6	70.5	353.2
Ōwhango	15,158.8	445.6	199.1	102.3	46.9	44.8	23.9	80.2
Ōhura	34,144.7	891.6	574	359.3	184.4	184.6	114.5	275.5
Pohangina	28,253.8	1,168.3	757	646.6	305.8	302.9	126.2	57.7
Pongaroa	58,991.3	1,739.9	744.2	329.8	164.7	203.2	129.5	324.6
Mangamutu	1,588.8	105.7	77.5	67.2	48.1	68	36.3	41.2
Pahiatua	56,689.3	2,460.1	1,611.8	924.5	451.3	537.7	295.9	521
Ashhurst	10,701.0	754.6	509.6	353.3	201.9	200.4	86.3	142

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	194.2	216.3	104.1	30	40.8	0.5	-
Taihape	69,461.7	1,982.6	638.1	351.6	178.8	210.2	132.2	364.8
Waitārere Beach	185.9	14.6	13.7	13.3	6.9	2.5	0	-
Raetihi	30,488.4	944.1	454.2	220.7	97.1	92	44.5	95.9
Manakau	5,986.2	572.8	305	222.5	118.6	78.3	9.2	0.9
Sanson	4,281.9	316.5	162.8	93.1	39.6	41.1	17.3	33
Linton	10,279.8	713.5	413.3	232.5	81.5	94.5	99.9	57.7
Ohakea	2,524.8	474.3	260.6	192.1	113.4	136.4	13.4	6.2
Norsewood	5,570.8	554.1	184.4	74.8	32.5	31.7	16	15
Tokomaru	7,107.1	410.5	237.7	216.1	185.5	239.7	21.1	8
Waiouru	3,136.5	214.6	60	25.4	9.4	9.6	3.9	3.1
National Park	9,073.6	396.5	157.4	80.7	48	36.8	15.3	21.6
Waikawa Beach	383.6	42.5	38.2	21.8	7.7	5.2	2.3	0.6
Mangatainoka	2,981.3	154	98.7	80.4	56.2	89.1	57.2	803
Ormondville	17,722.6	817.5	293	167.3	99.5	112.3	78	168.8
Rongotea	10,355.3	1,347.8	703.2	461	218.8	275.3	157.5	23.2
Rātana	2,717.0	252.7	142.8	150.7	81.8	70.6	17.5	36.7
Halcombe	20,806.9	1,553.1	732.7	516.8	355.8	624.8	278.3	358.4
Kimbolton	9,574.4	464.5	243.9	157.3	72.2	84.1	37.1	39.2
Rangataua	2,715.2	241.7	65.5	39.2	17.1	12.5	2.6	0.8
Raurimu	2,929.2	173	75.7	41.8	19.8	22.4	12.1	18.3
Kai Iwi	8,441.7	395.4	224.9	155	74.9	71.2	37.5	66.1

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.11: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +1°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,367	757.7	522	239.4	212.7	166.8	401.4
Palmerston North	23,773.1	1,737.5	1,170.8	829.1	440.1	499	305.9	561.3
Feilding	9,478.4	1,166.3	600	409.3	197.3	160.7	54.5	29.6
Marton	27,551.2	2,697.2	1,227.4	639.4	379.5	395.2	135.7	197
Ohakune	9,662.1	908.2	405.4	225.5	86.7	79.6	29.8	22.3
Longburn	1,453.9	258.6	291.4	188.5	32.6	68.8	59.5	95.7
Kairanga	6,934.0	1,048.9	1,096.4	713.1	302	448.6	317.3	276.6
Levin	10,346.0	1,834	356.2	192.3	111.7	96	17.6	4.8
Woodville	11,941.0	706.7	329.1	181.1	124.9	185.9	211.9	2,342.5
Foxton	13,738.4	2,516.3	1,220	700.7	294.4	405.7	357.8	496.3
Foxton Beach	1,761.7	186	169.5	122.6	247	143.4	25.3	80.5
Taumarunui	12,934.8	369.9	226.5	137.8	74.5	120.1	94	375.4
Dannevirke	36,922.8	3,142.1	997.5	608	330.8	369.2	181.7	405.5
Bulls	9,716.2	1,437	769.6	556.1	306.8	272.1	101.6	122.8
Tangimoana	8,493.8	1,391.3	637	436.1	165.6	278.5	86.4	46.8
Hunterville	53,017.8	1,923.2	989.4	546.2	247.1	242.5	131.6	325.3
Shannon	11,244.3	444.8	490.7	594.4	258.3	126.7	16.3	11.3
Koitiata	1,142.3	135.3	128.9	122.7	56.3	29.3	9.6	21.5
Ōhau	2,452.0	291.4	195.1	146.9	60.9	50.4	17.9	7.5
Hokio Beach	3,921.6	419.1	454.5	362.1	102.3	110.9	18.1	4.1
Bunnythorpe	9,427.8	881	415.4	285.1	134.1	103.1	32	6.3
Eketāhuna	40,805.7	2,564.6	1,316.2	645.1	266.6	282.5	138.2	109.5
Mangaweka	27,305.0	865	375.5	190.1	94.2	115.2	66.7	324.8
Ōwhango	15,158.8	444	195.5	100.1	46.3	43.9	23.2	77.2
Ōhura	34,144.7	890.8	563.2	336.7	162.8	171.3	111.2	256.6
Pohangina	28,253.8	1,164.8	768.4	613.4	277.1	282.9	114.1	52.9
Pongaroa	58,991.3	1,708.2	730.7	312.3	153.3	191	126.3	293.3
Mangamutu	1,588.8	106.1	85.6	74.9	47	62	13	26.9
Pahiatua	56,689.3	2,439.4	1,591.7	899.5	450.9	493.6	274.3	464.3
Ashhurst	10,701.0	756.8	501.8	332.4	187.4	181.7	79.9	137

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	174.4	178.9	90.4	26.6	38.1	0.4	-
Taihape	69,461.7	2,162	1,159.3	548.3	239.3	242.4	140.4	302
Waitārere Beach	185.9	14.7	13.7	12.2	6.3	2	0	-
Raetihi	30,488.4	933.5	437.2	214.4	89.3	86.3	40.4	85.3
Manakau	5,986.2	570.6	295.5	216.4	110.1	69.1	7.6	0.6
Sanson	4,281.9	290.8	187.2	122.4	57.3	45.4	22.6	25.6
Linton	10,279.8	706.7	403.1	224.8	77.3	94.1	98.9	53.4
Ohakea	2,524.8	422.4	192.2	135	94.5	59.6	4.8	4.6
Norsewood	5,570.8	547.6	181.2	74.1	31.5	31.4	15.4	14.6
Tokomaru	7,107.1	405.7	237.6	218.3	192.5	217.7	18.5	7.1
Waiouru	3,136.5	217.2	82.9	33	10.1	9.9	3.8	2.8
National Park	9,073.6	389.6	157.5	81.1	42.8	34.2	14.7	19.3
Waikawa Beach	383.6	44.6	37.2	18.6	7	4.5	2.4	0.3
Mangatainoka	2,981.3	161	104.3	86.6	56.2	80.5	57.6	725.3
Ormondville	17,722.6	813.5	292.7	165.9	95.9	108.6	74.3	157.4
Rongotea	10,355.3	1,294.1	646.5	410.7	227.9	259.3	130.4	18
Rātana	2,717.0	251.4	160.6	158.1	69.3	46.4	14.5	33.9
Halcombe	20,806.9	1,493.1	854.3	664.3	472.5	584.3	215.2	276.2
Kimbolton	9,574.4	453.6	251.4	153.7	73.2	76.7	33.7	32.5
Rangataua	2,715.2	236.3	63.3	38.5	16	11.6	2.2	0.6
Raurimu	2,929.2	173.1	73.7	42	18.8	21.9	11.3	15.5
Kai Iwi	8,441.7	370.3	234.9	165	75.7	68	34.2	53.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.12: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +1°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,364	756.3	530	243.4	211.7	167.4	402.6
Palmerston North	23,773.1	1,754.4	1,246.3	965	520.3	619.9	347	550
Feilding	9,478.4	1,240.8	698.4	410.3	188.1	163.4	53.7	26.9
Marton	27,551.2	2,688.3	1,218.2	625	396.2	415.3	143.2	195.8
Ohakune	9,662.1	908.3	405.4	225.5	86.7	79.6	29.8	22.3
Longburn	1,453.9	210	354.5	347.3	72.1	84.6	59.5	82.7
Kairanga	6,934.0	952.6	1,061.1	834.5	314.7	475.6	366.5	504.9
Levin	10,346.0	1,834.9	355.8	189.3	110.9	95.8	17.6	4.8
Woodville	11,941.0	691.2	326.2	183	114.4	141.2	143.6	2,595.7
Foxton	13,738.4	2,548.1	1,246	803.3	449.7	496.5	210.9	160.6
Foxton Beach	1,761.7	217.7	223.8	255.6	68	66.8	13.5	79.1
Taumarunui	12,934.8	369.1	229.3	143.7	75.2	120	94.1	374.9
Dannevirke	36,922.8	3,143.2	1,004.4	613.7	332.3	370.1	181.9	405.9
Bulls	9,716.2	1,427.4	770.8	584	341.3	285.2	102.2	114.5
Tangimoana	8,493.8	1,397	640.2	479.9	203.3	254.5	43.8	14.1
Hunterville	53,017.8	1,925.3	1,019.7	574.6	256.6	239.5	128.1	305.6
Shannon	11,244.3	352.3	275	418.9	282.4	434	340	22.1
Koitiata	1,142.3	134.9	129	122.6	55.6	28.8	9.6	21.5
Ōhau	2,452.0	298	203.5	151.2	53.5	37.6	11.9	5.9
Hokio Beach	3,921.6	419.1	454.6	362.1	102.3	110.9	18.1	4.1
Bunnythorpe	9,427.8	877.7	434.5	295.4	129.6	98.3	32.2	5.3
Eketāhuna	40,805.7	2,561.8	1,304.9	634.3	260	269	129.6	96.2
Mangaweka	27,305.0	865.2	375.2	190.1	94.2	115.1	66.7	324.8
Ōwhango	15,158.8	444.2	195.5	100.1	46.3	43.9	23.2	77.2
Ōhura	34,144.7	891.1	563.1	336.6	162.9	171.3	111.2	256.6
Pohangina	28,253.8	1,164.5	768.8	613.3	276.9	282.9	113.8	52.9
Pongaroa	58,991.3	1	0.3	-	-	-	-	-
Mangamutu	1,588.8	104.3	84	75.6	48	61.7	10.8	35.4
Pahiatua	56,689.3	2,445	1,560.1	859.8	433.7	484.4	280.2	457.5
Ashhurst	10,701.0	747.6	494.4	375	248.3	220.4	80.7	139.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	174.4	178.9	90.4	26.6	38.1	0.4	-
Taihape	69,461.7	2,162.1	1,159.8	548.4	239.3	242.3	140.5	302
Waitārere Beach	185.9	14.7	13.7	12.2	6.3	2	0	-
Raetihi	30,488.4	933.7	437.2	214.4	89.3	86.3	40.4	85.3
Manakau	5,986.2	571	295.4	215.8	110.1	69.1	7.6	0.6
Sanson	4,281.9	290.9	187	122.4	57.4	45.3	22.6	25.6
Linton	10,279.8	705.6	489.3	347.5	151.6	186.7	62.2	30.8
Ohakea	2,524.8	426.7	193.6	135.7	92.6	51.1	4.3	4.2
Norsewood	5,570.8	547.4	181.2	74	31.5	31.4	15.4	14.6
Tokomaru	7,107.1	342.1	200.5	236	218.4	292.7	159.2	12.3
Waiouru	3,136.5	217.2	82.9	33	10.1	9.9	3.8	2.8
National Park	9,073.6	389.5	157.5	81.1	42.8	34.2	14.7	19.3
Waikawa Beach	383.6	44.6	37.2	18.6	7	4.5	2.4	0.3
Mangatainoka	2,981.3	155.6	103.7	88.2	56.9	76	51	770.1
Ormondville	17,722.6	812.7	291.3	167.5	96.9	110.1	75.4	158.7
Rongotea	10,355.3	1,239.8	728.5	554.8	280	282.3	172.4	52.9
Rātana	2,717.0	251.5	161.1	157.7	69.1	46.2	14.5	33.9
Halcombe	20,806.9	1,494.2	859.4	671.8	482.3	566	208.8	273.4
Kimbolton	9,574.4	452.3	250.5	153.6	73.2	76.7	33.7	32.5
Rangataua	2,715.2	236.3	63.3	38.4	16	11.6	2.2	0.6
Raurimu	2,929.2	173.1	73.7	42	18.7	21.9	11.3	15.5
Kai Iwi	8,441.7	370.1	235	164.9	75.8	68	34.2	53.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.13: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +2°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,367.5	754	543.7	282.4	248.3	157.7	494.8
Palmerston North	23,773.1	1,755.7	1,187.9	894.3	504.8	559.5	331.5	625.4
Feilding	9,478.4	1,182.2	626.1	440.9	211.1	171.2	61.1	35.1
Marton	27,551.2	2,750.2	1,252.7	617.2	383.4	450.8	165	221.9
Ohakune	9,662.1	929.4	408.2	238.7	92.7	87.1	34.5	26.3
Longburn	1,453.9	225.2	339.8	260.6	45.8	62.3	67.4	104.7
Kairanga	6,934.0	988.2	1,050.2	751.7	309.9	489.4	367.5	497.7
Levin	10,346.0	1,896.5	376.9	195.8	118	104.5	21.7	6.6
Woodville	11,941.0	687.2	333.9	178.6	118.3	152.3	117.4	2,703.3
Foxton	13,738.4	2,565.5	1,243.3	741	329.1	376.6	389	525.6
Foxton Beach	1,761.7	187.2	178.8	125.3	247.4	150	26.5	80.7
Taumarunui	12,934.8	368.1	217	159.1	84.2	115.1	108.8	427.7
Dannevirke	36,922.8	3,247.2	1,017.2	629.6	348.7	397.7	199.4	440.9
Bulls	9,716.2	1,444.2	780.2	560.7	323.7	318.5	106.2	141.2
Tangimoana	8,493.8	1,414.8	643.4	461.9	190	280.2	117.2	56.3
Hunterville	53,017.8	1,957	1,013.1	555.9	261.4	255.4	136	357.1
Shannon	11,244.3	428	449	635.5	300.2	152.6	17.3	11.8
Koitiata	1,142.3	136.3	128	126.3	63.2	37.4	9.6	22.2
Ōhau	2,452.0	296	196.2	165.3	64.2	60.2	21.4	9.2
Hokio Beach	3,921.6	399.7	450.4	412.6	109.1	117.4	21.9	4.1
Bunnythorpe	9,427.8	912.2	427.9	288.6	136.8	112.1	36.5	7.6
Eketāhuna	40,805.7	2,605.8	1,367.9	672.9	273.2	282.7	136.2	112.2
Mangaweka	27,305.0	883.5	383.1	194.6	100.2	117.7	71	345.1
Ōwhango	15,158.8	452.8	200.5	104	47.6	46	24.4	82.9
Ōhura	34,144.7	891.4	582.4	373.7	203.3	202.5	118.3	294.4
Pohangina	28,253.8	1,161.3	753.9	643.8	303.5	302.2	126.3	56.7
Pongaroa	58,991.3	1,754.2	750.5	334	166.9	205.5	130.6	329.2
Mangamutu	1,588.8	105.7	80.3	71.3	49.6	68.6	33.1	40.6
Pahiatua	56,689.3	2,480.3	1,637	944.6	462.6	546.4	295.7	524.6
Ashhurst	10,701.0	753.4	516.8	356.8	197.8	203.1	90.6	146.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	174.1	182.6	96.9	27.9	41.6	0.5	-
Taihape	69,461.7	2,202.2	1,179.3	560.2	244.2	249.2	146.1	338.4
Waitārere Beach	185.9	14.6	13.7	13.1	6.7	2.5	0	-
Raetihi	30,488.4	947.6	452.6	219.9	97.3	90.3	44.2	94.8
Manakau	5,986.2	581	312	225.6	122.3	83.2	10	1
Sanson	4,281.9	299.2	189.9	121	57.7	50.8	24.4	29.1
Linton	10,279.8	717.9	422.8	236.5	83	96.8	102.4	65
Ohakea	2,524.8	422.2	177.3	161.5	101.4	89.2	6.6	5.3
Norsewood	5,570.8	561.6	187.1	75.1	33	32	16.3	15.2
Tokomaru	7,107.1	413.5	238.6	215.6	183.4	247	22	8.4
Waiouru	3,136.5	221.2	85	34	10.5	10.9	4.1	2.9
National Park	9,073.6	402.3	158	81.8	46.7	36.9	15.3	21.5
Waikawa Beach	383.6	42.6	37.8	24.3	8	5.5	2.4	0.6
Mangatainoka	2,981.3	156.2	100.8	83.6	57.2	89.5	56.5	799.7
Ormondville	17,722.6	831.9	296.8	166.9	99.8	112.4	79.1	171.7
Rongotea	10,355.3	1,321.4	680	451.5	236.8	278.6	152.7	20.9
Rātana	2,717.0	255.9	150.8	156.8	78.9	57.6	15.5	35.2
Halcombe	20,806.9	1,518	844.2	644.6	455.1	636.5	244.3	313.3
Kimbolton	9,574.4	462.9	252.4	158.9	75.5	81.2	36.6	36.4
Rangataua	2,715.2	243.8	65.6	39.4	16.9	12.5	2.4	0.8
Raurimu	2,929.2	174.3	76.3	43.2	19.9	23.4	12.1	18.8
Kai Iwi	8,441.7	393.9	225.9	156	74.2	69	35.8	63

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.14: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +2°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,366.6	751.3	539.5	290.4	252.5	156.2	496.2
Palmerston North	23,773.1	1,770.2	1,357.6	1,095.5	580.2	674.2	392.2	597.8
Feilding	9,478.4	1,253.6	726	443.1	201	173.7	60.1	32.3
Marton	27,551.2	2,740.2	1,245	597.7	394.5	476.9	168.1	227.5
Ohakune	9,662.1	929.4	408.2	238.7	92.7	87.1	34.5	26.3
Longburn	1,453.9	176.7	347.1	393.7	117.4	85.3	62.6	88.1
Kairanga	6,934.0	911	1,051.2	916.9	328.3	477	395.9	561.6
Levin	10,346.0	1,897.2	377.2	193	116.8	104.2	21.7	6.6
Woodville	11,941.0	694.6	335.4	181.5	119.7	150.5	116.9	2,704.6
Foxton	13,738.4	2,607.3	1,269	812.3	463.3	518.6	231.9	162.2
Foxton Beach	1,761.7	216.2	232.8	262.4	72.2	70.1	13.5	79.1
Taumarunui	12,934.8	368.7	219	160.9	83.5	114.6	109	427.8
Dannevirke	36,922.8	3,249.6	1,024.8	634.8	349.5	398.7	199.8	441.4
Bulls	9,716.2	1,435.1	778.7	590	355.9	336.3	104.9	132.8
Tangimoana	8,493.8	1,420.7	648.4	490.6	240.8	268.7	65.8	16.3
Hunterville	53,017.8	1,953.9	1,038.6	584.6	270.6	252.2	132.3	336.9
Shannon	11,244.3	326.1	203.3	277.5	382.7	461.4	524.7	32.4
Koitiata	1,142.3	135.3	127.7	126.7	64.2	39.1	9.6	22.3
Ōhau	2,452.0	302.9	205.9	170	60.3	44.6	14.6	7.1
Hokio Beach	3,921.6	399.7	450.3	412.6	109.1	117.4	21.9	4.1
Bunnythorpe	9,427.8	910.8	444.9	304.6	133.7	105.2	36.5	6.5
Eketāhuna	40,805.7	2,604.4	1,368.1	671.1	272.9	282.9	136.1	112.3
Mangaweka	27,305.0	883.2	383.4	194.5	100.2	117.7	71	345
Ōwhango	15,158.8	452.6	200.7	104	47.6	46	24.4	82.9
Ōhura	34,144.7	891.4	582.4	373.7	203.3	202.5	118.3	294.4
Pohangina	28,253.8	1,160.9	754.3	643.6	303.6	301.8	126.2	56.7
Pongaroa	58,991.3	1	0.3	-	-	-	-	-
Mangamutu	1,588.8	104.6	79.7	73.8	51.4	71	34.1	40.1
Pahiatua	56,689.3	2,489.4	1,626.8	915.7	453.2	540.5	298.2	524.8
Ashhurst	10,701.0	743	496.2	385.8	256.8	264.8	90.3	148.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	174.1	182.6	96.9	27.9	41.6	0.5	-
Taihape	69,461.7	2,202.2	1,179.2	559.7	244.7	249.2	146.2	338.4
Waitārere Beach	185.9	14.6	13.7	13.1	6.7	2.5	0	-
Raetihi	30,488.4	947.6	452.6	219.9	97.3	90.3	44.2	94.8
Manakau	5,986.2	581.1	312	224.9	122.4	82.7	9.9	1
Sanson	4,281.9	299.4	189.7	121.2	57.6	50.8	24.4	28.9
Linton	10,279.8	707.9	505.9	357.8	157.9	192.4	64.8	35.9
Ohakea	2,524.8	425.1	183	160.8	103.3	77	5.6	4.7
Norsewood	5,570.8	561.7	187.1	75.1	33	32	16.3	15.2
Tokomaru	7,107.1	341.4	191.2	197	210.5	303.6	251.9	22.8
Waiouru	3,136.5	221.1	85	34	10.5	10.9	4.1	2.9
National Park	9,073.6	401.9	158	81.8	46.7	36.9	15.3	21.5
Waikawa Beach	383.6	42.7	37.8	24.1	7.9	5.5	2.4	0.6
Mangatainoka	2,981.3	155.9	100.2	83.7	57.3	89.6	56.8	799.8
Ormondville	17,722.6	831.5	296.2	166.9	99.7	112.5	79.2	171.7
Rongotea	10,355.3	1,271.3	747	563.4	293.1	288	176.6	59.6
Rātana	2,717.0	255.6	150.6	156.7	79.4	57.9	15.6	35.3
Halcombe	20,806.9	1,522.4	846.7	650.2	465.8	625.5	232.7	310.3
Kimbolton	9,574.4	462.7	252.7	158.5	75.5	81.2	36.6	36.4
Rangataua	2,715.2	243.8	65.6	39.4	16.9	12.5	2.4	0.8
Raurimu	2,929.2	174.4	76.2	43.2	19.9	23.4	12.1	18.8
Kai Iwi	8,441.7	393.9	225.9	156	74.2	69	35.8	63

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.15: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +3°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,370.3	752.3	535	322.4	334.4	157.3	567.2
Palmerston North	23,773.1	1,753.8	1,218	950.9	567	645.1	361.4	691.3
Feilding	9,478.4	1,198.9	644.2	472.2	221.4	178.7	66.3	39.6
Marton	27,551.2	2,803.2	1,282.3	599.7	385.5	491.5	198.5	248.4
Ohakune	9,662.1	951.7	413.4	257.6	99.1	95.4	37.8	30.9
Longburn	1,453.9	183.6	341.3	342.9	99.6	62.2	72	112.1
Kairanga	6,934.0	913.5	1,001.1	834.3	309.5	473	458	700.9
Levin	10,346.0	1,951.5	401.2	200	123.5	112.4	25.7	8.6
Woodville	11,941.0	710.7	346.5	188.6	119.5	152.9	139.5	2,621.3
Foxton	13,738.4	2,605.1	1,264.8	759.9	379.8	344.8	429.3	548.3
Foxton Beach	1,761.7	183.7	191.7	129.5	246.6	156.4	27.3	80.8
Taumarunui	12,934.8	367.7	213.6	158	101.8	111.6	102.4	490.4
Dannevirke	36,922.8	3,343.9	1,036.5	637.9	365.4	423.6	219.2	481.4
Bulls	9,716.2	1,444.4	777.2	574.7	324.3	367.5	117.6	158.1
Tangimoana	8,493.8	1,435.5	651.4	479.1	231.5	272.9	159.2	65.2
Hunterville	53,017.8	1,984	1,028.9	573.2	276.7	266.3	151	385.8
Shannon	11,244.3	419.6	395.3	667.8	342.8	183.7	18.8	12.7
Koitiata	1,142.3	129.5	125.4	131.1	68.9	49.1	10.2	22.9
Ōhau	2,452.0	298.4	201	181.3	67.8	69.6	23.5	11.2
Hokio Beach	3,921.6	398.9	424.9	462.8	116.9	123	25.7	4.3
Bunnythorpe	9,427.8	935.1	445.4	283.2	144.5	124.3	39.6	9.2
Eketāhuna	40,805.7	2,632.4	1,429.8	731.4	295.6	308.5	152.6	140.5
Mangaweka	27,305.0	903.9	388.9	200.4	103.7	125.5	74	367
Ōwhango	15,158.8	460.5	204.5	107.3	49.2	48.8	24.6	89.7
Ōhura	34,144.7	883.8	593.8	401.5	228.4	243.1	127.7	332.8
Pohangina	28,253.8	1,151.9	737.2	664.1	335	319.7	138.8	66.4
Pongaroa	58,991.3	1,796.7	763.8	349.4	179.1	226.3	140.1	367.1
Mangamutu	1,588.8	105.7	89.7	83.7	53.2	72.2	16.5	37.3
Pahiatua	56,689.3	2,495.1	1,721.3	1,033.7	503.2	579.7	301.4	585.4
Ashhurst	10,701.0	750.3	514.3	379.5	211.1	224.3	105.1	156.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	174.7	187.6	103.8	30	44.3	0.7	-
Taihape	69,461.7	2,233.6	1,188.6	569.4	245.7	254.6	152.8	368
Waitārere Beach	185.9	15.2	13.7	13.9	6.8	2.9	0	-
Raetihi	30,488.4	963.8	464.7	224.9	103.3	94.8	47.2	105.1
Manakau	5,986.2	591.4	321.2	238.3	129.4	101	11.8	1.7
Sanson	4,281.9	306.3	195.3	119.8	57.3	55.6	23.7	33.4
Linton	10,279.8	739.4	449.1	247.6	94.5	95.4	108.1	75.1
Ohakea	2,524.8	437.2	158.5	165.1	113.4	117.3	10.2	5.9
Norsewood	5,570.8	579.3	194.9	75.6	34	32.7	17	15.8
Tokomaru	7,107.1	420.2	245.7	218.9	180.4	264.6	26.4	9.8
Waiouru	3,136.5	226.2	85.3	37.2	11	11.4	4.3	3.1
National Park	9,073.6	409.1	164.8	80.4	48.4	40	15.6	24.7
Waikawa Beach	383.6	42.3	37.3	29.2	8.7	6.5	2.2	1.1
Mangatainoka	2,981.3	165.4	110	96.1	64.5	86	57.5	783.2
Ormondville	17,722.6	848.8	301.4	167.5	101.7	111.5	81.7	184.2
Rongotea	10,355.3	1,349.3	694.1	491	251.4	298.1	167.3	27.5
Rātana	2,717.0	257.7	144.8	148.9	83.6	70.7	17.7	36.8
Halcombe	20,806.9	1,526.4	866.6	628.1	427.8	674.5	285.3	353.3
Kimbolton	9,574.4	469.7	254	164.3	77.9	83.6	39.7	41.4
Rangataua	2,715.2	254.5	67.2	39.3	18.3	13.7	2.9	0.9
Raurimu	2,929.2	177.6	75.7	44.5	20.8	24.8	13.3	21.3
Kai Iwi	8,441.7	400.4	230	155.2	75.8	72.3	37.4	66.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.16: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +3°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,368.6	751.2	533.8	320.8	341	155.8	568.6
Palmerston North	23,773.1	1,704.8	1,392.4	1,235	661.1	732	434.7	643.5
Feilding	9,478.4	-	-	-	-	-	-	-
Marton	27,551.2	2,793.7	1,273.6	578.1	383.2	523.6	203.7	256.3
Ohakune	9,662.1	951.8	413.4	257.6	99.1	95.4	37.8	30.9
Longburn	1,453.9	141.3	331.9	416.8	188.8	91.8	64.6	92.4
Kairanga	6,934.0	885.3	1,017.2	1,004.2	352.2	474.3	426.8	616.4
Levin	10,346.0	1,952.2	402.1	197.8	121.6	112.2	25.7	8.6
Woodville	11,941.0	694.7	336.3	186.4	119.8	162.1	112.8	2,784.6
Foxton	13,738.4	2,656.7	1,302.3	824.5	425.1	573.6	265.5	163.5
Foxton Beach	1,761.7	211.5	243.4	269.2	76.3	72.7	13.6	79.2
Taumarunui	12,934.8	367.9	214.1	159.5	101.8	110	103.1	490
Dannevirke	36,922.8	-	-	-	-	-	-	-
Bulls	9,716.2	-	-	-	-	-	-	-
Tangimoana	8,493.8	1,444.6	657.5	492.6	282.1	285.2	93.2	18.4
Hunterville	53,017.8	1,983.2	1,047.7	595.6	285	262.1	146.1	364.5
Shannon	11,244.3	323.7	183.8	173.5	279.2	629.1	588.2	75.4
Koitiata	1,142.3	128.6	124.7	131.4	69.8	50.3	10.4	23
Ōhau	2,452.0	304.4	210.6	186.8	65.7	53.5	17.1	8.4
Hokio Beach	3,921.6	398.9	424.9	462.6	117	123	25.8	4.3
Bunnythorpe	9,427.8	-	-	-	-	-	-	-
Eketāhuna	40,805.7	-	-	-	-	-	-	-
Mangaweka	27,305.0	903.9	389.1	200.3	103.7	125.6	73.9	367
Ōwhango	15,158.8	460.3	204.5	107.3	49.2	48.8	24.6	89.7
Ōhura	34,144.7	883.8	593.8	401.6	228.4	243.1	127.7	332.8
Pohangina	28,253.8	1,152.1	737.5	664.1	334.8	319.7	138.6	66.3
Pongaroa	58,991.3	1	0.3	-	-	-	-	-
Mangamutu	1,588.8	98.4	79.8	66.8	46.6	79.1	51.1	58.6
Pahiatua	56,689.3	2,511.9	1,699.5	976.6	471.6	564.1	331.7	595.8
Ashhurst	10,701.0	-	-	-	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	174.7	187.6	103.8	30	44.3	0.7	-
Taihape	69,461.7	2,234	1,188.6	569.4	245.5	255	152.9	367.5
Waitārere Beach	185.9	15.2	13.7	13.9	6.8	2.9	0	-
Raetihi	30,488.4	963.8	464.7	224.9	103.3	94.8	47.2	105.1
Manakau	5,986.2	591.5	322.4	236.8	129.4	99.7	11.7	1.7
Sanson	4,281.9	306.3	195.2	119.8	57.4	55.6	23.7	33.3
Linton	10,279.8	715.1	522.6	367.7	161.7	198	66.9	40
Ohakea	2,524.8	438.9	165.5	166.4	117.5	103.3	7.5	5.4
Norsewood	5,570.8	579.2	194.8	75.7	34	32.7	17	15.8
Tokomaru	7,107.1	343.7	191	178.3	186.9	340.1	264.4	60.9
Waiouru	3,136.5	226.2	85.3	37.2	11	11.4	4.3	3.1
National Park	9,073.6	409.2	164.8	80.4	48	40.4	15.6	24.7
Waikawa Beach	383.6	42.3	37.5	29	8.6	6.3	2.3	1
Mangatainoka	2,981.3	161	99.7	80.6	54.1	87.8	69.8	831.9
Ormondville	17,722.6	846.7	302.2	166.2	103.8	113.5	82.9	186
Rongotea	10,355.3	1,294.5	756.4	572.1	310.5	298.2	176.9	66.7
Rātana	2,717.0	257.7	144.6	148.5	84.2	71.1	17.8	36.8
Halcombe	20,806.9	1,532	868.9	632.3	436.5	674.5	267.3	350.3
Kimbolton	9,574.4	472	254.7	164.7	78	83.6	39.7	41.4
Rangataua	2,715.2	254.5	67.2	39.3	18.3	13.7	2.9	0.9
Raurimu	2,929.2	177.6	75.7	44.6	20.8	24.8	13.2	21.3
Kai Iwi	8,441.7	400.7	229.9	155.2	75.8	72.3	37.4	66.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.1.17: Area of town/settlement and depth of modelled flooding by area for 0.5% AEP, Climate Warming +3°C + SLR, Defences Up

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	13,394.4	1,365.1	750.5	535.5	319.4	366	156.3	589
Palmerston North	23,773.1	1,747.1	1,211.7	949.2	566.8	644.1	361	691.1
Feilding	9,478.4	1,199.1	644.2	472.2	221.4	178.7	66.3	39.6
Marton	27,551.2	2,803.1	1,282.3	599.7	385.5	491.5	198.4	248.4
Ohakune	9,662.1	8.4	1.3	1	0.3	0.3	-	-
Longburn	1,453.9	183.7	341.2	342.8	99.6	62.2	72	112.1
Kairanga	6,934.0	913.6	1,001	834.3	309.5	473	458	700.9
Levin	10,346.0	1,951.7	401.1	200.1	123.5	112.4	25.7	8.6
Woodville	11,941.0	220.5	120.1	79	72.8	164.4	187.7	1,227.7
Foxton	13,738.4	2,618.6	1,291.2	711.2	281.3	391.4	433.9	556.2
Foxton Beach	1,761.7	171.4	188	118.1	65	340.1	78.6	99
Taumarunui	12,934.8	367.7	213.6	158	101.8	111.6	102.4	490.4
Dannevirke	36,922.8	187.6	96.2	61.7	34	54.4	32.2	101.2
Bulls	9,716.2	1,441.7	771.7	582	326.5	369.2	117.6	158.1
Tangimoana	8,493.8	1,432.8	648.8	479	234.8	273.8	159.6	65.9
Hunterville	53,017.8	1,984.1	1,028.8	573.3	276.6	266.3	151	385.8
Shannon	11,244.3	419.4	393.5	668.7	344.7	183.4	18.9	12.7
Koitiata	1,142.3	120.1	112	127.2	95	59.1	15.4	30.5
Ōhau	2,452.0	297.2	199.8	184	69.7	72.3	28.2	11.6
Hokio Beach	3,921.6	395.6	422	473.3	123.4	126.2	26.2	2.4
Bunnythorpe	9,427.8	935.4	445.4	284	143.7	124.3	39.6	9.2
Eketāhuna	40,805.7	689.9	331.2	162	77.3	87.5	34.2	25.1
Mangaweka	27,305.0	904.4	389.1	200.1	103.8	125.6	73.9	367.1
Ōwhango	15,158.8	460.5	204.5	107.3	49.2	48.8	24.6	89.7
Ōhura	34,144.7	883.8	593.8	401.5	228.4	243.1	127.7	332.8
Pohangina	28,253.8	1,152.4	737.5	663.9	335.1	319.7	138.8	66.4
Pongaroa	58,991.3	1,795.3	761.1	349.7	180.7	229	141.3	371.9
Mangamutu	1,588.8	0.3	-	-	-	-	-	-
Pahiatua	56,689.3	73.1	35.9	11.6	4	1.9	0.6	0.1
Ashhurst	10,701.0	750.2	514.3	379.5	211.1	224.3	105.1	156.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	1,101.4	173	187.6	106.6	31	45.7	2.3	0.5
Taihape	69,461.7	2,233.4	1,188.6	569.5	245.5	254.8	152.8	368
Waitārere Beach	185.9	14.5	13.9	14	7	3.2	0.1	0
Raetihi	30,488.4	176.1	101.3	42.3	20.3	17.9	7.9	17.7
Manakau	5,986.2	591.2	322.2	239.8	129.1	102.7	11.9	1.8
Sanson	4,281.9	306.3	195.3	119.8	57.3	55.6	23.7	33.4
Linton	10,279.8	739.3	449.1	247.6	94.5	95.4	108.1	75.1
Ohakea	2,524.8	437.2	158.4	165.2	113.4	117.3	10.2	5.9
Norsewood	5,570.8	520	173.7	66.5	31.2	30.8	16	15.5
Tokomaru	7,107.1	420	245.7	218.9	180.3	264.9	26.4	9.8
Waiouru	3,136.5	226.2	85.3	37.2	11	11.4	4.3	3.1
National Park	9,073.6	409.1	164.8	80.4	48.4	40	15.6	24.7
Waikawa Beach	383.6	42.5	40.4	32.5	11.2	7.4	2.2	1.2
Mangatainoka	2,981.3	3.1	4.9	13.1	14.3	26.1	14.9	281.7
Ormondville	17,722.6	848.8	301.4	167.5	101.7	111.5	81.7	184.2
Rongotea	10,355.3	1,349.3	694.1	491	251.4	298.1	167.2	27.5
Rātana	2,717.0	257.1	144.8	148.6	86.1	71.2	19.4	36.5
Halcombe	20,806.9	1,526.9	866.1	628.1	427.7	674.7	285.2	353.3
Kimbolton	9,574.4	472	255	164	78.3	83.6	39.7	41.4
Rangataua	2,715.2	58.6	25.1	13.4	4.6	5.1	0.9	-
Raurimu	2,929.2	177.6	75.7	44.5	20.8	24.8	13.3	21.3
Kai Iwi	8,441.7	400.9	229.3	155	75.9	73.5	38.9	69.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.1: Area of district and depth of modelled flooding by area for 5% AEP, Current Climate, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,117.1	1,823.7	1,036.8	467	489	186.2	509.1
Whanganui District	22,565.9	1,593.9	955.7	569.6	208.4	289.8	62	273
Horowhenua District	56,671.1	6,287	3,171.5	2,229.1	870.5	746.5	318	363.1
Manawatū District	124,773.4	9,586.5	5,390.3	3,196.9	1,498.9	1,190.1	380	274.9
Tararua District	222,445.9	10,952.6	4,801.2	2,524.7	1,243.8	1,500.1	992	2,870.1
Rangitīkei District	178,775.8	8,530.7	4,236.6	2,100.9	855.9	751.7	406.2	686.8
Ruapehu District	124,363.0	4,477.5	1,995.3	987.9	421.6	416.4	241.2	432.5
Area outside town/settlement								
Palmerston North City	96.3	0.9	0.7	1.7	6.5	17.1	11.8	29.1
Whanganui District	214,759.8	4,236.2	2,391.7	1,265.4	510.4	467.7	264.9	1,677
Horowhenua District	49,718.6	3,259.7	2,953.9	1,406.6	1,060.9	1,319.2	604.6	744.1
Manawatū District	131,885.3	8,467	3,921.5	2,311.1	1,225	1,180.6	480.8	527.4
Tararua District	207,093.4	6,054	2,967.4	1,426.7	653.5	732	420.9	1,040.3
Rangitīkei District	208,456.1	6,439.9	3,353	1,902.4	754.6	643.1	309.5	721.9
Ruapehu District	549,079.7	10,544.3	4,842.7	2,433.6	1,143.6	1,246.7	687.4	1,813.7
Total area within districts								
Palmerston North City	39,474.8	3,118	1,824.5	1,038.5	473.5	506.1	198	538.2
Whanganui District	237,325.7	5,830	3,347.5	1,835.1	718.8	757.5	326.9	1,950
Horowhenua District	106,389.7	9,546.6	6,125.4	3,635.7	1,931.4	2,065.7	922.6	1,107.3
Manawatū District	256,658.7	18,053.5	9,311.8	5,508	2,723.9	2,370.7	860.8	802.3
Tararua District	429,539.3	17,006.6	7,768.6	3,951.4	1,897.3	2,232.1	1,412.8	3,910.4
Rangitīkei District	387,231.9	14,970.6	7,589.6	4,003.3	1,610.5	1,394.8	715.7	1,408.6
Ruapehu District	673,442.7	15,021.8	6,838	3,421.6	1,565.2	1,663.1	928.6	2,246.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.2: Area of district and depth of modelled flooding by area for 5% AEP, Current Climate, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,171.4	1,954.1	1,122.7	516	511.5	216.8	491.7
Whanganui District	22,565.9	1,600	949.9	558.4	202.9	288.9	61.6	272.9
Horowhenua District	56,671.1	6,239	3,217	2,419.6	1,124.5	742.5	107.1	244.8
Manawatū District	124,773.4	9,537.9	5,759.6	3,405.7	1,547.3	1,452.4	838.4	376.4
Tararua District	222,445.9	9,467.6	4,170	2,278.1	1,112.1	1,335.7	886.8	2,778.2
Rangitīkei District	178,775.8	8,557.3	4,306.5	2,222.3	917.4	728.5	400.3	665.6
Ruapehu District	124,363.0	4,477.9	1,995	985.8	421.1	416.3	241.2	432.6
Area outside town/settlement								
Palmerston North City	96.3	2.8	3.1	6.6	9.4	17.6	6.3	27.1
Whanganui District	214,759.8	4,237.6	2,390.6	1,264.7	510.6	466.5	264.9	1,674.9
Horowhenua District	49,718.6	2,563.7	2,072.6	2,365.9	2,602.2	2,474.2	167.4	365.8
Manawatū District	131,885.3	8,323.1	3,887.8	2,338.5	1,315.6	1,565.5	1,198.4	921.4
Tararua District	207,093.4	4,398.8	2,196	1,104.7	502.4	529.4	291.4	819.7
Rangitīkei District	208,456.1	6,285.4	3,542.4	2,460.4	1,101.9	683	317	711.2
Ruapehu District	549,079.7	10,544.7	4,842.4	2,434.2	1,143.6	1,246.7	687.4	1,813.8
Total area within districts								
Palmerston North City	39,474.8	3,174.2	1,957.2	1,129.3	525.5	529.1	223.1	518.8
Whanganui District	237,325.7	5,837.6	3,340.5	1,823.1	713.6	755.4	326.5	1,947.8
Horowhenua District	106,389.7	8,802.7	5,289.6	4,785.6	3,726.7	3,216.7	274.5	610.6
Manawatū District	256,658.7	17,861	9,647.3	5,744.1	2,862.9	3,017.9	2,036.7	1,297.8
Tararua District	429,539.3	13,866.4	6,366	3,382.8	1,614.4	1,865.1	1,178.2	3,598
Rangitīkei District	387,231.9	14,842.7	7,848.9	4,682.7	2,019.3	1,411.5	717.3	1,376.8
Ruapehu District	673,442.7	15,022.6	6,837.4	3,419.9	1,564.8	1,663	928.6	2,246.4

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.3: Area of district and depth of modelled flooding by area for 2% AEP, Current Climate, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,163.9	1,908.5	1,106.2	514.9	626.2	276.4	583.1
Whanganui District	22,565.9	1,642.1	973.4	607.7	226.4	287.7	101.7	307.1
Horowhenua District	56,671.1	6,452.5	3,316.3	2,285.3	1,067.3	805.5	380.6	451.6
Manawatū District	124,773.4	9,783.9	5,664.9	3,531.2	1,714.6	1,654.2	485.8	366.2
Tararua District	222,445.9	11,368.3	5,018	2,658.1	1,326	1,548.2	1,018.9	3,577
Rangitīkei District	178,775.8	8,732.7	4,417.6	2,334.9	1,034.8	917.8	458.3	862.2
Ruapehu District	124,363.0	4,591.3	2,081.5	1,057.7	472.7	473.7	275	551.6
Area outside town/settlement								
Palmerston North City	96.3	1	0.8	0.4	1.9	15.8	15.5	32.6
Whanganui District	214,759.8	4,300.7	2,454	1,354.7	595.9	554.8	323.4	1,943
Horowhenua District	49,718.6	3,066.5	3,136.6	1,696	1,028.7	1,339.8	645.9	965.4
Manawatū District	131,885.3	8,690.1	3,992.7	2,342	1,282.7	1,615.8	740.1	674.9
Tararua District	207,093.4	6,205.6	3,076.5	1,498.4	712.1	789.8	466.3	1,259.5
Rangitīkei District	208,456.1	6,601.9	3,495.6	2,043.9	892.8	757.7	379.2	889.6
Ruapehu District	549,079.7	10,765.9	5,044.9	2,616.6	1,249	1,368.4	789.7	2,202.4
Total area within districts								
Palmerston North City	39,474.8	3,164.9	1,909.3	1,106.6	516.8	642	291.8	615.7
Whanganui District	237,325.7	5,942.8	3,427.3	1,962.4	822.3	842.5	425.1	2,250.1
Horowhenua District	106,389.7	9,519	6,452.9	3,981.3	2,096	2,145.3	1,026.5	1,417
Manawatū District	256,658.7	18,474	9,657.6	5,873.2	2,997.3	3,269.9	1,225.9	1,041.1
Tararua District	429,539.3	17,573.9	8,094.5	4,156.6	2,038.1	2,338	1,485.2	4,836.5
Rangitīkei District	387,231.9	15,334.6	7,913.2	4,378.9	1,927.6	1,675.5	837.4	1,751.8
Ruapehu District	673,442.7	15,357.3	7,126.5	3,674.3	1,721.7	1,842.1	1,064.7	2,754

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.4: Area of district and depth of modelled flooding by area for 2% AEP, Current Climate, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,225.9	2,133.6	1,315.7	643.4	719.4	284.7	574.5
Whanganui District	22,565.9	1,646.8	966.7	601.8	224.8	287.2	101.8	307
Horowhenua District	56,671.1	6,392.1	3,251.2	2,472.8	1,294.6	1,058	183.4	249.5
Manawatū District	124,773.4	9,735.1	5,950.9	3,807.5	1,783.9	1,746.3	893	634.9
Tararua District	222,445.9	9,801.2	4,350.4	2,395.7	1,188.3	1,367.3	899.5	3,426.7
Rangitīkei District	178,775.8	8,720.3	4,475.3	2,443	1,105.7	910.2	448.4	836.5
Ruapehu District	124,363.0	4,591.6	2,081.8	1,055.1	471	473.5	275	551.7
Area outside town/settlement								
Palmerston North City	96.3	2.3	2.9	5.9	8.2	19	6.9	27.6
Whanganui District	214,759.8	4,304.1	2,456.1	1,353.8	596.5	553.1	322.9	1,939.6
Horowhenua District	49,718.6	2,620.8	2,201.9	2,354.3	2,231.3	3,277.3	339	383.1
Manawatū District	131,885.3	8,527.9	4,040	2,463	1,345.5	1,781.8	1,271.4	1,374
Tararua District	207,093.4	4,491	2,275.3	1,164.8	547.3	577.7	320.7	955.9
Rangitīkei District	208,456.1	6,422.3	3,585.6	2,602.4	1,370.5	916	363.6	868.8
Ruapehu District	549,079.7	10,765	5,044.9	2,616.5	1,249	1,368.3	789.8	2,202.6
Total area within districts								
Palmerston North City	39,474.8	3,228.3	2,136.5	1,321.6	651.6	738.4	291.6	602.2
Whanganui District	237,325.7	5,950.8	3,422.8	1,955.7	821.3	840.4	424.7	2,246.6
Horowhenua District	106,389.7	9,013	5,453.1	4,827.1	3,525.9	4,335.3	522.4	632.6
Manawatū District	256,658.7	18,263	9,990.9	6,270.6	3,129.4	3,528.1	2,164.5	2,008.9
Tararua District	429,539.3	14,292.3	6,625.7	3,560.5	1,735.6	1,945	1,220.2	4,382.7
Rangitīkei District	387,231.9	15,142.6	8,060.8	5,045.4	2,476.2	1,826.2	812.1	1,705.3
Ruapehu District	673,442.7	15,356.6	7,126.7	3,671.6	1,720	1,841.8	1,064.8	2,754.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.5: Area of district and depth of modelled flooding by area for 1% AEP, Current Climate, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	2,984	1,789.1	1,094.7	527.3	668.2	359.2	646.9
Whanganui District	22,565.9	1,685.7	980.1	632.9	239.7	244.3	184.5	326.8
Horowhenua District	56,671.1	2,048.1	970.4	473.3	161.5	83.8	67.7	85
Manawatū District	124,773.4	9,876.2	5,814.3	3,795.5	1,876	1,903.4	711.3	459
Tararua District	222,445.9	5,670.1	2,189.4	1,326.9	729.2	851	590.4	3,580.7
Rangitīkei District	178,775.8	8,832.1	4,560.5	2,517.1	1,174.2	1,060.7	501.9	991.8
Ruapehu District	124,363.0	4,665.4	2,143.4	1,108.1	499	519.4	297.9	647.4
Area outside town/settlement								
Palmerston North City	96.3	1.1	0.7	0.4	0.4	12.4	16.7	36.4
Whanganui District	214,759.8	4,339.1	2,515	1,419.5	646.3	647.5	365.5	2,185.2
Horowhenua District	49,718.6	350.7	108.7	43.3	4.4	16.8	124.9	182.5
Manawatū District	131,885.3	8,819.3	4,104.5	2,327.1	1,239.1	1,808	1,157.7	838.8
Tararua District	207,093.4	3,919.8	1,907	972.8	465.2	527.1	286.6	1,002.5
Rangitīkei District	208,456.1	6,639.1	3,704.6	2,245.2	1,096.2	907.3	465.4	1,014.5
Ruapehu District	549,079.7	10,926.9	5,159	2,744.3	1,327.9	1,466.8	860.6	2,517.9
Total area within districts								
Palmerston North City	39,474.8	2,985.1	1,789.8	1,095.1	527.7	680.6	375.9	683.3
Whanganui District	237,325.7	6,024.8	3,495.2	2,052.3	886.1	891.9	550.1	2,511.9
Horowhenua District	106,389.7	2,398.9	1,079.1	516.7	165.9	100.6	192.6	267.5
Manawatū District	256,658.7	18,695.5	9,918.7	6,122.6	3,115.1	3,711.4	1,869	1,297.9
Tararua District	429,539.3	9,589.8	4,096.4	2,299.7	1,194.4	1,378.1	877	4,583.2
Rangitīkei District	387,231.9	15,471.2	8,265.1	4,762.3	2,270.4	1,968	967.3	2,006.3
Ruapehu District	673,442.7	15,592.3	7,302.4	3,852.4	1,826.9	1,986.3	1,158.5	3,165.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.6: Area of district and depth of modelled flooding by area for 1% AEP, Current Climate, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,242.8	2,258	1,483.3	729	846.7	357.6	637
Whanganui District	22,565.9	1,691.3	972.8	624.5	239.3	245.5	184.6	326.8
Horowhenua District	56,671.1	6,486.5	3,277.5	2,485.5	1,181.4	1,541.1	263.5	258.4
Manawatū District	124,773.4	9,804.3	6,074.9	4,109.1	1,946.6	1,969.1	930.4	830.6
Tararua District	222,445.9	9,998.1	4,503.9	2,491	1,235.3	1,404.8	886.8	3,846.5
Rangitīkei District	178,775.8	8,794.9	4,588.5	2,607.8	1,254.4	1,069.2	488.2	962.6
Ruapehu District	124,363.0	4,665.7	2,142.5	1,106.8	496.1	519	297.8	647.5
Area outside town/settlement								
Palmerston North City	96.3	2.2	2.7	5.6	7.2	19.9	7.3	27.9
Whanganui District	214,759.8	4,342.4	2,516.6	1,419.6	646.9	645.6	364.7	2,180.5
Horowhenua District	49,718.6	2,541.3	2,169.5	2,205	1,993	3,328.4	1,223.2	409
Manawatū District	131,885.3	8,644.1	4,164.3	2,557.8	1,345.3	1,851.5	1,334.5	1,707.2
Tararua District	207,093.4	4,549.1	2,306.9	1,213.2	580.5	626.2	331.9	1,058.9
Rangitīkei District	208,456.1	6,458.9	3,779.3	2,738.4	1,597.9	1,194.4	430.1	982.8
Ruapehu District	549,079.7	10,928.4	5,158.9	2,744.2	1,328	1,466.9	860.8	2,518.1
Total area within districts								
Palmerston North City	39,474.8	3,245	2,260.7	1,488.9	736.2	866.7	364.8	664.9
Whanganui District	237,325.7	6,033.7	3,489.4	2,044.2	886.2	891.1	549.4	2,507.4
Horowhenua District	106,389.7	9,027.8	5,447	4,690.5	3,174.4	4,869.5	1,486.7	667.4
Manawatū District	256,658.7	18,448.5	10,239.2	6,666.9	3,291.9	3,820.6	2,264.9	2,537.8
Tararua District	429,539.3	14,547.2	6,810.8	3,704.2	1,815.8	2,031.1	1,218.7	4,905.4
Rangitīkei District	387,231.9	15,253.8	8,367.8	5,346.2	2,852.2	2,263.7	918.3	1,945.4
Ruapehu District	673,442.7	15,594.1	7,301.4	3,851.1	1,824.1	1,985.9	1,158.6	3,165.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.7: Area of district and depth of modelled flooding by area for 0.5% AEP, Current Climate, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,270.9	2,078.5	1,254.4	589.5	716.7	447	726.1
Whanganui District	22,565.9	1,722.3	971.6	643.4	294	232.8	206.8	378
Horowhenua District	56,671.1	6,628.3	3,411.6	2,411.5	1,381.2	1,017.3	455.3	563.6
Manawatū District	124,773.4	9,993.3	5,971.5	4,017.6	2,045.6	2,066.4	987.4	592.3
Tararua District	222,445.9	11,797.5	5,373	2,876.5	1,433.2	1,640.5	977.8	4,462.7
Rangitīkei District	178,775.8	8,916.1	4,584.4	2,649.6	1,299.2	1,226.6	548.8	1,122.3
Ruapehu District	124,363.0	4,747.6	2,213.9	1,165.4	529.1	550.8	318.4	739.3
Area outside town/settlement								
Palmerston North City	96.3	1.1	0.8	0.4	0.1	8.4	17.5	39.9
Whanganui District	214,759.8	4,361.5	2,569.5	1,597.8	763.6	756.5	425	2,455.7
Horowhenua District	49,718.6	2,812.3	2,924.6	2,520.5	971.4	1,634.9	719.5	1,173.5
Manawatū District	131,885.3	8,935.5	4,182.8	2,427.3	1,194.6	1,736.7	1,373.7	1,253.8
Tararua District	207,093.4	6,359.7	3,160.5	1,628.5	791.6	901.7	522.1	1,565.2
Rangitīkei District	208,456.1	6,600.4	3,694.6	2,436.4	1,210	1,244	546.6	1,165
Ruapehu District	549,079.7	11,063.4	5,251	2,854.2	1,407	1,558	926.6	2,839.1
Total area within districts								
Palmerston North City	39,474.8	3,272.1	2,079.3	1,254.8	589.6	725.1	464.5	766.1
Whanganui District	237,325.7	6,083.8	3,541	2,241.2	1,057.5	989.3	631.9	2,833.8
Horowhenua District	106,389.7	9,440.6	6,336.1	4,932	2,352.6	2,652.2	1,174.7	1,737.1
Manawatū District	256,658.7	18,928.8	10,154.3	6,445	3,240.2	3,803.1	2,361.1	1,846.1
Tararua District	429,539.3	18,157.3	8,533.6	4,505	2,224.8	2,542.2	1,499.9	6,027.9
Rangitīkei District	387,231.9	15,516.5	8,279	5,085.9	2,509.2	2,470.6	1,095.4	2,287.3
Ruapehu District	673,442.7	15,810.9	7,465	4,019.6	1,936	2,108.9	1,244.9	3,578.4

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.8: Area of district and depth of modelled flooding by area for 0.5% AEP, Current Climate, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,245.2	2,354.5	1,634.3	821.3	944.6	438.6	697.3
Whanganui District	22,565.9	1,724.3	972.2	640.2	292.1	233.4	208.2	377.8
Horowhenua District	56,671.1	6,560.1	3,324.5	2,573.5	1,185.6	1,690.9	402.3	272.1
Manawatū District	124,773.4	9,888.3	6,162.5	4,393	2,086.9	2,159.6	1,013.1	987.3
Tararua District	222,445.9	10,168.7	4,654.4	2,575.3	1,286.7	1,455	860.4	4,211.4
Rangitīkei District	178,775.8	8,895.1	4,609	2,706	1,380.6	1,253.1	531.9	1,089.6
Ruapehu District	124,363.0	4,746	2,212.6	1,165.6	526.4	550.1	318.4	739.3
Area outside town/settlement								
Palmerston North City	96.3	2	2.8	5.5	6.2	20.7	7.6	28.1
Whanganui District	214,759.8	4,366.7	2,570.9	1,598	764.8	754.2	424.3	2,450.5
Horowhenua District	49,718.6	2,493.9	2,125.1	2,143.3	1,903	2,830	2,273.3	430.9
Manawatū District	131,885.3	8,744.2	4,209.4	2,652.3	1,343.8	1,905.3	1,349.7	1,991.8
Tararua District	207,093.4	4,585.6	2,321.5	1,246.2	617.5	662.2	357.2	1,148
Rangitīkei District	208,456.1	6,415.1	3,762.9	2,907.4	1,730.6	1,592.3	487.5	1,117.4
Ruapehu District	549,079.7	11,063.9	5,250.8	2,854	1,407	1,558.2	926.8	2,839.2
Total area within districts								
Palmerston North City	39,474.8	3,247.3	2,357.3	1,639.8	827.5	965.3	446.2	725.4
Whanganui District	237,325.7	6,091	3,543.1	2,238.2	1,056.9	987.5	632.6	2,828.4
Horowhenua District	106,389.7	9,054	5,449.6	4,716.8	3,088.5	4,520.9	2,675.5	703.1
Manawatū District	256,658.7	18,632.5	10,371.9	7,045.3	3,430.7	4,064.9	2,362.7	2,979.1
Tararua District	429,539.3	14,754.3	6,975.9	3,821.5	1,904.2	2,117.2	1,217.6	5,359.4
Rangitīkei District	387,231.9	15,310.2	8,371.9	5,613.5	3,111.2	2,845.3	1,019.4	2,207
Ruapehu District	673,442.7	15,809.9	7,463.3	4,019.6	1,933.4	2,108.3	1,245.1	3,578.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.9: Area of district and depth of modelled flooding by area for 0.2% AEP, Current Climate, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,348.7	2,174.8	1,353	630.5	746.1	477.5	769.9
Whanganui District	22,565.9	1,760.8	987.9	683.1	336.2	304.7	207.9	451.5
Horowhenua District	56,671.1	6,781.8	3,578.9	2,666.4	1,378.5	1,207.5	465.1	588
Manawatū District	124,773.4	10,367.3	6,195.9	4,244.7	2,111.2	2,412.5	1,146.2	910.4
Tararua District	222,445.9	12,068	5,555.4	3,003.4	1,527.5	1,745.2	999.1	4,883.2
Rangitīkei District	178,775.8	8,652.7	4,069.3	2,411.3	1,340.3	1,544.9	690.3	1,383.8
Ruapehu District	124,363.0	4,767.4	2,216.1	1,223.8	563.4	599.6	344.3	853.9
Area outside town/settlement								
Palmerston North City	96.3	1.1	0.9	0.5	0.1	6.9	17.5	41.5
Whanganui District	214,759.8	4,357.8	2,594.7	1,601.9	889.2	1,078.9	575.7	2,836.7
Horowhenua District	49,718.6	2,757.9	2,744.3	2,877	1,051.3	1,736.9	737.3	1,207
Manawatū District	131,885.3	9,141	4,190.9	2,383.4	1,144.3	1,642.5	1,439.4	1,767.7
Tararua District	207,093.4	6,470.2	3,241	1,688.9	842	990.7	568.1	1,745.4
Rangitīkei District	208,456.1	6,479.2	3,201.8	2,286.1	1,293.4	1,665.9	744.5	1,445.5
Ruapehu District	549,079.7	11,213.2	5,229.6	2,924	1,489.3	1,646.1	1,017.8	3,266.4
Total area within districts								
Palmerston North City	39,474.8	3,349.7	2,175.6	1,353.4	630.6	753	494.9	811.3
Whanganui District	237,325.7	6,118.6	3,582.5	2,285.1	1,225.5	1,383.6	783.6	3,288.2
Horowhenua District	106,389.7	9,539.8	6,323.1	5,543.4	2,429.8	2,944.4	1,202.4	1,795
Manawatū District	256,658.7	19,508.3	10,386.8	6,628.1	3,255.5	4,055	2,585.6	2,678.2
Tararua District	429,539.3	18,538.2	8,796.3	4,692.3	2,369.5	2,735.9	1,567.3	6,628.7
Rangitīkei District	387,231.9	15,131.9	7,271.1	4,697.4	2,633.7	3,210.9	1,434.7	2,829.3
Ruapehu District	673,442.7	15,980.6	7,445.7	4,147.8	2,052.7	2,245.7	1,362.1	4,120.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.10: Area of district and depth of modelled flooding by area for 0.1% AEP, Current Climate, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,367.6	2,252.4	1,459	687.5	800.4	517.3	835.1
Whanganui District	22,565.9	1,766.7	977.8	706.1	366.9	338.2	207.9	548
Horowhenua District	56,671.1	6,824.4	3,599.7	2,764.6	1,433.4	1,293.5	485.2	619.3
Manawatū District	124,773.4	10,436.9	6,205.7	4,424.2	2,209.3	2,631.8	1,242.4	1,171.7
Tararua District	222,445.9	12,224.1	5,650.3	3,092.3	1,566.7	1,853.7	1,050.5	5,117.3
Rangitīkei District	178,775.8	8,835.4	4,134.5	2,454.4	1,355.2	1,678.4	775.4	1,513.9
Ruapehu District	124,363.0	4,814.7	2,253.7	1,288.6	614.4	633.6	365.5	931.4
Area outside town/settlement								
Palmerston North City	96.3	1.1	0.8	0.5	0.1	4.6	17.6	43.6
Whanganui District	214,759.8	4,385.6	2,597.6	1,571.6	885.5	1,202.6	712.2	3,184.3
Horowhenua District	49,718.6	2,712.6	2,642.6	3,083.7	1,084.7	1,868.4	747.5	1,243.7
Manawatū District	131,885.3	9,218.3	4,274.7	2,431.6	1,115.3	1,629	1,357.5	2,288.3
Tararua District	207,093.4	6,544.1	3,286.3	1,731	877.3	1,034.4	611.2	1,863.9
Rangitīkei District	208,456.1	6,500.5	3,252	2,310.2	1,353.2	1,824.7	949.9	1,616.2
Ruapehu District	549,079.7	11,327.7	5,276.4	2,982.9	1,535.7	1,708.3	1,050	3,577.6
Total area within districts								
Palmerston North City	39,474.8	3,368.8	2,253.2	1,459.5	687.7	805	535	878.8
Whanganui District	237,325.7	6,152.3	3,575.4	2,277.7	1,252.4	1,540.8	920.1	3,732.3
Horowhenua District	106,389.7	9,537	6,242.4	5,848.3	2,518.1	3,161.9	1,232.7	1,863
Manawatū District	256,658.7	19,655.2	10,480.4	6,855.8	3,324.6	4,260.8	2,599.9	3,460
Tararua District	429,539.3	18,768.2	8,936.5	4,823.3	2,444	2,888.1	1,661.7	6,981.2
Rangitīkei District	387,231.9	15,335.9	7,386.5	4,764.6	2,708.4	3,503.1	1,725.4	3,130.1
Ruapehu District	673,442.7	16,142.4	7,530.1	4,271.5	2,150.1	2,341.9	1,415.5	4,509.1

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.11: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +1°C, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,331.5	2,181.8	1,384.9	650.4	767.5	501.3	810
Whanganui District	22,565.9	1,741.9	994.4	686.9	315	279.9	200.3	444.2
Horowhenua District	56,671.1	6,709.7	3,453.5	2,573.8	1,387.7	1,223.3	479.1	608.9
Manawatū District	124,773.4	10,063.9	6,097.7	4,262.4	2,110.5	2,345.8	1,039.2	893.1
Tararua District	222,445.9	12,118.5	5,591.1	3,028.9	1,538.4	1,789.9	1,082.6	4,524.7
Rangitīkei District	178,775.8	9,065.2	4,638.9	2,676.8	1,386.6	1,395.2	609.4	1,248.7
Ruapehu District	124,363.0	4,813.2	2,298.7	1,266.6	574.7	607	345.7	860.3
Area outside town/settlement								
Palmerston North City	96.3	1.1	0.9	0.4	0.1	5.3	17.5	43
Whanganui District	214,759.8	4,347.1	2,591.6	1,611.1	902.2	971.1	521.9	2,735.2
Horowhenua District	49,718.6	2,740.3	2,710.2	2,890.7	1,042.1	1,829.6	740.9	1,234.2
Manawatū District	131,885.3	9,087.1	4,241.9	2,447.2	1,193.3	1,673.7	1,359.3	1,859.6
Tararua District	207,093.4	6,477.8	3,253.6	1,694.5	852.2	969.5	564.5	1,703.5
Rangitīkei District	208,456.1	6,624.1	3,682.3	2,495.2	1,305.6	1,547.5	643	1,314.1
Ruapehu District	549,079.7	11,279	5,320.6	2,953.1	1,501.6	1,651	1,021.7	3,282.4
Total area within districts								
Palmerston North City	39,474.8	3,332.5	2,182.7	1,385.3	650.5	772.9	518.8	853
Whanganui District	237,325.7	6,089	3,586	2,298	1,217.3	1,251.1	722.3	3,179.4
Horowhenua District	106,389.7	9,449.9	6,163.8	5,464.5	2,429.7	3,052.9	1,220.1	1,843.1
Manawatū District	256,658.7	19,151	10,339.6	6,709.5	3,303.8	4,019.5	2,398.4	2,752.8
Tararua District	429,539.3	18,596.3	8,844.8	4,723.3	2,390.6	2,759.4	1,647	6,228.2
Rangitīkei District	387,231.9	15,689.3	8,321.2	5,172	2,692.2	2,942.8	1,252.3	2,562.8
Ruapehu District	673,442.7	16,092.2	7,619.2	4,219.7	2,076.3	2,258	1,367.5	4,142.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.12: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +1°C, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,286.6	2,425.7	1,796.5	895.7	1,038.6	508.3	764.6
Whanganui District	22,565.9	1,738.7	993	694.8	319.2	278.9	200.9	445.4
Horowhenua District	56,671.1	6,626.7	3,292.1	2,652.5	1,399.9	1,599.2	779	286
Manawatū District	124,773.4	9,993.1	6,231.7	4,642.1	2,211.4	2,346.3	1,092.6	1,123.9
Tararua District	222,445.9	10,405.7	4,825.2	2,678	1,354.5	1,527.9	877.8	4,518.8
Rangitīkei District	178,775.8	9,050.2	4,671.3	2,715.3	1,457.5	1,426.2	599.5	1,213
Ruapehu District	124,363.0	4,813.6	2,301.3	1,272.6	575.4	606.9	345.8	859.9
Area outside town/settlement								
Palmerston North City	96.3	1.8	3	5.3	5.8	21.1	7.8	28.2
Whanganui District	214,759.8	4,348.4	2,591.6	1,612.5	904.6	968.8	521	2,729.8
Horowhenua District	49,718.6	2,422.9	2,095.2	2,032.7	1,781.8	2,662.3	3,093.6	541.5
Manawatū District	131,885.3	8,895.7	4,253.5	2,717.9	1,390.2	1,964.8	1,349.2	2,240.3
Tararua District	207,093.4	4,662.4	2,379.8	1,266.5	646.6	718.6	384.9	1,239.7
Rangitīkei District	208,456.1	6,414.6	3,757	2,905.7	1,858.3	1,950.7	565.8	1,244.7
Ruapehu District	549,079.7	11,278.3	5,320.5	2,952.7	1,502	1,651.1	1,021.8	3,282.3
Total area within districts								
Palmerston North City	39,474.8	3,288.4	2,428.6	1,801.8	901.5	1,059.7	516.1	792.9
Whanganui District	237,325.7	6,087	3,584.6	2,307.3	1,223.8	1,247.7	721.9	3,175.1
Horowhenua District	106,389.7	9,049.6	5,387.3	4,685.2	3,181.7	4,261.5	3,872.5	827.4
Manawatū District	256,658.7	18,888.8	10,485.2	7,360.1	3,601.6	4,311.1	2,441.8	3,364.1
Tararua District	429,539.3	15,068.2	7,205	3,944.5	2,001.1	2,246.5	1,262.7	5,758.5
Rangitīkei District	387,231.9	15,464.8	8,428.3	5,621	3,315.8	3,376.9	1,165.3	2,457.7
Ruapehu District	673,442.7	16,091.9	7,621.8	4,225.3	2,077.4	2,257.9	1,367.6	4,142.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.13: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +2°C, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,356.3	2,268.9	1,518.3	730.6	837.2	544.6	900.1
Whanganui District	22,565.9	1,765.9	981.6	699.6	356.7	316.6	192.5	547.2
Horowhenua District	56,671.1	6,807	3,479.6	2,741.9	1,484.8	1,295.8	529.9	644
Manawatū District	124,773.4	10,106.9	6,110.4	4,508.8	2,211.9	2,552.4	1,188.2	1,190.5
Tararua District	222,445.9	12,359	5,732.5	3,134.7	1,590.6	1,867.9	1,053	5,120.6
Rangitīkei District	178,775.8	9,215.8	4,712.8	2,670.2	1,438	1,537.9	675	1,377.7
Ruapehu District	124,363.0	4,888.2	2,343.2	1,351.4	647.5	654.2	380.6	977.5
Area outside town/settlement								
Palmerston North City	96.3	1.2	0.8	0.5	0.1	3.5	17.2	45.2
Whanganui District	214,759.8	4,382.5	2,582.8	1,582.8	885.5	1,153.5	652.5	3,071
Horowhenua District	49,718.6	2,646.4	2,578.6	3,080.3	1,199	1,963.3	917.5	1,285
Manawatū District	131,885.3	9,193.1	4,317.7	2,537.3	1,152.9	1,666.4	1,194.3	2,498.5
Tararua District	207,093.4	6,595.1	3,295.2	1,730.6	877.2	1,030.3	607.8	1,856.3
Rangitīkei District	208,456.1	6,703.2	3,698.3	2,480.4	1,381.9	1,756.3	772.1	1,475.4
Ruapehu District	549,079.7	11,460.7	5,388.6	3,033.9	1,560.3	1,756.2	1,067.3	3,732.1
Total area within districts								
Palmerston North City	39,474.8	3,357.5	2,269.7	1,518.8	730.7	840.7	561.8	945.3
Whanganui District	237,325.7	6,148.4	3,564.4	2,282.3	1,242.3	1,470.1	845.1	3,618.2
Horowhenua District	106,389.7	9,453.4	6,058.2	5,822.2	2,683.8	3,259.1	1,447.4	1,929
Manawatū District	256,658.7	19,300	10,428.1	7,046.1	3,364.8	4,218.8	2,382.6	3,689
Tararua District	429,539.3	18,954.1	9,027.7	4,865.3	2,467.8	2,898.2	1,660.8	6,976.9
Rangitīkei District	387,231.9	15,919	8,411.1	5,150.6	2,819.8	3,294.2	1,447	2,853.1
Ruapehu District	673,442.7	16,348.8	7,731.8	4,385.3	2,207.7	2,410.3	1,447.9	4,709.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.14: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +2°C, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,282.9	2,563.8	1,979	985.1	1,133.8	565.3	827.6
Whanganui District	22,565.9	1,765	979	695.4	364.7	320.7	191	548.5
Horowhenua District	56,671.1	6,713.3	3,279.6	2,575.6	1,543.2	1,698.3	1,090.2	312
Manawatū District	124,773.4	10,078	6,240.7	4,854.2	2,362.7	2,512.8	1,191.6	1,254.5
Tararua District	222,445.9	10,636	4,986.2	2,783.2	1,418.3	1,658.6	926.6	4,793.1
Rangitīkei District	178,775.8	9,193.4	4,738	2,714.6	1,498	1,584.8	654.5	1,346.3
Ruapehu District	124,363.0	4,888.5	2,345.2	1,353.2	646.7	653.7	380.8	977.6
Area outside town/settlement								
Palmerston North City	96.3	1.8	2.9	5.3	5.6	21.1	8	28.4
Whanganui District	214,759.8	4,385	2,583.9	1,583.4	886.4	1,152.1	651	3,065.6
Horowhenua District	49,718.6	2,285.6	2,173	2,126.9	1,576.5	2,971.9	3,009	1,239.2
Manawatū District	131,885.3	9,047.2	4,304.4	2,785.6	1,438.7	1,979.5	1,376.6	2,467.1
Tararua District	207,093.4	4,761.6	2,413.1	1,296.2	659.8	762.6	424.9	1,326.4
Rangitīkei District	208,456.1	6,452.9	3,772.1	2,844.3	1,918.3	2,251.5	697.8	1,375.6
Ruapehu District	549,079.7	11,461	5,388.9	3,034.2	1,560.4	1,756.1	1,067.2	3,732
Total area within districts								
Palmerston North City	39,474.8	3,284.7	2,566.7	1,984.2	990.7	1,154.9	573.4	856
Whanganui District	237,325.7	6,150	3,562.9	2,278.8	1,251.2	1,472.9	842	3,614.1
Horowhenua District	106,389.7	8,998.9	5,452.6	4,702.5	3,119.7	4,670.2	4,099.2	1,551.2
Manawatū District	256,658.7	19,125.2	10,545.1	7,639.8	3,801.4	4,492.3	2,568.2	3,721.7
Tararua District	429,539.3	15,397.5	7,399.3	4,079.4	2,078.1	2,421.2	1,351.5	6,119.4
Rangitīkei District	387,231.9	15,646.3	8,510	5,558.9	3,416.2	3,836.4	1,352.3	2,721.9
Ruapehu District	673,442.7	16,349.5	7,734.1	4,387.4	2,207.1	2,409.7	1,448	4,709.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.15: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +3°C, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,355.1	2,359.2	1,657.5	840.6	928.5	594.1	989.5
Whanganui District	22,565.9	1,774.9	984.1	690	398.2	406.3	193.8	623.7
Horowhenua District	56,671.1	6,909.5	3,478.7	2,888.1	1,598.2	1,360.2	588.7	674.4
Manawatū District	124,773.4	10,126.2	6,079.6	4,737.1	2,348.3	2,688.4	1,389.7	1,481.2
Tararua District	222,445.9	12,605.2	5,952.6	3,341	1,699.3	1,972.1	1,115.7	5,197.9
Rangitīkei District	178,775.8	9,332.5	4,762.4	2,689.1	1,461.3	1,667.9	765.1	1,501.6
Ruapehu District	124,363.0	4,961	2,384.6	1,405.3	706.2	713.3	392.2	1,107.7
Area outside town/settlement								
Palmerston North City	96.3	1.2	1	0.5	0.1	2.8	16.4	46.7
Whanganui District	214,759.8	4,411.4	2,577.1	1,549.5	855.9	1,206.6	771.8	3,460.2
Horowhenua District	49,718.6	2,524.5	2,408.5	3,134	1,541.9	1,941.9	1,235.6	1,322.8
Manawatū District	131,885.3	9,324	4,362	2,580.9	1,210.5	1,578.2	1,224	2,934.2
Tararua District	207,093.4	6,698.2	3,353.4	1,797.4	954.6	1,133.8	653.8	1,992.8
Rangitīkei District	208,456.1	6,742.5	3,732.6	2,539.2	1,394.2	1,894.9	957.3	1,643.8
Ruapehu District	549,079.7	11,658.1	5,457.3	3,078.5	1,606.4	1,832	1,102.3	4,176.5
Total area within districts								
Palmerston North City	39,474.8	3,356.3	2,360.2	1,658	840.7	931.2	610.5	1,036.2
Whanganui District	237,325.7	6,186.3	3,561.2	2,239.5	1,254.1	1,612.9	965.6	4,083.9
Horowhenua District	106,389.7	9,434	5,887.2	6,022.1	3,140.1	3,302.1	1,824.2	1,997.2
Manawatū District	256,658.7	19,450.3	10,441.6	7,317.9	3,558.8	4,266.6	2,613.7	4,415.4
Tararua District	429,539.3	19,303.4	9,306	5,138.5	2,653.9	3,105.9	1,769.5	7,190.7
Rangitīkei District	387,231.9	16,075.1	8,494.9	5,228.3	2,855.6	3,562.9	1,722.5	3,145.3
Ruapehu District	673,442.7	16,619.1	7,841.8	4,483.8	2,312.5	2,545.3	1,494.5	5,284.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.16: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +3°C, Defences Down

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,200.7	2,617.9	2,165.6	1,101.5	1,229.9	623.2	886.5
Whanganui District	22,565.9	1,773.6	983	688.7	396.6	412.8	192.3	625.1
Horowhenua District	56,671.1	6,824.3	3,317.3	2,560.7	1,408.2	1,998.8	1,212.1	398.9
Manawatū District	124,773.4	10,150.4	6,234.4	5,004.1	2,538.9	2,678.6	1,300.7	1,391.5
Tararua District	222,445.9	10,811.7	5,138.4	2,890.4	1,465.4	1,738.8	1,017.6	5,061.7
Rangitīkei District	178,775.8	9,313	4,777.4	2,722.5	1,507.3	1,733.1	737.4	1,470.4
Ruapehu District	124,363.0	4,961	2,385.1	1,406.8	705.8	712	393	1,107.4
Area outside town/settlement								
Palmerston North City	96.3	1.7	2.9	5.2	5.4	21.2	8.2	28.4
Whanganui District	214,759.8	4,414.6	2,575.6	1,549.3	856.7	1,205	770.3	3,455.4
Horowhenua District	49,718.6	2,075	1,968.4	2,026.9	1,630.9	2,982.6	3,085	2,063.7
Manawatū District	131,885.3	9,208.5	4,357	2,822.6	1,482.8	1,956.8	1,426.5	2,682.1
Tararua District	207,093.4	4,824.2	2,452.2	1,324.6	689.1	794.2	463.2	1,423.4
Rangitīkei District	208,456.1	6,453	3,751.3	2,841.1	1,890.3	2,485.7	893.4	1,518.8
Ruapehu District	549,079.7	11,657.7	5,457.3	3,078.6	1,606.7	1,831.8	1,102.4	4,176.1
Total area within districts								
Palmerston North City	39,474.8	3,202.5	2,620.7	2,170.8	1,106.9	1,251.1	631.4	914.9
Whanganui District	237,325.7	6,188.2	3,558.5	2,238	1,253.3	1,617.9	962.6	4,080.5
Horowhenua District	106,389.7	8,899.3	5,285.7	4,587.6	3,039.1	4,981.4	4,297.1	2,462.6
Manawatū District	256,658.7	19,358.9	10,591.4	7,826.7	4,021.7	4,635.5	2,727.2	4,073.6
Tararua District	429,539.3	15,635.9	7,590.5	4,215	2,154.5	2,533.1	1,480.8	6,485.1
Rangitīkei District	387,231.9	15,766	8,528.7	5,563.7	3,397.7	4,218.7	1,630.9	2,989.2
Ruapehu District	673,442.7	16,618.7	7,842.4	4,485.4	2,312.5	2,543.8	1,495.4	5,283.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.2.17: Area of district and depth of modelled flooding by area for 0.5% AEP, Climate Warming +3°C + SLR, Defences Up

District	Area of the settlement in hectares	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Area inside town/settlement								
Palmerston North City	39,378.5	3,350.4	2,354.3	1,656.2	840.2	927.5	593.7	989.5
Whanganui District	22,565.9	1,771.1	982.3	690.2	394.4	436.4	193.1	645.2
Horowhenua District	56,671.1	6,908.1	3,494.4	2,837.2	1,322.7	1,589.2	645.3	696.1
Manawatū District	124,773.4	10,127	6,078.2	4,739.7	2,351.3	2,689.3	1,390.4	1,482.2
Tararua District	222,445.9	4,271.6	1,784.5	889.2	499	682.6	498.4	2,185.7
Rangitīkei District	178,775.8	9,320.2	4,743.4	2,692.6	1,491.9	1,680.1	771.1	1,508.8
Ruapehu District	124,363.0	3,041.5	1,567.9	940.3	510.8	532.8	313.2	989.4
Area outside town/settlement								
Palmerston North City	96.3	1.1	0.9	0.4	0.1	2.8	16.4	46.7
Whanganui District	214,759.8	4,281	2,527	1,537.3	854.3	1,202.8	773.6	3,374.2
Horowhenua District	49,718.6	2,571.5	2,446	3,173.1	1,578.1	2,042.6	886.4	1,326
Manawatū District	131,885.3	9,324.3	4,361.9	2,580.4	1,211	1,577.9	1,224.3	2,934.2
Tararua District	207,093.4	3,985	1,907.1	997.5	522.7	627.8	388.2	1,280
Rangitīkei District	208,456.1	6,736.5	3,729.7	2,519	1,410	1,915.1	979	1,665.7
Ruapehu District	549,079.7	10,525.4	4,929.7	2,801.3	1,481.7	1,712.2	1,040.2	3,973.1
Total area within districts								
Palmerston North City	39,474.8	3,351.6	2,355.2	1,656.5	840.4	930.2	610.1	1,036.2
Whanganui District	237,325.7	6,052.2	3,509.2	2,227.5	1,248.7	1,639.2	966.6	4,019.4
Horowhenua District	106,389.7	9,479.6	5,940.5	6,010.4	2,900.8	3,631.7	1,531.7	2,022.1
Manawatū District	256,658.7	19,451.3	10,440.1	7,320.1	3,562.4	4,267.2	2,614.7	4,416.4
Tararua District	429,539.3	8,256.6	3,691.6	1,886.7	1,021.8	1,310.4	886.7	3,465.7
Rangitīkei District	387,231.9	16,056.7	8,473	5,211.6	2,901.9	3,595.2	1,750.1	3,174.5
Ruapehu District	673,442.7	13,566.9	6,497.6	3,741.6	1,992.5	2,244.9	1,353.4	4,962.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.1: Total hectares of property use type flooded for town/settlement for 5% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	182	81.9	43.1	8.5	2.3	1.2	0.2
Palmerston North	3,060.7	258	148.6	66	22.5	12.2	1.4	0.2
Feilding	1,015.1	119.7	15.1	9	3.8	1.6	0.1	0.2
Marton	365.7	44.8	12.6	3.1	1.1	1.1	0.4	-
Ohakune	272.9	21.1	7.3	3.3	1	0.8	0	-
Longburn	46.1	3	1.1	0.1	-	-	-	-
Kairanga	45.4	8.9	2.2	0.5	0	0	-	-
Levin	1,280.1	290.4	33.5	6.5	1.2	1.3	0	-
Woodville	119.2	17.9	4.6	3.9	1.7	1.8	0.8	2.8
Foxton	227.8	36.6	25.3	12	1.2	0.3	0	0
Foxton Beach	182.5	28.4	16.4	3.4	0.7	0.1	-	-
Taumarunui	292.6	20.6	11.8	6	2.4	1.1	0.9	1.1
Dannevirke	346.6	30.3	4.1	1.4	0.6	0.3	0	-
Bulls	172.2	25.6	7.5	1.9	0.4	0.1	-	-
Tangimoana	38.6	7.4	6.3	1.4	0.1	-	-	-
Hunterville	163.2	10.8	5.7	2.3	0.5	0.4	0	0
Shannon	118.1	5.9	1.5	0.6	0.2	0.1	-	-
Koitiata	9.2	0.6	0.8	1.1	0.5	-	-	-
Ōhau	223.5	18.4	2.4	1.3	0.5	0.3	-	-
Hokio Beach	64	5.7	3.7	1.2	0.4	0	-	-
Bunnythorpe	132.8	8.1	3.2	1.6	0.6	0.1	0.1	-
Eketāhuna	91.5	8.2	1.7	0.3	0.1	0	0	0
Mangaweka	21.7	2.9	0.2	0	0.1	0	-	-
Ōwhango	24.1	2.5	0.3	0.5	0.3	0.4	0.1	-
Ōhura	31.9	3.3	2.7	1.4	0.2	0	-	-
Pohangina	23.7	1.6	0.4	0.1	0	0	-	-
Pongaroa	16.6	1.5	0.9	0.4	0.2	0.1	0	-
Mangamutu	13.6	1.5	0.4	-	-	-	-	-
Pahiatua	213.1	35.2	13.1	2.8	0.4	0.2	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	27.5	4.9	0.7	0.2	0	-	-
Himatangi Beach	50.7	4.8	1.9	0.3	-	-	-	-
Taihape	297.3	9.7	3.5	1.1	0.6	0.3	0.4	0.2
Waitārere Beach	111.8	6.5	6.8	5.8	0.9	0.1	-	-
Raetihi	101.9	9	3.7	3.1	1.3	0.7	0	-
Manakau	115.9	15.9	4	1.6	0.2	0.1	-	-
Sanson	58.6	5.1	1.9	1.4	0.1	0	-	-
Linton	44.7	2.5	0.9	0.9	0.2	0.1	-	-
Ohakea	9.9	1.2	0.1	-	-	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	3.8	0.7	0.8	0	0	0.1	-
Waiouru	8.4	0.7	0.1	-	-	-	-	-
National Park	139.3	3.1	2	0.7	0.4	1.1	0.1	-
Waikawa Beach	59.7	5.7	3.7	0.7	0	-	-	-
Mangatainoka	20.2	1.6	1.3	0.6	0.3	0.3	0	0.6
Ormondville	40.5	4.4	0.5	0.2	0	0	-	-
Rongotea	110	9.3	4.8	1.8	0	0	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	10.5	5.1	1.1	0.1	0.1	-	-
Kimbolton	52.5	2.9	2.2	0.2	-	0.7	-	-
Rangataua	28.5	2.5	0.5	0	-	-	-	-
Raurimu	16.9	0.9	0.2	0.1	0	0	-	-
Kai Iwi	38.6	2.3	1.1	0.3	0.9	0.1	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	49.6	28.5	10.7	4.6	7.1	0	-
Palmerston North	686.1	82.9	43.9	22.6	8.8	9.3	2.3	9.3
Feilding	170.9	36.6	11.5	2.7	1	0.3	0.1	-
Marton	213.9	28.4	24.7	22.2	1.9	1.4	0.7	1.8
Ohakune	22.4	2.1	1.4	0.6	0.2	0.2	0	-
Longburn	60.8	9.8	3.1	0.8	0	0	0	0
Kairanga	8	1.3	0.7	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	92.6	5.7	0.5	0.9	0.3	-	-
Woodville	12.5	1	0.5	0.5	0.7	1.5	0.2	0.3
Foxton	41.4	7.6	4.5	0.6	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	3.6	1.2	0.2	0	0	0	0
Dannevirke	129.7	12.3	3.2	1.4	0.8	1	0.1	0.1
Bulls	53.9	6.9	3.1	0.4	0.2	0.2	0.2	0.2
Tangimoana	4.1	0.7	0.1	0	-	-	-	-
Hunterville	23.4	2.9	0.8	0.1	0	0	-	-
Shannon	24.9	2.7	0.9	0.2	-	-	-	0
Ōhau	7.2	0.9	0.1	0.1	0.1	0.7	0.2	-
Hokio Beach	50	7.7	4	1	-	-	-	-
Bunnythorpe	20.9	2.5	0.5	0.1	-	-	-	-
Eketāhuna	14	1.9	0.2	0	-	-	-	-
Mangaweka	10.3	2	0.3	0.1	0	0	0	-
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0	0	-	-	-
Pongaroa	2.5	0.3	0.5	0.1	0	-	-	-
Mangamutu	15.3	3.1	1.9	0.6	-	-	-	-
Pahiatua	17.7	3.3	0.9	0.1	-	-	-	-
Ashhurst	19.8	2.4	2.4	2.8	1.1	0.5	0.1	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.3	0.5	0.2	0.1	0.1	-	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.1	0.4	0.1	0	0	-	-
Manakau	0.3	0	-	0	0	0	-	-
Sanson	10.2	1.6	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0	-	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	1.3	0.6	0.8	-	-	-	-
Mangatainoka	4.7	0.6	0.2	0	-	-	-	-
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.5	1.3	2.6	3.6	1.3	0.6	1.5
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0	0.1	0	-	-	-
Rural property use type								
Whanganui	9,193.7	803	454.4	270.6	86.6	59.4	9.7	2.5
Palmerston North	14,029.6	855.9	511.1	313.8	160	147.5	51.5	103.1
Feilding	7,528	706.6	343.6	214.4	102.6	54.6	13.5	1.4
Marton	27,105.7	2,267.3	936.5	397.9	162.8	115.8	30.2	31.7
Ohakune	44,184.2	696.7	294.8	131.7	43.1	27.5	6.1	3.1
Longburn	1,302.6	186.7	138.6	61.3	26.4	31.7	16.7	18.2
Kairanga	6,733.2	1,260.8	862.2	421.5	206.9	144.9	8.9	2.7
Levin	7,837.6	947.6	189.5	132.3	65.5	39.8	4.2	0.6
Woodville	10,615.9	570.9	278.3	190.8	129.3	240.6	262.4	1,328.5
Foxton	11,957.6	1,974.4	933.7	546.5	153.5	222.1	169.5	58
Foxton Beach	861.7	87.6	93.2	187.7	38.5	18.2	0.8	4.6
Taumarunui	12,241.3	278.2	154.3	82.8	39	49.8	26.5	28.7
Dannevirke	34,395.2	2,406.8	795	429	190.4	167.6	73.3	81.5
Bulls	9,085.6	1,217.8	645.5	310.5	97.4	43.5	12.5	10.5
Tangimoana	9,602.2	1,124.8	444.7	211	85.3	58.9	11.2	8.8
Hunterville	55,534.7	1,628.3	765.6	349.2	132.4	108.6	61.5	100.3
Shannon	7,725	473.3	457.3	366.1	131.8	38.2	9.1	7.8
Koitiata	908.1	101.3	71.4	40.9	5.8	2.4	0.7	1.8
Ōhau	2,857.8	253.4	158.5	76.8	24.2	20.8	2.8	3.5
Hokio Beach	2,923.4	310.2	274	192.1	53.1	21	1.1	3.5
Bunnythorpe	8,837.9	698.2	352.7	242.3	100	53.9	9.2	1
Eketāhuna	37,977.3	2,037.2	895.6	386.6	140.9	120.1	37.7	17.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	670.5	276.2	99.3	37.1	29.6	14.8	45.9
Ōwhango	21,112.2	352.6	146	70.6	28.8	24.6	10.5	21.5
Ōhura	24,006.2	706.4	370.4	156.1	63	56.8	36.7	33.6
Pohangina	26,177.4	910.5	495.9	240.2	90.9	88.7	26.8	15.6
Pongaroa	57,773.7	1,215.5	531.1	205.3	99.5	110.5	60.9	62.1
Mangamutu	1,464.7	98.5	72.9	50.6	32.9	30.2	9.9	2.6
Pahiatua	56,300.9	1,876.3	1,012.9	470.7	178.3	160.8	73.4	53.3
Ashhurst	9,723	614	366.3	186.4	63.3	54	23.5	17.6
Himatangi Beach	1,181.1	167.7	144.9	57.9	27.8	16.9	0	-
Taihape	66,124.7	1,775.7	911.7	375.1	123.1	100.7	45.2	42.5
Waitārere Beach	13.3	1.1	1.2	0.9	0.1	-	-	-
Raetihi	153,110.1	823.6	336.6	146.2	49.6	35	12.8	17.9
Manakau	5,969.4	439.2	224.2	136.5	55.3	18.1	1.2	0
Sanson	3,977.1	246.7	162.4	93.1	32.9	16.3	1.5	0.7
Linton	9,076.6	480.5	300.9	158	61.2	62.4	11.1	5.6
Ohakea	1,988.8	322.9	105.2	38.2	8.8	2.8	0.7	0.1
Norsewood	5,388.4	445.6	135.8	52.3	21.2	19.5	10.1	8.3
Tokomaru	5,474	362.6	231.2	217.2	115.4	47.7	7.3	1.7
Waiouru	2,552.9	132.9	60.7	25.2	7.6	5.6	3.1	1.4
National Park	4,186.3	220.8	54.1	20.8	12.7	10.1	4.5	4.6
Waikawa Beach	270	32.6	21.3	9.6	3	1.5	0.5	-
Mangatainoka	2,846.3	132.8	88.5	58.7	36.2	68	67.7	474.7
Ormondville	15,472.3	550	199.8	102.2	41.7	54.1	31.9	55.6
Rongotea	9,950.9	1,113.5	517.4	334.8	172.5	132.8	7.1	2.6
Rātana	1,699.3	132.8	83.5	41.2	20.1	15.1	4.2	7.9
Halcombe	20,547.4	1,268.2	813.6	517	227.1	141.8	52.8	30.4
Kimbolton	9,408.6	388.7	208	114.4	39.6	26.3	10.1	8.4
Rangataua	6,946.1	158	40.3	23.3	7.5	3.8	0.4	0.2
Raurimu	2,159.8	106.2	38.8	17.3	9.6	9	4.6	7.3
Kai Iwi	9,060.1	304.6	231.5	142.7	54.5	50.7	22.2	21.6
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	91.2	44.3	36.5	22.7	9.4	2.3	5
Palmerston North	5,568.9	231.7	144.5	109.2	59.4	62.7	16.6	12.3
Feilding	476.3	47.4	26.8	18.4	4.3	1.5	0.5	0.1
Marton	1,724.2	59.9	28.1	11.8	3.6	2.1	1.3	1
Ohakune	2,300.5	23.1	10.5	7.2	4.1	2.7	0.4	0
Longburn	36.4	0.6	0.5	0.2	0	-	-	0
Kairanga	29.9	2.4	0.1	0.2	0.3	0.1	0	0
Levin	495.8	97.5	15.2	5.8	8.3	4.3	0.4	0.1
Woodville	73.1	12.5	0.4	0.3	0.2	0.2	0.7	16.8
Foxton	594.5	83.8	49	28.6	3.6	1.5	0.3	0
Foxton Beach	309.8	29.1	21.5	13.8	15.6	0.8	-	-
Taumarunui	503.9	10.7	5.6	6.6	3	4.6	1.6	2.6
Dannevirke	855.3	59.5	14.8	5.8	2.8	2.3	0.5	0
Bulls	223.2	27	8.7	4.2	3.1	1.2	0.2	0.1
Tangimoana	421.8	30.9	20.2	3.7	1.3	2.5	1.2	0.4
Hunterville	2,173.7	23	13	6.9	3.1	3.8	1.8	1.3
Shannon	2,594	28	12.6	4.8	2.1	2.1	0.8	0.5
Koitiata	64.1	13.8	9.2	2.4	0.6	0.1	-	-
Ōhau	35.6	2.2	0.7	0.2	-	-	-	-
Hokio Beach	857.5	120.2	146.7	28.9	21.5	54.4	0.4	0
Bunnythorpe	80.9	7	1.7	0.9	0.5	0.8	0.3	0
Eketāhuna	1,475.7	7.6	2.7	1.7	0.6	1.1	0.9	0.6
Mangaweka	252	8.7	1.8	0.8	0.4	0.5	0.7	1.8
Ōwhango	1,328.7	0.5	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	10.8	3.8	0.8	0.6	0.8	0.5	0.1
Pohangina	882.3	30.4	16	6.7	3.4	2.9	0.3	0.1
Pongaroa	3,913	126.7	49.8	12.7	4.8	6.3	3.5	1.1
Mangamutu	26	0.7	0.9	0.5	-	-	-	-
Pahiatua	2,893.9	22.3	9.5	3.6	1.4	1.6	1.2	0.6
Ashhurst	115.4	7	2.4	1.4	0.9	0.7	0	-
Himatangi Beach	59.4	1.2	0.5	0.6	0.4	0.4	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	87.5	38.1	12.9	6.4	3.4	1.1	0.5
Waitārere Beach	24.3	1.4	0.7	0.2	0.4	-	-	-
Raetihi	8,257	12.3	9.1	4.5	1.8	1.4	0.1	0.1
Manakau	138	5.4	3.2	2.4	0.6	0.3	-	-
Sanson	55.8	2.5	0.9	0.2	0	-	0	-
Linton	426.8	51.3	11.6	13.5	6.9	10.8	3.9	7.1
Ohakea	56.4	4.3	1.4	0.9	0.1	-	-	-
Norsewood	148.5	2.9	1	0.8	0.3	0.4	0.4	0.4
Tokomaru	1,681.2	25.5	16.3	4.5	0.8	0.8	0.2	0.1
Waiouru	2.1	0.1	0.2	0	0	-	-	-
National Park	1,051.5	14	4.5	1.1	0.8	0.4	0.1	0
Waikawa Beach	4.2	0.4	0.5	0.2	0	0.7	-	-
Mangatainoka	178	5.8	3.2	1.8	1.7	2.3	0.1	0
Ormondville	889.7	25.4	15.9	29.7	7.7	5.6	2.7	2.1
Rongotea	137.6	0.7	0.7	1.4	0.1	0	-	-
Rātana	25.6	1.5	0.3	0.2	0	0.1	0	0.1
Halcombe	913.2	50.3	22.6	22.8	7.5	5.3	1.5	6
Kimbolton	334.7	0.4	0.5	-	-	0.5	0	-
Rangataua	766.7	24.5	12.2	7.1	2.5	2.3	0.7	0.1
Raurimu	190.1	6.3	4	2.7	0.2	0.1	0.1	0.1
Kai Iwi	148.2	4.9	5.8	2.7	1.9	1.3	0.2	0.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.2: Total hectares of property use type flooded for town/settlement for 5% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	182.1	81.7	42.1	7.7	2.1	0.9	0.1
Palmerston North	3,060.7	261.7	104.2	36.5	12.1	6	1.3	0.2
Feilding	1,015.1	161.9	24	7.5	4	2.1	0.3	0
Marton	365.7	45.2	13.9	3.3	1.2	1.1	0.5	-
Ohakune	272.9	21.1	7.3	3.3	1	0.8	0	-
Longburn	46.1	3	2.3	1.1	0.2	0	-	-
Kairanga	45.4	12.1	4.4	1	0.1	0.6	0	0
Levin	1,280.1	290.4	33.5	6.5	1.2	1.3	0	-
Woodville	119.2	18.6	4.7	3.7	1.9	1.8	0.8	2.8
Foxton	227.8	36.7	25.1	12.2	1.1	0.2	-	-
Foxton Beach	182.5	28.6	14.9	3.2	0.6	0	-	-
Taumarunui	292.6	20.6	11.4	5.8	2.2	1	0.9	1.1
Dannevirke	346.6	30.3	4.1	1.4	0.6	0.3	0	-
Bulls	172.2	25.9	7.8	2	0.5	0.1	0	-
Tangimoana	38.6	7.6	5.7	1.2	0.1	-	-	-
Hunterville	163.2	10.8	7.5	3.1	0.8	0.5	0.1	0
Shannon	118.1	6	1.8	0.6	0.2	0.1	-	-
Koitiata	9.2	0.6	0.8	1.1	0.5	-	-	-
Ōhau	223.5	18.4	2.4	1.3	0.5	0.3	-	-
Hokio Beach	64	5.7	3.7	1.2	0.4	0	-	-
Bunnythorpe	132.8	8	3.2	1.6	0.6	0.1	0.1	-
Eketāhuna	91.5	8.2	1.7	0.3	0.1	0	0	0
Mangaweka	21.7	2.9	0.2	0	0.1	0	-	-
Ōwhango	24.1	2.5	0.3	0.5	0.3	0.4	0.1	-
Ōhura	31.9	3.3	2.7	1.4	0.2	0	-	-
Pohangina	23.7	1.6	0.4	0.1	0	0	-	-
Mangamutu	13.6	1.5	0.4	-	-	-	-	-
Pahiatua	213.1	35.5	13.1	2.7	0.4	0.2	0.1	0.1
Ashhurst	179.3	24.7	4.1	0.5	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	4.8	1.9	0.3	-	-	-	-
Taihape	297.3	9.7	3.5	1.1	0.6	0.3	0.4	0.2
Waitārere Beach	111.8	6.5	6.8	5.8	0.9	0.1	-	-
Raetihi	101.9	9	3.7	3.1	1.3	0.7	0	-
Manakau	115.9	15.9	4	1.6	0.2	0.1	-	-
Sanson	58.6	5.1	1.9	1.4	0.1	0	-	-
Linton	44.7	2.6	0.9	0.9	0.2	0.2	0.1	-
Ohakea	9.9	1.2	0.1	-	-	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	4	0.6	0.5	0	0	0.1	-
Waiouru	8.4	0.7	0.1	-	-	-	-	-
National Park	139.3	3.1	2	0.7	0.4	1.1	0.1	-
Waikawa Beach	59.7	5.7	3.7	0.7	0	-	-	-
Mangatainoka	20.2	1.6	1.3	0.6	0.3	0.3	0	0.6
Ormondville	40.5	4.4	0.5	0.2	0	0	-	-
Rongotea	110	9.3	6.3	2.2	0.5	0.5	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	10.5	5.1	1.1	0.1	0.1	-	-
Kimbolton	52.5	2.9	2.2	0.2	-	0.7	-	-
Rangataua	28.5	2.5	0.5	0	-	-	-	-
Raurimu	16.9	0.9	0.2	0.1	0	0	-	-
Kai Iwi	38.6	2.3	1.1	0.3	0.9	0.1	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	52.8	22.5	6.1	4.2	7	0	-
Palmerston North	686.1	84.5	40.7	20.6	6.3	9.2	2.3	9.2
Feilding	170.9	47	15.8	3.6	0.3	0.3	0	-
Marton	213.9	22	31.3	33.3	11.3	3.5	0.7	1.6
Ohakune	22.4	2.1	1.4	0.6	0.2	0.2	0	-
Longburn	60.8	13.9	9.7	2.3	0.6	0.4	0	0
Kairanga	8	1.4	1	0.1	0	-	-	-
Levin	180.9	92.6	5.7	0.5	0.9	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	1.1	0.5	0.5	0.8	1.6	0.1	0.4
Foxton	41.4	7.2	5.2	1.1	0.8	0.1	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	3.6	1.2	0.2	0	0	0	0
Dannevirke	129.7	12.3	3.2	1.4	0.8	1	0.1	0.1
Bulls	53.9	6.9	3.1	0.4	0.2	0.2	0.2	0.2
Tangimoana	4.1	0.7	0	0	-	-	-	-
Hunterville	23.4	2.6	1.1	0.1	0	0.1	-	-
Shannon	24.9	2.5	1.7	1.4	0	-	-	0
Ōhau	7.2	0.9	0.1	0.1	0.1	0.7	0.2	-
Hokio Beach	50	7.7	4	1	-	-	-	-
Bunnythorpe	20.9	2.5	0.5	0.1	-	-	-	-
Eketāhuna	14	1.9	0.2	0	-	-	-	-
Mangaweka	10.3	2	0.3	0.1	0	0	0	-
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0	0	-	-	-
Mangamutu	15.3	2.9	1.4	0.7	-	-	-	-
Pahiatua	17.7	3.3	0.9	0.1	-	-	-	-
Ashhurst	19.8	3.5	2.4	1.1	0.2	0.5	0.1	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.3	0.5	0.2	0.1	0.1	-	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.1	0.4	0.1	0	0	-	-
Manakau	0.3	0	-	0	0	0	-	-
Sanson	10.2	1.6	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0	-	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0	-	-	-	-
National Park	18.3	1.3	0.6	0.8	-	-	-	-
Mangatainoka	4.7	0.6	0.2	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.5	2.5	3.6	0.9	0.8	0.5	1.4
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0	0.1	0	-	-	-
Rural property use type								
Whanganui	9,193.7	803	454.4	270.6	86.7	59.4	9.7	2.5
Palmerston North	14,029.6	852.2	555.5	350.7	171.8	159.4	62	93.9
Feilding	7,528	754	380.2	217.4	100.6	56.8	13.9	1.4
Marton	27,105.7	2,268.4	949.2	420.3	166.8	101.3	26.9	30.4
Ohakune	44,184.2	696.7	294.8	131.7	43.1	27.5	6.1	3.1
Longburn	1,302.6	243.5	171.6	67.9	38.2	46.6	20.3	17.4
Kairanga	6,733.2	1,057.9	997.8	499.3	266.6	347.9	347.4	107.1
Levin	7,837.6	947.6	189	132.2	65.5	39.8	4.2	0.6
Woodville	10,615.9	582.9	281.7	194.8	127.3	238.7	262.9	1,329
Foxton	11,957.6	1,968.7	925.3	568.7	271.9	279.7	29.2	16.9
Foxton Beach	861.7	99.9	113.5	162.7	23.2	9.3	0	4.6
Taumarunui	12,241.3	278.2	154.2	82.8	39	49.8	26.6	28.7
Dannevirke	34,395.2	2,405.8	800.3	431.4	191	167.8	73.5	81.5
Bulls	9,085.6	1,211.4	667.3	364.3	123	47.1	12.4	10.1
Tangimoana	9,602.2	1,130.9	451.9	226.6	84.2	45.9	9.4	5.4
Hunterville	55,534.7	1,657.8	782.8	362.7	139.2	104.2	53.8	94.8
Shannon	7,725	422.5	394.8	445.6	239.8	64.8	6.1	6.5
Koitiata	908.1	101.7	71.5	40.9	5.9	2.4	0.6	1.8
Ōhau	2,857.8	248.3	164	80	23.1	18.1	3.3	2
Hokio Beach	2,923.4	310.2	274	192.1	53.1	21	1.1	3.5
Bunnythorpe	8,837.9	701.4	363.7	237.8	99.3	53.9	8.9	1
Eketāhuna	37,977.3	2,038.9	895.2	386.4	141	120.1	37.7	17.2
Mangaweka	25,542.3	669.5	276.2	99.4	37.1	29.6	14.8	45.9
Ōwhango	21,112.2	352.5	146.1	70.6	28.8	24.6	10.5	21.5
Ōhura	24,006.2	706.5	370.4	156.1	63	56.8	36.7	33.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	910	496.2	239.9	90.9	88.6	26.7	15.6
Pongaroa	57,773.7	0.7	0.2	-	-	-	-	-
Mangamutu	1,464.7	97.4	74.4	52.4	34.8	30.9	10.1	2.4
Pahiatua	56,300.9	1,880.5	1,012	468	177.1	160.9	73.3	53.1
Ashhurst	9,723	624.4	369.9	188.8	65.9	54.5	28	16.2
Himatangi Beach	1,181.1	167.7	145	57.9	27.8	16.9	0	-
Taihape	66,124.7	1,775.9	911.3	375	123.1	100.6	45.3	42.5
Waitārere Beach	13.3	1.1	1.2	0.9	0.1	-	-	-
Raetihi	153,110.1	823.6	336.6	146.2	49.6	35	12.8	17.9
Manakau	5,969.4	439.4	223.6	136.3	55.3	18.1	1.2	0
Sanson	3,977.1	246.8	162.3	93.1	32.9	16.3	1.5	0.7
Linton	9,076.6	476.8	301	174.2	74.6	59.7	13.9	5.7
Ohakea	1,988.8	325.7	108.7	37.2	8.3	2.5	0.6	0.1
Norsewood	5,388.4	445.5	135.8	52.3	21.2	19.5	10.1	8.3
Tokomaru	5,474	307.8	238.4	299.6	177	62.4	7.3	1.7
Waiouru	2,552.9	132.9	60.7	25.2	7.6	5.6	3.1	1.4
National Park	4,186.3	220.8	54.1	20.8	12.7	10.1	4.5	4.6
Waikawa Beach	270	32.6	21.3	9.6	3	1.5	0.5	-
Mangatainoka	2,846.3	132.1	88.4	58.6	36.3	68	67.7	474.6
Ormondville	15,472.3	549.3	199.8	102.2	41.7	54.1	32	55.6
Rongotea	9,950.9	1,079.5	649	442.9	185.1	226.6	145.5	15.1
Rātana	1,699.3	132.9	83.4	41.1	20.2	15.2	4.2	7.9
Halcombe	20,547.4	1,272.1	811	520.3	220.1	140.2	52.5	29.9
Kimbolton	9,408.6	388.8	207.8	114.5	39.6	26.3	10.1	8.4
Rangataua	6,946.1	158.1	40.2	23.3	7.5	3.8	0.4	0.2
Raurimu	2,159.8	106.2	38.8	17.3	9.6	9	4.6	7.3
Kai Iwi	9,060.1	304.8	231.5	142.6	54.6	50.7	22.2	21.6
Other property use type								
Whanganui	1,392.5	92.6	46.7	34.4	18.6	8.9	2.2	5
Palmerston North	5,568.9	231.9	143	110	64.2	58.3	24.4	12.7
Feilding	476.3	59.9	31.4	10.5	2.6	1.4	0.4	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	59.9	28.5	11.9	3.5	2.1	1.3	1
Ohakune	2,300.5	23.1	10.5	7.2	4.1	2.7	0.4	0
Longburn	36.4	5.4	0.7	0.2	0.1	-	-	0
Kairanga	29.9	2.3	0.1	0.3	0.3	0.1	0	-
Levin	495.8	97.5	15.2	5.8	8.3	4.3	0.4	0.1
Woodville	73.1	11.8	0.3	0.3	0.2	0.2	0.7	16.8
Foxton	594.5	84	49.1	28.3	3	0.3	-	0
Foxton Beach	309.8	28.8	17.9	12.5	15.8	0.5	-	-
Taumarunui	503.9	11.2	6	5	2.7	4.6	1.6	2.6
Dannevirke	855.3	59.5	14.9	5.9	2.8	2.3	0.5	0
Bulls	223.2	27	8.7	4.2	3.2	1.2	0.2	0.1
Tangimoana	421.8	31.1	20	3.7	1.7	2	1.2	0.1
Hunterville	2,173.7	23.6	13.4	6.9	3.2	4	1.9	1.3
Shannon	2,594	27.9	12.5	4.7	2.1	2.1	0.8	0.5
Koitiata	64.1	13.8	9.2	2.4	0.6	0.1	-	-
Ōhau	35.6	2.2	0.7	0.2	-	-	-	-
Hokio Beach	857.5	120.2	146.7	28.9	21.5	54.4	0.4	0
Bunnythorpe	80.9	7	1.8	1	0.6	0.8	0.3	0
Eketāhuna	1,475.7	7.6	2.7	1.7	0.6	1.1	0.9	0.6
Mangaweka	252	8.7	1.8	0.8	0.4	0.5	0.7	1.8
Ōwhango	1,328.7	0.5	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	10.9	3.8	0.8	0.6	0.8	0.5	0.1
Pohangina	882.3	30.3	16	6.7	3.4	2.9	0.3	0.1
Mangamutu	26	0.7	0.9	0.5	-	-	-	-
Pahiatua	2,893.9	22.2	9.2	3.6	1.4	1.6	1.2	0.6
Ashhurst	115.4	6.9	2.3	1.5	0.9	0.7	0	-
Himatangi Beach	59.4	1.2	0.5	0.6	0.4	0.4	0	-
Taihape	2,174.7	87.5	38.1	12.9	6.4	3.4	1.1	0.5
Waitārere Beach	24.3	1.4	0.7	0.2	0.4	-	-	-
Raetihi	8,257	12.3	9.1	4.5	1.8	1.4	0.1	0.1
Manakau	138	5.4	3.2	2.4	0.6	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	2.5	0.9	0.2	0	-	0	-
Linton	426.8	51.3	11.8	13.5	6.7	10.8	3.8	7.1
Ohakea	56.4	4.3	1.4	0.9	0.1	-	-	-
Norsewood	148.5	2.9	1	0.8	0.3	0.4	0.4	0.4
Tokomaru	1,681.2	25.5	16.3	4.4	0.9	0.8	0.2	0.1
Waiouru	2.1	0.1	0.2	0	0	-	-	-
National Park	1,051.5	14	4.5	1.1	0.8	0.4	0.1	0
Waikawa Beach	4.2	0.4	0.5	0.2	0	0.7	-	-
Mangatainoka	178	5.8	3.2	1.8	1.7	2.3	0.1	0
Ormondville	889.7	25.4	15.9	29.7	7.7	5.6	2.7	2.1
Rongotea	137.6	0.4	1.9	1.4	0	-	-	-
Rātana	25.6	1.5	0.3	0.2	0	0.1	0	0.1
Halcombe	913.2	50.3	22.6	22.8	7.5	5.3	1.5	6
Kimbolton	334.7	0.4	0.5	-	-	0.5	0	-
Rangataua	766.7	24.5	12.2	7.1	2.5	2.3	0.7	0.1
Raurimu	190.1	6.3	4.1	2.7	0.2	0.1	0.1	0.1
Kai Iwi	148.2	4.9	5.8	2.7	1.9	1.3	0.2	0.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.3: Total hectares of property use type flooded for town/settlement for 2% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	189.7	86.9	46.8	11.7	3.6	1.3	0.3
Palmerston North	3,060.7	264.8	157.9	80.7	27	15.1	2.2	0.3
Feilding	1,015.1	130.2	15.3	10.1	4.6	1.9	0.2	0.3
Marton	365.7	45.9	15.1	3.5	1.2	1.3	0.5	0.1
Ohakune	272.9	22.7	8	4	1.1	1	0.1	-
Longburn	46.1	3.1	1.3	0.2	-	-	-	-
Kairanga	45.4	9.3	3.9	0.9	0.1	0	0	-
Levin	1,280.1	299.2	40.3	7.7	1.3	1.3	0	-
Woodville	119.2	17.1	5.2	4.8	2.8	6.5	2.4	4.2
Foxton	227.8	37.5	26.9	12.8	1.2	0.4	0	0
Foxton Beach	182.5	28.9	18	4.1	0.8	0.2	-	-
Taumarunui	292.6	21.1	12.9	6.7	3.2	1.7	0.9	1.6
Dannevirke	346.6	31.7	4.5	1.5	0.6	0.3	0	-
Bulls	172.2	27.4	9.3	2.8	0.5	0.1	-	-
Tangimoana	38.6	7.4	7.1	1.9	0.1	-	-	-
Hunterville	163.2	11.2	6.8	3	0.8	0.5	0.1	0
Shannon	118.1	6.1	1.6	0.6	0.2	0.2	-	-
Koitiata	9.2	0.6	0.8	1.2	0.5	0.1	-	-
Ōhau	223.5	19.8	2.8	1.4	0.5	0.3	-	-
Hokio Beach	64	6	3.7	1.4	0.6	0.1	-	-
Bunnythorpe	132.8	8.7	3.4	1.6	0.2	0.5	0.1	-
Eketāhuna	91.5	8.6	1.7	0.3	0.1	0	0	0
Mangaweka	21.7	3.1	0.3	0	0.1	0	-	-
Ōwhango	24.1	2.6	0.3	0.5	0.3	0.4	0.1	-
Ōhura	31.9	3.6	2.8	1.6	0.3	0	-	-
Pohangina	23.7	1.8	0.4	0.1	0	0	-	-
Pongaroa	16.6	1.5	1	0.4	0.3	0.1	0.1	-
Mangamutu	13.6	1.6	0.4	-	-	-	-	-
Pahiatua	213.1	37.2	14	3.2	0.3	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	29.1	5.6	0.8	0.2	0	-	-
Himatangi Beach	50.7	4.9	2.1	0.3	-	-	-	-
Taihape	297.3	9.9	3.5	1.2	0.6	0.5	0.3	0.4
Waitārere Beach	111.8	6.9	7.2	7.1	2.2	0.4	-	-
Raetihi	101.9	9.3	4.1	3.2	1.2	0.9	0	-
Manakau	115.9	16.7	4.7	1.9	0.2	0.1	-	-
Sanson	58.6	5.2	2	1.4	0.4	0	-	-
Linton	44.7	2.6	0.9	0.8	0.3	0.1	-	-
Ohakea	9.9	1.2	0.1	0.1	-	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	3.9	0.8	0.7	0	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3	2.4	0.5	0.5	1	0.4	-
Waikawa Beach	59.7	5.4	4.4	0.9	0.1	0	-	-
Mangatainoka	20.2	1.5	1.4	0.5	0.1	0.2	0.3	0.7
Ormondville	40.5	4.7	0.5	0.2	0	0	-	-
Rongotea	110	9.7	5.2	2.2	0	0	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	10.7	5.5	1.2	0.1	0.1	-	-
Kimbolton	52.5	2.7	2.4	0.2	-	0.7	-	-
Rangataua	28.5	2.6	0.6	0	-	-	-	-
Raurimu	16.9	1	0.2	0.1	0	0	-	-
Kai Iwi	38.6	2.4	1.1	0.3	1	0.1	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	49	31.3	11.6	3.2	8.1	1.7	0
Palmerston North	686.1	84.4	45.8	25.6	11.8	11.2	4.7	10.4
Feilding	170.9	39.6	15.2	3.5	1.2	0.3	0.1	-
Marton	213.9	24.4	23.3	33.1	11.4	2.3	0.9	2.1
Ohakune	22.4	2.4	1.5	0.6	0.2	0.2	0	-
Longburn	60.8	10.6	3.5	0.8	0.1	0	0	0
Kairanga	8	1.2	0.8	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	98.2	6.1	0.5	0.7	0.6	-	-
Woodville	12.5	0.9	0.2	0.8	0.6	0.7	1.7	1.2
Foxton	41.4	8.3	4.7	0.7	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	3.9	1.2	0.3	0	0.1	0	0
Dannevirke	129.7	13.3	3.4	1.5	0.8	0.9	0.6	0.2
Bulls	53.9	6.8	3.6	1.8	0.7	0.4	0.2	0.4
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	3	0.9	0.1	0	0.1	-	-
Shannon	24.9	2.8	0.9	0.2	-	-	-	0
Ōhau	7.2	0.9	0.2	0.1	0.1	0.4	0.6	0
Hokio Beach	50	7.8	4.1	1.3	-	-	-	-
Bunnythorpe	20.9	2.6	0.5	0.1	-	-	-	-
Eketāhuna	14	1.9	0.3	0	-	-	-	-
Mangaweka	10.3	2.2	0.6	0.1	0.1	0	0	-
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	-	0	-	-
Pongaroa	2.5	0.3	0.6	0.1	0	-	-	-
Mangamutu	15.3	3.4	2	0.7	-	-	-	-
Pahiatua	17.7	3.3	1	0.1	-	-	-	-
Ashhurst	19.8	2.6	2.6	2.8	1.2	0.5	0.2	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.4	0.6	0.2	0.1	0.1	-	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.2	0.4	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0.1	-	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	1	1	-	-	-	-
Mangatainoka	4.7	0.7	0.2	0	-	-	-	-
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.6	1.1	1.6	2.8	4	0.7	1.7
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0	0.1	0	-	-	-
Rural property use type								
Whanganui	9,193.7	831.2	465.3	286.8	101.7	69.3	15.7	4.5
Palmerston North	14,029.6	868.3	547.1	347	182.7	214.6	81.7	124.9
Feilding	7,528	748.5	383.8	230.2	115.3	72.5	16.2	4
Marton	27,105.7	2,318.1	1,022.4	460.5	191.6	153.9	43.2	44.6
Ohakune	44,184.2	727.1	314.6	146.4	50	33.4	8.8	4.5
Longburn	1,302.6	187.7	144.2	73.5	21.5	42.4	22.7	23.4
Kairanga	6,733.2	1,188	1,023.3	498.7	228.1	322.9	20.2	3.5
Levin	7,837.6	998	200.4	137	73.7	48.9	5.8	1.1
Woodville	10,615.9	570.1	262.6	166.7	118.7	194.7	200.9	1,674.5
Foxton	11,957.6	2,058.6	980.8	544.8	157.5	197.9	200.4	110
Foxton Beach	861.7	90.3	88.4	147.2	88.3	23.7	1.5	4.7
Taumarunui	12,241.3	279.2	157.3	79.1	43.4	56.5	39.5	45.2
Dannevirke	34,395.2	2,543.2	823.5	459.8	216.9	197.2	86.2	100.9
Bulls	9,085.6	1,261.1	672.3	376.8	134.2	63	16.2	12.2
Tangimoana	9,602.2	1,173.4	475.4	225.1	94.2	82.3	20.9	11.9
Hunterville	55,534.7	1,694.5	829.5	390.8	160.3	133.9	70.3	129.2
Shannon	7,725	453.4	480.2	418.4	175.6	53.1	9.8	8.6
Koitiata	908.1	108.6	74.5	51.9	7.1	3.2	0.9	2.4
Ōhau	2,857.8	251.7	175	91.4	30.5	27.1	4.8	4.2
Hokio Beach	2,923.4	308.2	276	213.4	61.6	32.4	1.4	2.7
Bunnythorpe	8,837.9	732	348.5	247.2	115	68.4	14.4	1.3
Eketāhuna	37,977.3	2,100.1	963.1	419.3	151.9	129.1	44.8	19.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	697.1	274.6	100.4	35.5	34.8	18.5	59.9
Ōwhango	21,112.2	358.8	151.5	74.6	31.6	25.2	11.4	26.6
Ōhura	24,006.2	713.3	392.2	176.5	74	66	40.2	48.6
Pohangina	26,177.4	928.9	530.9	284.7	107.1	103.2	32.8	18.9
Pongaroa	57,773.7	1,271.4	547.8	222.3	106.5	129.1	72.6	90
Mangamutu	1,464.7	98.6	78.6	58.5	35.5	37.8	11.9	12.9
Pahiatua	56,300.9	1,967.3	1,115.2	528.1	216.8	184.5	87.5	65.3
Ashhurst	9,723	626.9	378.6	218.1	95.5	66.6	31.9	21.1
Himatangi Beach	1,181.1	165.9	155.8	66.9	24.8	24.6	0.1	-
Taihape	66,124.7	1,788.7	938.5	404	149	117.5	50.4	59
Waitārere Beach	13.3	0.8	1.5	0.9	0.2	-	-	-
Raetihi	153,110.1	838.9	355.3	160.1	56.2	41.1	15.3	21.8
Manakau	5,969.4	465.7	234.7	158.9	66.9	29.7	2.3	0
Sanson	3,977.1	251.8	166	104.4	34.1	19.1	4.2	0.7
Linton	9,076.6	486.6	305.8	161	55.4	76.3	23.8	7.5
Ohakea	1,988.8	330.5	100.8	78.6	25.5	7.2	1.4	0.1
Norsewood	5,388.4	462.7	140.4	56.1	21.5	20.6	10.2	8.9
Tokomaru	5,474	353.8	230.8	229.6	140.5	74.5	9.3	2
Waiouru	2,552.9	134.9	63	27.9	8.2	6.3	3.2	2.2
National Park	4,186.3	231.5	56.1	23.1	13.3	11.4	4.4	5.5
Waikawa Beach	270	33	22.9	10.9	4.3	1.8	0.5	-
Mangatainoka	2,846.3	131.7	86.8	59.5	34.6	47.8	56.8	557.1
Ormondville	15,472.3	565.7	201.9	102.5	44	55.4	36.3	63.1
Rongotea	9,950.9	1,156.3	532.5	344.1	183.8	192.2	15.5	3.1
Rātana	1,699.3	132.8	86.4	41.2	23.1	19.4	5.8	9.1
Halcombe	20,547.4	1,304	805.1	531.7	272.1	191.1	68	43.2
Kimbolton	9,408.6	405.1	209.2	118.3	45.2	34.7	12.1	12
Rangataua	6,946.1	168.3	41.6	25	8.5	4.9	0.4	0.2
Raurimu	2,159.8	110.3	39.9	18.3	9.8	9.1	5.1	8.6
Kai Iwi	9,060.1	315.8	229.5	146.5	58.9	54.7	23.4	30.2
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	93.1	47.1	39.1	20.6	15.8	6.5	6.6
Palmerston North	5,568.9	234.5	148.6	99.6	59.3	89.1	26.9	18.4
Feilding	476.3	51.3	28.4	22.8	6	2.1	0.5	0.3
Marton	1,724.2	62.1	28.9	13.7	3.1	3.3	1.7	1.5
Ohakune	2,300.5	24	10.3	7.7	4.4	3.8	0.8	0
Longburn	36.4	0.6	0.6	0.2	0.1	-	-	0
Kairanga	29.9	2.4	0.1	0.2	0.3	0.1	0	0
Levin	495.8	102.8	17.1	6.5	6.3	6.9	0.9	0.1
Woodville	73.1	13.7	0.5	0.2	0.2	0.3	0.1	17.4
Foxton	594.5	83.5	51.6	30.4	4.2	1.7	0.6	0
Foxton Beach	309.8	26.2	24.2	14.7	17.3	0.9	-	-
Taumarunui	503.9	11.4	5.4	5.9	2.9	4.9	4.3	3.8
Dannevirke	855.3	64.4	15.7	5.8	3.1	2.9	0.8	0.1
Bulls	223.2	28.7	9.8	4.7	2.6	3.5	0.4	0.2
Tangimoana	421.8	33.9	21.3	3.4	1.5	2.9	1.2	0.6
Hunterville	2,173.7	23.8	13.1	7.1	3.5	3.7	3	2.3
Shannon	2,594	28.3	13.8	5.1	2.2	2.2	0.9	0.5
Koitiata	64.1	13.8	10.1	2.4	0.8	0.1	-	-
Ōhau	35.6	2.3	0.9	0.4	0	-	-	-
Hokio Beach	857.5	115.5	159.2	30.8	17.2	60.1	2.8	0.1
Bunnythorpe	80.9	8.1	1.9	0.9	0.6	0.8	0.4	0.1
Eketāhuna	1,475.7	8.2	2.7	1.6	0.7	1.1	0.9	0.8
Mangaweka	252	9.1	1.8	0.8	0.4	0.4	0.6	2.3
Ōwhango	1,328.7	0.5	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.1	4.2	1.1	0.5	0.8	0.7	0.2
Pohangina	882.3	30.9	16	7.4	3.5	3.5	0.3	0.1
Pongaroa	3,913	132.2	53.9	14.2	5.2	6.6	4.4	3.1
Mangamutu	26	0.7	1	0.5	-	-	-	-
Pahiatua	2,893.9	22.2	11.2	4.1	1.7	1.7	1.2	0.7
Ashhurst	115.4	7.7	2.5	1.9	0.8	0.9	0.2	-
Himatangi Beach	59.4	1.2	0.6	0.6	0.4	0.5	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	90.2	39.9	14.9	5.8	4.5	2.1	0.8
Waitārere Beach	24.3	1.4	0.7	0.3	0.4	-	-	-
Raetihi	8,257	12.7	9.2	4.7	2.1	1.2	0.3	0.1
Manakau	138	5.4	2.7	3.1	0.8	0.4	0	-
Sanson	55.8	2.5	1	0.2	0	-	0	-
Linton	426.8	55.9	11.2	8.6	8.3	9.8	8.2	9.1
Ohakea	56.4	4.5	1.4	1.1	0.1	-	-	-
Norsewood	148.5	2.9	1	0.9	0.3	0.4	0.4	0.4
Tokomaru	1,681.2	26.3	16.3	5	1	0.8	0.3	0.1
Waiouru	2.1	0.1	0.1	0.1	0	-	-	-
National Park	1,051.5	14.8	4.7	1.1	0.9	0.4	0.1	0
Waikawa Beach	4.2	0.3	0.5	0.2	0	0.4	0.2	-
Mangatainoka	178	5.7	3.7	1.4	0.9	2.6	1.4	0
Ormondville	889.7	26.4	14.3	26.7	13.4	6.8	2.9	3.2
Rongotea	137.6	1.2	0.7	1.4	0.1	0	-	-
Rātana	25.6	1.5	0.3	0.3	0.1	0.1	0.1	0.2
Halcombe	913.2	51.9	22.8	21	9.4	6	2.5	7.7
Kimbolton	334.7	0.4	0.4	-	-	-	0.5	0.1
Rangataua	766.7	25.3	12.5	7.3	3.1	2.5	0.9	0.2
Raurimu	190.1	6.7	4.3	3	0.2	0	0.2	0.1
Kai Iwi	148.2	5.3	4.7	3.9	1.9	1.4	0.1	0.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.4: Total hectares of property use type flooded for town/settlement for 2% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	189.5	86.7	47.1	11.3	3.3	1.4	0.2
Palmerston North	3,060.7	277.3	120	46.5	19.3	14.3	2.8	0.4
Feilding	1,015.1	171.8	30.6	8.4	4.5	2.6	0.3	0.1
Marton	365.7	46.4	16.1	3.8	1.2	1.3	0.5	0.1
Ohakune	272.9	22.7	8	4	1.1	1	0.1	-
Longburn	46.1	4.6	3.4	1.7	0.7	0.2	-	-
Kairanga	45.4	11.6	6.4	2.5	0.1	0.5	0.1	0
Levin	1,280.1	299.2	40.3	7.7	1.3	1.3	0	-
Woodville	119.2	17.7	5.4	4.7	2.9	6.3	2.6	4.2
Foxton	227.8	37.4	26.7	12.8	1.4	0.2	0	-
Foxton Beach	182.5	29.2	16.3	3.8	0.8	0	-	-
Taumarunui	292.6	21	12.5	6.5	3	1.5	0.9	1.6
Dannevirke	346.6	31.7	4.5	1.5	0.6	0.3	0	-
Bulls	172.2	27.4	9.4	2.9	0.5	0.2	0.1	-
Tangimoana	38.6	6.9	8.7	4.7	0.3	-	-	-
Hunterville	163.2	11.3	8.6	4.1	1.1	0.8	0.1	0
Shannon	118.1	6.2	1.7	1	0.3	0.1	-	-
Koitiata	9.2	0.6	0.8	1.2	0.5	0.1	-	-
Ōhau	223.5	19.7	2.8	1.4	0.5	0.3	-	-
Hokio Beach	64	6	3.7	1.4	0.6	0.1	-	-
Bunnythorpe	132.8	8.7	3.4	1.6	0.2	0.5	0.1	-
Eketāhuna	91.5	8.6	1.7	0.3	0.1	0	0	0
Mangaweka	21.7	3.1	0.3	0	0.1	0	-	-
Ōwhango	24.1	2.6	0.3	0.5	0.3	0.4	0.1	-
Ōhura	31.9	3.6	2.8	1.6	0.3	0	-	-
Pohangina	23.7	1.8	0.4	0.1	0	0	-	-
Mangamutu	13.6	1.6	0.4	-	-	-	-	-
Pahiatua	213.1	37.2	14.1	3.1	0.3	0.2	0.1	0.2
Ashhurst	179.3	26.1	4.6	0.6	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	4.9	2.1	0.3	-	-	-	-
Taihape	297.3	9.9	3.5	1.2	0.6	0.5	0.3	0.4
Waitārere Beach	111.8	6.9	7.2	7.1	2.2	0.4	-	-
Raetihi	101.9	9.3	4.1	3.2	1.2	0.9	0	-
Manakau	115.9	16.7	4.7	1.9	0.2	0.1	-	-
Sanson	58.6	5.2	2	1.4	0.4	0	-	-
Linton	44.7	2.8	1.1	0.8	0.4	0.2	0.1	-
Ohakea	9.9	1.2	0.1	0.1	-	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.2	0.6	0.6	0	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3	2.4	0.5	0.5	1	0.4	-
Waikawa Beach	59.7	5.4	4.4	0.9	0.1	0	-	-
Mangatainoka	20.2	1.5	1.4	0.5	0.1	0.2	0.3	0.7
Ormondville	40.5	4.7	0.5	0.2	0	0	-	-
Rongotea	110	10	6.5	2.5	0.2	0.8	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	10.7	5.5	1.2	0.1	0.1	-	-
Kimbolton	52.5	2.7	2.4	0.2	-	0.7	-	-
Rangataua	28.5	2.6	0.6	0	-	-	-	-
Raurimu	16.9	1	0.2	0.1	0	0	-	-
Kai Iwi	38.6	2.4	1.1	0.3	1	0.1	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	52.5	25.9	6.4	2.7	8.1	1.7	0
Palmerston North	686.1	87.9	43.8	22.9	5.7	11	4.1	10.2
Feilding	170.9	48.8	21.9	4.4	1.5	0.3	0	-
Marton	213.9	17.6	17.8	42.9	19.4	9.1	1.2	2
Ohakune	22.4	2.4	1.5	0.6	0.2	0.2	0	-
Longburn	60.8	13.3	17.5	6.3	0.7	0.7	0	0
Kairanga	8	1.3	1.3	0.1	0	-	-	-
Levin	180.9	98.2	6.1	0.5	0.7	0.6	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	1	0.2	0.8	0.7	0.6	1.8	1.1
Foxton	41.4	7.7	5.4	1.3	0.7	0.3	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	3.9	1.2	0.3	0	0.1	0	0
Dannevirke	129.7	13.3	3.4	1.5	0.8	0.9	0.6	0.2
Bulls	53.9	6.8	3.6	1.8	0.8	0.3	0.2	0.4
Tangimoana	4.1	0.7	0.1	0	-	-	-	-
Hunterville	23.4	3.3	1.1	0.3	0.1	0.1	-	-
Shannon	24.9	1.8	2.2	2.5	1.2	0	-	0
Ōhau	7.2	0.9	0.2	0.1	0.1	0.4	0.6	0
Hokio Beach	50	7.8	4.1	1.3	-	-	-	-
Bunnythorpe	20.9	2.6	0.5	0.1	-	-	-	-
Eketāhuna	14	1.9	0.3	0	-	-	-	-
Mangaweka	10.3	2.2	0.6	0.1	0.1	0	0	-
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	-	0	-	-
Mangamutu	15.3	3.3	1.2	0.8	-	-	-	-
Pahiatua	17.7	3.3	1	0.1	-	-	-	-
Ashhurst	19.8	3.5	2.5	1.4	0.2	0.5	0.1	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.4	0.6	0.2	0.1	0.1	-	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.2	0.4	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0	-	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0	-	-	-	-
National Park	18.3	0.7	1	1	-	-	-	-
Mangatainoka	4.7	0.7	0.2	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.6	1.4	3.3	2.9	1	0.5	1.6
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0	0.1	0	-	-	-
Rural property use type								
Whanganui	9,193.7	831.6	465.3	286.8	101.7	69.3	15.7	4.4
Palmerston North	14,029.6	854.6	627.1	428	239.4	258	80.8	126.3
Feilding	7,528	793.8	418.5	235.9	113	74.1	17	4
Marton	27,105.7	2,310.7	1,034.1	479.3	203.3	143.4	39.2	43.7
Ohakune	44,184.2	727.1	314.6	146.4	50	33.4	8.8	4.5
Longburn	1,302.6	238.2	211.3	100.9	34.4	61.3	26.4	21.5
Kairanga	6,733.2	991.3	1,031.7	592.6	269.4	417.6	311.9	268.8
Levin	7,837.6	998.4	199.1	136	73.7	48.8	5.8	1.1
Woodville	10,615.9	579.7	265.9	172	118.1	192.9	201.2	1,674.6
Foxton	11,957.6	2,043.8	951.1	587.2	290.2	333.7	69.3	17.5
Foxton Beach	861.7	104	108.2	175.7	25.3	11.1	0.1	4.6
Taumarunui	12,241.3	279.2	157.3	79.1	43.4	56.5	39.5	45.2
Dannevirke	34,395.2	2,542.9	829.3	461.8	217.2	197.7	86.4	101.1
Bulls	9,085.6	1,251	674.3	416.4	165.2	72.1	15.3	12.8
Tangimoana	9,602.2	1,180.5	479.4	240.8	99.6	65.5	11.5	6
Hunterville	55,534.7	1,702.8	856.3	409.2	166.9	131.5	62.6	117.9
Shannon	7,725	398.1	354	399.4	309.4	197.8	12.5	7.3
Koitiata	908.1	108.5	74.7	52.9	7.2	3.2	1	2.4
Ōhau	2,857.8	251.2	178.6	96.6	27.8	22.9	3.8	3.2
Hokio Beach	2,923.4	308.2	276	213.4	61.6	32.4	1.4	2.7
Bunnythorpe	8,837.9	733.8	362.9	243.9	111.8	68.2	14.3	1.1
Eketāhuna	37,977.3	2,099.8	962.7	419.2	151.8	129.2	44.8	19.8
Mangaweka	25,542.3	697.2	274.8	100.4	35.4	34.9	18.5	59.9
Ōwhango	21,112.2	358.9	151.5	74.5	31.6	25.2	11.4	26.6
Ōhura	24,006.2	713.9	392.2	176.5	73.9	66	40.2	48.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	928.7	531.1	284.4	107.1	103.1	32.9	18.9
Pongaroa	57,773.7	1	0.2	-	-	-	-	-
Mangamutu	1,464.7	95.6	79.2	61	37.8	39	12.1	12.5
Pahiatua	56,300.9	1,965	1,106.4	522.2	214.7	184.7	87.4	65.2
Ashhurst	9,723	641.9	396.2	247.2	109.9	70.8	32.9	25.1
Himatangi Beach	1,181.1	165.9	155.8	66.9	24.8	24.6	0.1	-
Taihape	66,124.7	1,788.1	938.8	403.7	149.4	117.5	50.4	59
Waitārere Beach	13.3	0.8	1.5	0.9	0.2	-	-	-
Raetihi	153,110.1	838.9	355.3	160.1	56.2	41.1	15.3	21.8
Manakau	5,969.4	465.8	234.2	158.6	66.9	29.7	2.3	0
Sanson	3,977.1	251.9	165.9	104.4	34.1	19.1	4.2	0.7
Linton	9,076.6	490.6	303.7	179	87.1	77.9	17.7	7.3
Ohakea	1,988.8	328.7	105.3	81.2	20.5	6	1.2	0.1
Norsewood	5,388.4	462.7	140.4	56.1	21.5	20.7	10.1	8.9
Tokomaru	5,474	301.3	217	304.3	188.3	127	9.4	2.2
Waiouru	2,552.9	134.9	63	27.9	8.2	6.3	3.2	2.2
National Park	4,186.3	231.5	56.1	23.1	13.3	11.4	4.4	5.5
Waikawa Beach	270	33	22.9	10.9	4.3	1.8	0.5	-
Mangatainoka	2,846.3	131.7	86.6	59.7	34.8	47.8	56.8	557
Ormondville	15,472.3	564.8	201.7	102.5	44	55.4	36.3	63.1
Rongotea	9,950.9	1,119.4	660	481.2	213.2	239.6	158.1	27
Rātana	1,699.3	132.8	86.5	41.2	23.1	19.4	5.8	9.1
Halcombe	20,547.4	1,307.5	806.1	534.8	274.1	182.1	67.4	42.5
Kimbolton	9,408.6	405.1	209	118.4	45.2	34.7	12.1	12
Rangataua	6,946.1	168.3	41.6	25	8.5	4.9	0.4	0.2
Raurimu	2,159.8	110.2	39.9	18.3	9.8	9.1	5.1	8.6
Kai Iwi	9,060.1	315.8	229.7	146.5	58.9	54.7	23.4	30.2
Other property use type								
Whanganui	1,392.5	93	47	39.9	20.7	15.7	6.5	6.6
Palmerston North	5,568.9	233.6	151	101.1	64.7	96.5	40.6	20.3
Feilding	476.3	62.4	37.2	13.8	3.1	1.8	0.5	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	62	29.4	13.7	3.1	3.3	1.7	1.5
Ohakune	2,300.5	24	10.3	7.7	4.4	3.8	0.8	0
Longburn	36.4	7.3	2	0.3	0.2	0	-	0
Kairanga	29.9	2.4	0	0.2	0.3	0.2	0	-
Levin	495.8	102.8	17.1	6.5	6.3	6.9	0.9	0.1
Woodville	73.1	12.7	0.3	0.2	0.2	0.3	0.1	17.4
Foxton	594.5	83.9	51.8	30.4	3.6	0.4	-	0
Foxton Beach	309.8	26.5	19.8	13.1	17.4	0.6	-	-
Taumarunui	503.9	11.7	6.5	4.1	1.3	4.9	4.3	3.8
Dannevirke	855.3	64.3	15.7	6	3.1	2.9	0.8	0.1
Bulls	223.2	28.7	9.8	4.7	2.6	3.5	0.4	0.2
Tangimoana	421.8	34	21.1	4.7	0.9	3	1.2	0.2
Hunterville	2,173.7	24.1	13.9	7.4	3.6	3.9	3.1	2.4
Shannon	2,594	28.1	13.6	5	2.2	2.2	0.9	0.5
Koitiata	64.1	13.8	10.1	2.4	0.8	0.1	-	-
Ōhau	35.6	2.3	0.9	0.4	0	-	-	-
Hokio Beach	857.5	115.5	159.2	30.8	17.2	60.1	2.8	0.1
Bunnythorpe	80.9	8.2	2	1	0.7	0.8	0.4	0.1
Eketāhuna	1,475.7	8.2	2.7	1.6	0.7	1.1	0.9	0.8
Mangaweka	252	9.1	1.8	0.8	0.4	0.4	0.6	2.3
Ōwhango	1,328.7	0.5	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.1	4.2	1.1	0.5	0.8	0.7	0.2
Pohangina	882.3	30.9	16	7.4	3.5	3.5	0.3	0.1
Mangamutu	26	0.7	1	0.5	-	-	-	-
Pahiatua	2,893.9	22	10.6	3.9	1.8	1.7	1.2	0.7
Ashhurst	115.4	7.6	2.4	2.1	0.8	0.9	0.2	-
Himatangi Beach	59.4	1.2	0.6	0.6	0.4	0.5	0	-
Taihape	2,174.7	90.6	39.5	14.9	5.8	4.5	2.1	0.8
Waitārere Beach	24.3	1.4	0.7	0.3	0.4	-	-	-
Raetihi	8,257	12.7	9.2	4.7	2.1	1.2	0.3	0.1
Manakau	138	5.4	2.7	3.1	0.8	0.4	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	2.5	1	0.2	0	-	0	-
Linton	426.8	56	11.4	9.3	8.2	9.7	7.6	8.8
Ohakea	56.4	4.5	1.4	1.1	0.1	-	-	-
Norsewood	148.5	2.9	1	0.9	0.3	0.4	0.4	0.4
Tokomaru	1,681.2	26.3	16.3	5.1	1	0.8	0.3	0.1
Waiouru	2.1	0.1	0.1	0.1	0	-	-	-
National Park	1,051.5	14.8	4.7	1.1	0.9	0.4	0.1	0
Waikawa Beach	4.2	0.3	0.5	0.2	0	0.4	0.2	-
Mangatainoka	178	5.7	3.7	1.4	0.9	2.6	1.4	0
Ormondville	889.7	26.3	14.2	26.8	13.4	6.8	2.9	3.2
Rongotea	137.6	0.3	2	1.4	0	-	-	-
Rātana	25.6	1.5	0.3	0.3	0.1	0.1	0.1	0.2
Halcombe	913.2	51.9	22.8	21	9.4	6	2.5	7.7
Kimbolton	334.7	0.4	0.4	-	-	-	0.5	0.1
Rangataua	766.7	25.3	12.5	7.3	3.1	2.5	0.9	0.2
Raurimu	190.1	6.7	4.3	3	0.2	0	0.2	0.1
Kai Iwi	148.2	5.3	4.7	3.9	1.9	1.4	0.1	0.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.5: Total hectares of property use type flooded for town/settlement for 1% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	194.9	91	53.3	14.2	6.3	2.8	0.5
Palmerston North	3,060.7	272.4	163.7	87.7	29.5	17.4	2.3	0.4
Feilding	1,015.1	137.1	16.8	8.6	6.8	2.2	0.2	0.3
Marton	365.7	47.2	17.2	3.7	1.3	1.4	0.6	0.2
Ohakune	272.9	23.2	8.8	4.3	1.3	1.1	0.2	-
Longburn	46.1	3.2	1	0.4	0.6	0.5	-	-
Kairanga	45.4	8.8	5.2	1.2	0.3	0	0	-
Woodville	119.2	15.5	5.8	5.3	4.2	6.8	6.4	6.5
Foxton	227.8	9.6	2.7	0	-	-	-	-
Foxton Beach	182.5	13.3	6.8	2.1	0.3	0	-	-
Taumarunui	292.6	21.5	12.9	7.5	3.2	2.7	0.8	2.1
Dannevirke	346.6	32.6	4.8	1.6	0.6	0.4	0	0
Bulls	172.2	28.1	10.5	3.7	0.6	0.2	0	-
Tangimoana	38.6	7.4	7.7	2.4	0.2	-	-	-
Hunterville	163.2	11.3	8.3	3.6	1	0.7	0.1	0
Koitiata	9.2	0.6	0.8	1.2	0.4	0.1	-	-
Bunnythorpe	132.8	8.9	3.5	1.7	0.2	0.5	0.1	-
Mangaweka	21.7	3.2	0.3	0	0.1	0.1	-	-
Ōwhango	24.1	2.6	0.3	0.5	0.3	0.4	0.1	-
Ōhura	31.9	3.5	2.9	1.7	0.3	0	-	-
Pohangina	23.7	2.2	0.4	0.2	0	0	-	-
Mangamutu	13.6	1.5	0.4	-	-	-	-	-
Pahiatua	213.1	7.2	3.1	2.3	0.4	0.1	0.1	0.2
Ashhurst	179.3	30.8	5.9	0.9	0.2	0	-	-
Himatangi Beach	50.7	5.1	2.4	0.3	-	-	-	-
Taihape	297.3	10.5	3.5	1.3	0.6	0.4	0.2	0.6
Raetihi	101.9	9.6	4.5	3	1.6	0.9	0	-
Sanson	58.6	5.4	1.9	1	0.9	0	-	-
Linton	44.7	2.6	0.9	0.7	0.4	0.1	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ohakea	9.9	1.4	0.1	0.1	-	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	0.1	0.3	0.3	0	0	-	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3	2.3	0.6	0.5	0.9	0.7	-
Mangatainoka	20.2	1.5	1.4	0.6	0.1	-	0.2	1.1
Ormondville	40.5	4.8	0.5	0.3	0	0	-	-
Rongotea	110	9.7	4.5	3	0.3	0	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	10.9	6.1	1.2	0.2	0.1	-	-
Kimbolton	52.5	2.7	2.4	0.2	-	0.7	-	-
Rangataua	28.5	2.6	0.7	0	-	-	-	-
Raurimu	16.9	1.1	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.4	1.1	0.3	1	0.1	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	50.6	33.7	13.5	2.1	8.9	2.9	0
Palmerston North	686.1	86.8	46.3	25.8	14.6	9.4	8.2	11.2
Feilding	170.9	39.9	17.9	4.8	1.4	0.3	0.1	-
Marton	213.9	21.1	20.8	30.3	24.3	5.3	1.2	2.3
Ohakune	22.4	2.5	1.4	0.7	0.2	0.2	0	-
Longburn	60.8	12.4	4.6	1.2	0.6	0.1	0	0
Kairanga	8	1.5	0.9	0.1	0	-	-	-
Woodville	12.5	1.1	0.5	0.3	0.3	1.4	0.6	2.9
Foxton	41.4	2.4	1.4	-	-	-	-	-
Foxton Beach	0.8	0	-	-	-	-	-	-
Taumarunui	37.9	4.2	1.3	0.3	0.1	0.1	0.1	0
Dannevirke	129.7	13.7	3.5	1.6	1	0.9	0.7	0.3
Bulls	53.9	7.1	4.7	1.7	1.6	1.1	0.2	0.5
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	3.8	1.2	0.2	0.1	0.1	-	-
Bunnythorpe	20.9	2.8	0.5	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	10.3	2.5	0.7	0.2	0.1	0.1	0	0
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	-	0	-	-
Mangamutu	15.3	3.8	1.9	0.8	-	-	-	-
Pahiatua	17.7	0	-	-	-	-	-	-
Ashhurst	19.8	2.6	2.9	2.8	1.3	0.4	0.3	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.4	0.6	0.2	0.1	0.2	0	-
Raetihi	13.2	1.4	0.4	0.1	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.2	0.1	0	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Waiouru	5.6	0.4	0.2	0.1	-	-	-	-
National Park	18.3	0.7	1	0.6	0.4	-	-	-
Mangatainoka	4.7	0.7	0.2	0	-	-	-	-
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.4	1.5	1.3	1.6	5.7	1	1.8
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	855.5	467.7	309.4	106	74.8	20.2	7.3
Palmerston North	14,029.6	877.7	569.2	383.2	204.4	244.9	116.2	144.6
Feilding	7,528	773.2	412.4	260.3	128.4	90.2	19.8	5.9
Marton	27,105.7	2,341.6	1,068	503	214.9	186.9	51.9	52.7
Ohakune	44,184.2	745.7	324	161.8	54.7	38.1	10.7	5.5
Longburn	1,302.6	183.9	151.9	92.2	23.6	59.8	29.3	28.7
Kairanga	6,733.2	1,116.5	1,068.8	596.9	248.2	363.1	163.1	6
Woodville	10,615.9	567.4	261.7	152.6	101.2	157.7	180.2	1,856.3
Foxton	11,957.6	1,645.5	715.7	363.5	109.8	72.6	52.5	59.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Foxton Beach	861.7	84	79.1	27.2	11.3	5.4	0	0.3
Taumarunui	12,241.3	283.8	157.1	78.2	41.6	60.5	42.1	66.5
Dannevirke	34,395.2	2,633.8	856.3	482.8	234.2	222.8	99.2	117.8
Bulls	9,085.6	1,283	683.6	423.7	166.8	78.5	18.6	15.5
Tangimoana	9,602.2	1,205.1	497.2	249.4	95.8	101.4	28	14.6
Hunterville	55,534.7	1,724.2	869.6	433.1	180	158.9	78.8	150.3
Koitiata	908.1	112.7	86.3	73.8	20	4.1	1.4	2.5
Bunnythorpe	8,837.9	757.7	352	252.7	116.7	84.5	17.6	3
Mangaweka	25,542.3	712.9	282.1	104.6	37.2	35.3	20.8	68.4
Ōwhango	21,112.2	364.7	156.5	75.4	34.1	26.2	11.5	29.5
Ōhura	24,006.2	717.7	410	193.3	80.4	75.4	43.3	58.5
Pohangina	26,177.4	941.9	545.6	320.9	119.4	109.2	39	23.5
Pongaroa	57,773.7	0	0.1	-	-	-	-	-
Mangamutu	1,464.7	91.4	75.5	63.1	38.6	42.7	10	21.8
Pahiatua	56,300.9	451	245	133.2	63.5	56	21.3	30
Ashhurst	9,723	648.2	394	226.4	116.5	83.4	37.5	27.1
Himatangi Beach	1,181.1	163.2	161.9	73.6	24.8	29.3	0.1	-
Taihape	66,124.7	1,797.6	962.3	424.8	156.5	132.6	59.7	69.8
Raetihi	153,110.1	844.1	373.8	166.6	63	46.9	18	25.2
Sanson	3,977.1	254.6	172.6	100.3	40.1	22.3	4.2	1.5
Linton	9,076.6	309.3	164	102.2	33.5	63.2	35.2	7.4
Ohakea	1,988.8	339.6	106.9	83.5	46.2	15	2.2	0.4
Norsewood	5,388.4	474.6	144.9	57.1	22.1	21.3	10	9.7
Tokomaru	5,474	39.9	20.4	10.3	2.1	3.7	0	-
Waiouru	2,552.9	138.3	62.5	24.4	8.6	7.5	2.7	1.9
National Park	4,186.3	238.1	58.8	23.3	13.4	11.8	4.5	6.4
Mangatainoka	2,846.3	133.5	87.9	61.4	31.4	46.3	40.5	606.1
Ormondville	15,472.3	576.9	206.4	103.5	47	57.8	38.2	68.9
Rongotea	9,950.9	1,195.1	552.3	348	194.2	212.3	47.9	4.5
Rātana	1,699.3	134.4	93.8	53.9	23	22.6	7	11.2
Halcombe	20,547.4	1,321.1	798.8	547.2	291.1	230.3	76	54

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Kimbolton	9,408.6	402.6	216.7	120.9	48.6	38.4	14.9	16
Rangataua	6,946.1	175.9	42.6	26.1	9.4	5.5	0.7	0.2
Raurimu	2,159.8	111.9	40.5	19.5	9.8	9.8	5.1	9.7
Kai Iwi	9,060.1	327.2	221	147.4	62.7	53.1	27.4	35.4
Other property use type								
Whanganui	1,392.5	95.5	51	34	19.1	27.5	9.1	7.8
Palmerston North	5,568.9	184.9	121.3	90.2	54.5	93.2	36.2	24.5
Feilding	476.3	54.3	27.6	25.6	8.7	2.5	0.5	0.4
Marton	1,724.2	62.1	30.7	14.6	3.7	3.3	1.8	1.8
Ohakune	2,300.5	25	10.1	8.5	4.1	4.7	1.1	0.1
Longburn	36.4	0.5	0.5	0.5	0.2	0.1	-	0
Kairanga	29.9	2.4	0.1	0.2	0.3	0.2	0	0
Woodville	73.1	14.3	0.5	0.3	0.2	0.4	0.1	17.4
Foxton	594.5	71.9	49.6	28	3.2	-	-	-
Foxton Beach	309.8	16.3	19.8	12.9	17.5	0.6	-	-
Taumarunui	503.9	10.9	6.2	8.2	4.4	3.5	4.9	5.8
Dannevirke	855.3	65.7	17.3	6.1	3.3	3.4	1	0.1
Bulls	223.2	27.4	9.6	6.2	2.8	5.3	1	0.3
Tangimoana	421.8	35.1	21.9	3.9	1.5	3.1	1.2	0.9
Hunterville	2,173.7	24.9	14.1	7.5	3.4	4	3.3	3.4
Koitiata	64.1	14.1	11	2.4	0.9	0.1	-	-
Bunnythorpe	80.9	8.4	2.2	1	0.6	0.8	0.5	0.1
Mangaweka	252	9.5	1.8	0.8	0.5	0.4	0.4	2.7
Ōwhango	1,328.7	0.5	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.3	4.6	1.2	0.5	0.8	0.7	0.4
Pohangina	882.3	32	17.3	7.4	3.9	4	0.4	0.1
Mangamutu	26	0.1	0.1	0.1	-	-	-	-
Pahiatua	2,893.9	7.3	5.9	2.1	0.9	0.6	0.2	0.2
Ashhurst	115.4	8.2	3	2.9	0.9	0.8	0.4	-
Himatangi Beach	59.4	1.4	0.7	0.6	0.4	0.5	0.1	-
Taihape	2,174.7	86.7	39.8	17	5.7	4.8	2.9	1.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Raetihi	8,257	12.7	9.5	4.9	1.8	1.9	0.4	0.2
Sanson	55.8	2.8	1.1	0.2	0	-	0	-
Linton	426.8	57.5	11.1	8.1	6.2	10.7	10.3	10.6
Ohakea	56.4	4.7	1.5	1.1	0.1	-	-	-
Norsewood	148.5	3	1	0.9	0.3	0.4	0.3	0.5
Waiouru	2.1	0.1	0.1	0.1	0	0	-	-
National Park	1,051.5	14.9	4.9	1.1	0.9	0.5	0.1	0
Mangatainoka	178	5.8	3.7	1.4	1	1.4	2.4	0.7
Ormondville	889.7	26.9	14.1	23.8	17.2	7.6	3.1	3.8
Rongotea	137.6	1.2	1	1	0.5	0	-	-
Rātana	25.6	1.7	0.4	0.3	0.1	0.2	0.1	0.2
Halcombe	913.2	53.1	21.6	20.5	10.5	7.5	2.4	8.6
Kimbolton	334.7	0.4	0.4	-	-	-	0.5	0.1
Rangataua	766.7	25.8	12.7	7.5	3.5	2.7	1	0.2
Raurimu	190.1	7.6	3.8	3.1	0.6	0.1	0.2	0.1
Kai Iwi	148.2	5	5	3.7	1.9	1.8	0.1	0.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.6: Total hectares of property use type flooded for town/settlement for 1% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	194.9	90.8	53.3	14.1	6.3	2.8	0.5
Palmerston North	3,060.7	291.6	141.8	63.7	25.8	24.8	4.3	1.4
Feilding	1,015.1	176.6	36.6	8.8	5.2	3.1	0.2	0.2
Marton	365.7	47.5	17.9	4.1	1.3	1.4	0.6	0.2
Ohakune	272.9	23.2	8.8	4.3	1.3	1.1	0.2	-
Longburn	46.1	5.1	5	2.3	0.8	0.5	-	-
Kairanga	45.4	10	8.9	2.8	0.8	0.3	0.3	0
Levin	1,280.1	305.4	44.4	8	1.5	1.2	0.1	-
Woodville	119.2	16	5.9	5.3	4	7	6.3	6.5
Foxton	227.8	37.5	27.6	13.5	1.4	0.3	0.1	-
Foxton Beach	182.5	31	17.2	4.2	0.9	0.1	-	-
Taumarunui	292.6	21.2	12.5	7.2	3	2.6	0.8	2.1
Dannevirke	346.6	32.6	4.8	1.6	0.6	0.4	0	0
Bulls	172.2	28.3	10.5	3.9	0.6	0.2	0.1	0
Tangimoana	38.6	4.7	9.4	9	0.9	0	-	-
Hunterville	163.2	11.1	9.5	4.8	1.8	0.8	0.2	0
Shannon	118.1	6.5	1.7	0.7	0.5	0.4	-	-
Koitiata	9.2	0.6	0.8	1.2	0.4	0.1	-	-
Ōhau	223.5	20.5	2.9	1.5	0.5	0.4	-	-
Hokio Beach	64	6.1	3.7	1.8	0.7	0.1	-	-
Bunnythorpe	132.8	9	3.5	1.7	0.2	0.5	0.1	-
Eketāhuna	91.5	9	1.8	0.3	0.1	0	0	0
Mangaweka	21.7	3.2	0.3	0	0.1	0.1	-	-
Ōwhango	24.1	2.6	0.3	0.5	0.3	0.4	0.1	-
Ōhura	31.9	3.5	2.9	1.7	0.3	0	-	-
Pohangina	23.7	2.2	0.4	0.2	0	0	-	-
Mangamutu	13.6	1.6	0.5	-	-	-	-	-
Pahiatua	213.1	38.4	14.1	3.6	0.5	0.2	0.1	0.2
Ashhurst	179.3	27.4	4.8	0.7	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	5.1	2.4	0.3	-	-	-	-
Taihape	297.3	10.5	3.5	1.3	0.6	0.4	0.2	0.6
Waitārere Beach	111.8	8.1	7.2	7.3	3.8	0.8	-	-
Raetihi	101.9	9.6	4.5	3	1.6	0.9	0	-
Manakau	115.9	17.4	5.2	1.9	0.4	0.1	-	-
Sanson	58.6	5.4	1.9	1	0.9	0	-	-
Linton	44.7	3	1.1	0.7	0.4	0.1	0.1	-
Ohakea	9.9	1.2	0.1	0.1	-	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.2	0.6	0.7	0.1	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3	2.3	0.6	0.5	0.9	0.7	-
Waikawa Beach	59.7	5.4	4.5	1.1	0.1	0	-	-
Mangatainoka	20.2	1.5	1.4	0.6	0.1	0	0.2	1.1
Ormondville	40.5	4.8	0.5	0.3	0	0	-	-
Rongotea	110	10.2	5.8	3.4	0.2	0.8	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	10.9	6.1	1.2	0.2	0.1	-	-
Kimbolton	52.5	2.7	2.4	0.2	-	0.7	-	-
Rangataua	28.5	2.6	0.7	0	-	-	-	-
Raurimu	16.9	1.1	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.4	1.1	0.3	1	0.1	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	54.3	28.7	7.8	1.5	8.8	2.9	0
Palmerston North	686.1	90.1	45.3	27.1	5.5	9	7.3	10.9
Feilding	170.9	48.4	24.7	6.8	2.1	0.4	0	-
Marton	213.9	17.2	10.3	33.9	31.9	15.8	1.5	2.2
Ohakune	22.4	2.5	1.4	0.7	0.2	0.2	0	-
Longburn	60.8	9.8	21.9	11.1	0.9	0.8	0	0
Kairanga	8	1.5	1.4	0.1	0	-	-	-
Levin	180.9	100	6.9	0.5	0.7	0.6	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	1	0.4	0.3	0.4	1.4	0.6	2.9
Foxton	41.4	7.9	5.4	1.5	0.7	0.3	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.2	1.3	0.3	0.1	0.1	0.1	0
Dannevirke	129.7	13.7	3.5	1.6	1	0.9	0.7	0.3
Bulls	53.9	7.2	4.7	1.7	1.6	1.1	0.2	0.5
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	3.2	1.1	0.5	0.1	0.1	-	-
Shannon	24.9	1.3	1	1.2	3	2.1	-	0
Ōhau	7.2	0.9	0.2	0.2	0.1	0.3	0.7	0.1
Hokio Beach	50	7.9	4.2	1.6	-	-	-	-
Bunnythorpe	20.9	2.8	0.5	0.1	0	-	-	-
Eketāhuna	14	1.9	0.3	0	-	-	-	-
Mangaweka	10.3	2.5	0.7	0.2	0.1	0.1	0	0
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	-	0	-	-
Mangamutu	15.3	3.7	1.4	0.8	-	-	-	-
Pahiatua	17.7	3.4	1.1	0.1	-	-	-	-
Ashhurst	19.8	3.6	2.6	1.7	0.1	0.4	0.2	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.4	0.6	0.2	0.1	0.2	0	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.4	0.4	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0.1	-	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0.1	-	-	-	-
National Park	18.3	0.7	1	0.6	0.4	-	-	-
Mangatainoka	4.7	0.7	0.2	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.6	1.2	2.6	3.7	1.4	0.5	1.7
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	855.6	467.6	309.4	106.3	74.8	20.2	7.3
Palmerston North	14,029.6	843.4	656.7	484.7	278.9	304.7	112.5	142.4
Feilding	7,528	807.9	449	266.6	125.8	90.6	20.2	6.1
Marton	27,105.7	2,327.6	1,067.9	522.8	234.3	183.1	47.5	51.8
Ohakune	44,184.2	745.7	324	161.8	54.7	38.1	10.7	5.5
Longburn	1,302.6	221.5	267.5	160.8	32.5	67.9	32.7	24.3
Kairanga	6,733.2	958.9	1,017.1	670.6	274.4	457.1	299	372.2
Levin	7,837.6	1,031.8	207	137.6	78.6	55.4	8	1.5
Woodville	10,615.9	579.1	263.8	157.1	101.2	155.7	180.2	1,856.8
Foxton	11,957.6	2,097.1	956.9	621.9	289.2	351.7	107.3	20.7
Foxton Beach	861.7	105.5	110	180.9	28	12.3	0.1	4.6
Taumarunui	12,241.3	283.9	157	78.2	41.7	60.4	42.1	66.5
Dannevirke	34,395.2	2,632.7	862.1	485.7	235.2	223	99.3	118.1
Bulls	9,085.6	1,273.5	682.6	447.1	201.4	92	18.2	15.2
Tangimoana	9,602.2	1,207.4	502.3	259.5	107.5	82.8	12.8	6.4
Hunterville	55,534.7	1,718.1	894.2	451.8	186	158.3	71.5	137.3
Shannon	7,725	373.1	345.8	327.1	193.6	500.4	24.5	8.9
Koitiata	908.1	112.4	86.2	73.8	19.9	4	1.4	2.5
Ōhau	2,857.8	250.2	184.8	109.7	34.3	27	5.4	3.3
Hokio Beach	2,923.4	307.1	275.7	226.6	68.3	41	1.9	2.8
Bunnythorpe	8,837.9	757.4	369.4	250.4	110.6	84.1	17.6	2.6
Eketāhuna	37,977.3	2,139.1	1,017.8	444	162.6	136.1	50.4	22.5
Mangaweka	25,542.3	712.9	282.2	104.7	37.2	35.3	20.8	68.4
Ōwhango	21,112.2	364.8	156.5	75.4	34	26.2	11.5	29.5
Ōhura	24,006.2	717.6	410.1	193.4	80.4	75.4	43.3	58.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	941.8	545.6	320.6	119.3	109.1	38.9	23.5
Pongaroa	57,773.7	0.9	0.3	-	-	-	-	-
Mangamutu	1,464.7	91.8	78.3	65.3	40	45.2	10.4	21.3
Pahiatua	56,300.9	2,003.2	1,161.6	570.5	233.2	207.6	95.9	74.7
Ashhurst	9,723	652.2	405.6	276.1	144.8	94.2	38	30.6
Himatangi Beach	1,181.1	163.2	161.9	73.6	24.8	29.3	0.1	-
Taihape	66,124.7	1,797	962.9	425.2	156.1	132.6	59.7	69.8
Waitārere Beach	13.3	1	1.6	0.8	0.3	-	-	-
Raetihi	153,110.1	844.2	373.8	166.6	63	46.9	18	25.2
Manakau	5,969.4	487.8	245.4	172.5	74.4	40.7	3.6	0
Sanson	3,977.1	254.6	172.6	100.3	40.1	22.3	4.2	1.5
Linton	9,076.6	500.3	311.7	175.5	94.9	99.9	21	8
Ohakea	1,988.8	326.5	109.8	85.9	40.8	11.7	2	0.2
Norsewood	5,388.4	474.8	144.9	57.1	22.1	21.3	10	9.7
Tokomaru	5,474	291.8	194.1	292.5	189.1	208.8	15.3	4
Waiouru	2,552.9	138.3	62.5	24.4	8.6	7.6	2.6	1.9
National Park	4,186.3	238.1	58.8	23.3	13.4	11.8	4.5	6.4
Waikawa Beach	270	32.6	24.3	12	4.8	2.1	0.8	-
Mangatainoka	2,846.3	133.5	87.7	61.9	31.4	46.4	40.5	605.9
Ormondville	15,472.3	575.5	206.3	103.6	47	57.8	38.1	68.9
Rongotea	9,950.9	1,148.6	672.5	499.6	233.1	249.6	162.5	36.7
Rātana	1,699.3	134.5	93.6	54	23	22.6	7	11.2
Halcombe	20,547.4	1,323.9	800	548.3	296.8	219	75.1	53.1
Kimbolton	9,408.6	402.6	216.8	120.8	48.6	38.4	14.9	16
Rangataua	6,946.1	175.9	42.5	26.2	9.4	5.5	0.7	0.2
Raurimu	2,159.8	111.9	40.5	19.5	9.8	9.8	5.1	9.7
Kai Iwi	9,060.1	327.3	221.1	147.3	62.7	53.1	27.4	35.4
Other property use type								
Whanganui	1,392.5	95.3	49.9	33.8	19.1	28.4	9.2	7.8
Palmerston North	5,568.9	229.5	154.3	112.7	60.7	109.7	53.1	34.7
Feilding	476.3	62.3	38.8	17.6	5.2	2.1	0.5	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	61.7	31.3	14.7	3.7	3.3	1.9	1.8
Ohakune	2,300.5	25	10.1	8.5	4.1	4.7	1.1	0.1
Longburn	36.4	5.8	3.8	0.3	0.1	0.1	-	0
Kairanga	29.9	2.4	0	0.2	0.3	0.2	0	-
Levin	495.8	105.6	18	7	4.8	9.2	1.4	0.2
Woodville	73.1	13.6	0.5	0.2	0.3	0.4	0.1	17.4
Foxton	594.5	83.5	55.6	31	3.6	0.4	0	0
Foxton Beach	309.8	26.1	20.6	13.4	17.9	1.1	-	-
Taumarunui	503.9	11.2	6.8	7.5	1.7	3.2	4.9	5.8
Dannevirke	855.3	65.6	17.4	6.2	3.3	3.3	1	0.1
Bulls	223.2	27.4	9.6	6.2	2.8	5.2	1	0.3
Tangimoana	421.8	35	21.5	6.2	0.9	3.2	1.2	0.2
Hunterville	2,173.7	24.5	14.5	7.9	3.6	4.1	3.3	3.5
Shannon	2,594	29.1	14.8	5.3	2.2	2.4	1	0.6
Koitiata	64.1	14.1	11	2.4	0.9	0.1	-	-
Ōhau	35.6	2.5	0.9	0.5	0	-	-	-
Hokio Beach	857.5	113	164	36.1	16.1	57.9	8.3	0.2
Bunnythorpe	80.9	8.4	2.4	1.1	0.7	0.9	0.4	0.1
Eketāhuna	1,475.7	8.1	2.9	1.6	0.7	1	1	1
Mangaweka	252	9.5	1.8	0.8	0.5	0.4	0.4	2.7
Ōwhango	1,328.7	0.5	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.3	4.6	1.2	0.5	0.8	0.7	0.4
Pohangina	882.3	32	17.3	7.4	3.9	4	0.4	0.1
Mangamutu	26	0.7	0.9	0.4	-	-	-	-
Pahiatua	2,893.9	22.2	12	3.9	1.7	1.6	1.2	0.8
Ashhurst	115.4	8.1	2.9	3	0.9	0.8	0.4	-
Himatangi Beach	59.4	1.4	0.7	0.6	0.4	0.5	0.1	-
Taihape	2,174.7	86.7	39.8	17	5.7	4.8	2.9	1.4
Waitārere Beach	24.3	1.3	0.8	0.4	0.4	-	-	-
Raetihi	8,257	12.7	9.5	4.9	1.8	1.9	0.4	0.2
Manakau	138	5.4	2.9	3.2	0.8	0.5	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	2.8	1.1	0.2	0	-	0	-
Linton	426.8	57.6	11.2	8.4	7.8	9.5	9.6	10.1
Ohakea	56.4	4.7	1.5	1.1	0.1	-	-	-
Norsewood	148.5	3	1	0.9	0.3	0.4	0.3	0.5
Tokomaru	1,681.2	26.8	16.2	5.7	1.1	0.8	0.4	0.2
Waiouru	2.1	0.1	0.1	0.1	0	0	-	-
National Park	1,051.5	14.9	4.9	1.1	0.9	0.5	0.1	0
Waikawa Beach	4.2	0.3	0.5	0.3	0.1	0.3	0.4	-
Mangatainoka	178	5.8	3.8	1.4	1	1.4	2.4	0.7
Ormondville	889.7	26.9	14.1	23.8	17.2	7.6	3.2	3.8
Rongotea	137.6	0.4	2.1	1	0.4	-	-	-
Rātana	25.6	1.7	0.4	0.3	0.1	0.2	0.1	0.2
Halcombe	913.2	53.1	21.3	20.5	10.5	7.5	2.4	8.6
Kimbolton	334.7	0.4	0.4	-	-	-	0.5	0.1
Rangataua	766.7	25.8	12.7	7.5	3.5	2.7	1	0.2
Raurimu	190.1	7.6	3.8	3.1	0.6	0.1	0.2	0.1
Kai Iwi	148.2	5	5	3.7	1.9	1.8	0.1	0.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.7: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	197	95.4	56.7	19.5	10.4	4.7	2.2
Palmerston North	3,060.7	279.5	166.8	94.5	32.5	19.4	2.5	0.4
Feilding	1,015.1	143.7	18	8.2	7.9	2.5	0.3	0.3
Marton	365.7	47.8	18.9	4.1	1.4	1.5	0.6	0.2
Ohakune	272.9	23.8	9.3	4.6	1.5	1.1	0.3	-
Longburn	46.1	4.4	2.1	1.2	0.6	0.7	-	-
Kairanga	45.4	8.2	7.2	0.9	0.4	0.3	0	-
Levin	1,280.1	312	48	8	1.5	1.4	0.2	-
Woodville	119.2	14.2	5	5.2	4.9	9.1	6.6	12.6
Foxton	227.8	37.8	28.6	14.2	1.2	0.4	0	0
Foxton Beach	182.5	30.6	20.6	5.1	0.9	0.5	-	-
Taumarunui	292.6	22.3	13.7	8.3	3.6	3.1	1.1	2.4
Dannevirke	346.6	33.7	5.1	1.6	0.6	0.4	0	0
Bulls	172.2	28.7	12.1	4.8	0.8	0.3	0	-
Tangimoana	38.6	6.6	10	4.9	0.5	0	-	-
Hunterville	163.2	11.4	8.9	4.3	1.1	0.8	0.2	0
Shannon	118.1	6.7	1.7	0.7	0.2	0.2	-	-
Koitiata	9.2	0.6	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	21.4	3.3	1.9	0.5	0.4	0	-
Hokio Beach	64	6.1	4	1.9	0.7	0.2	-	-
Bunnythorpe	132.8	9.3	4	1.6	0.3	0.5	0.1	-
Eketāhuna	91.5	9.2	1.8	0.3	0.1	0.1	0	0
Mangaweka	21.7	3.5	0.6	0	0.1	0.1	-	-
Ōwhango	24.1	2.8	0.3	0.6	0.3	0.4	0.1	-
Ōhura	31.9	3.5	3.1	1.9	0.3	0	-	-
Pohangina	23.7	2.7	0.3	0.2	0	0	-	-
Pongaroa	16.6	1.8	1.1	0.4	0.3	0.1	0.1	0
Mangamutu	13.6	1.6	0.5	0	-	-	-	-
Pahiatua	213.1	39	15.3	3.8	0.9	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	31.7	6.3	0.9	0.2	0	-	-
Himatangi Beach	50.7	5.1	2.8	0.5	-	-	-	-
Taihape	297.3	10.6	3.6	1.4	0.7	0.4	0.2	0.6
Waitārere Beach	111.8	8.2	6.9	8.1	4	1.6	-	-
Raetihi	101.9	9.8	4.8	2.9	1.9	1	0	-
Manakau	115.9	18.1	5.5	2.1	0.5	0.1	0	-
Sanson	58.6	5.5	2	0.8	1.2	0	-	-
Linton	44.7	3	0.9	0.7	0.4	0.1	-	-
Ohakea	9.9	1.4	0.8	0.2	0	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.1	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3.1	2.2	0.8	0.5	0.8	0.8	0.1
Waikawa Beach	59.7	5.4	4.6	1.3	0.1	0	-	-
Mangatainoka	20.2	1.4	1.3	0.7	0.1	-	0	1.2
Ormondville	40.5	4.8	0.6	0.3	0	0	-	-
Rongotea	110	10.3	4.4	3	0.5	0	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.6	6.4	1.3	0.4	0.1	-	-
Kimbolton	52.5	2.7	2.4	0.2	-	0.7	-	-
Rangataua	28.5	2.7	0.7	0	-	-	-	-
Raurimu	16.9	1.2	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.4	1.1	0.3	1	0.2	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	50.9	33.4	17.8	4	5.9	6.9	0.1
Palmerston North	686.1	88.7	49	26.3	14.4	9.1	10	12.3
Feilding	170.9	40.5	19.3	6.6	1.6	0.3	0.2	-
Marton	213.9	20.2	14.3	31	31.6	12.2	1.5	2.5
Ohakune	22.4	2.5	1.5	0.7	0.2	0.2	0	-
Longburn	60.8	12.6	15.2	6	0.6	0.7	0	0
Kairanga	8	1.5	1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	103.9	7.9	0.9	0.7	0.6	-	-
Woodville	12.5	0.8	0.3	0.6	0.7	0.7	1.2	3.5
Foxton	41.4	8.8	5	0.8	0	0	-	-
Foxton Beach	0.8	0.2	0.1	0	-	-	-	-
Taumarunui	37.9	4.3	1.5	0.4	0.1	0.1	0.1	0.1
Dannevirke	129.7	14	3.8	1.8	1.1	1.1	0.7	0.5
Bulls	53.9	6.9	4.1	2.9	1.7	2.1	0.2	0.6
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	3	1.2	0.3	0.1	0.1	-	-
Shannon	24.9	2.5	1.9	0.3	0	-	-	0
Ōhau	7.2	0.9	0.2	0.1	0.1	0.2	0.7	0.1
Hokio Beach	50	8.2	4.2	1.6	-	-	-	-
Bunnythorpe	20.9	2.8	0.5	0.1	0	-	-	-
Eketāhuna	14	2	0.3	0	-	-	-	-
Mangaweka	10.3	2.7	0.8	0.2	0.1	0.1	0	0
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	0	0	-	-
Pongaroa	2.5	0.3	0.6	0.1	0	-	-	-
Mangamutu	15.3	3.8	1.9	0.8	-	-	-	-
Pahiatua	17.7	3.6	1.2	0.1	-	-	-	-
Ashhurst	19.8	2.5	3	3.2	1.4	0.4	0.4	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.5	0.6	0.2	0.1	0.2	0	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.5	0.4	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.2	0.1	0	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0.6	1	0.4	-	-	-
Mangatainoka	4.7	0.7	0.1	0.1	-	-	-	-
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.4	1.2	1.6	1.3	5.9	1.4	1.9
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	874.2	463.4	306.8	146.6	87.5	20.5	10.8
Palmerston North	14,029.6	885.6	608.2	436.8	234.2	276.7	150.6	170.6
Feilding	7,528	795.1	444.6	282.2	138.3	100.2	23.5	7.3
Marton	27,105.7	2,363.4	1,080.4	532.7	245.8	224.2	65.7	64.7
Ohakune	44,184.2	767.6	336	172.2	60.6	43.7	13.2	6.3
Longburn	1,302.6	225.7	197.2	119	24.1	62.6	39.1	34.5
Kairanga	6,733.2	1,059.3	1,066.9	643.5	310.1	333.1	341.8	53.6
Levin	7,837.6	1,061.5	216.1	141.5	82.3	62.2	9.6	2
Woodville	10,615.9	567	269.7	141.2	88	129.1	138.6	2,015.2
Foxton	11,957.6	2,136.1	992.4	550.2	251	227.8	232.3	186.2
Foxton Beach	861.7	95.6	89.6	68.8	172	32.6	2	4.9
Taumarunui	12,241.3	286.6	164	80.7	41.5	61.9	40.6	89
Dannevirke	34,395.2	2,717.9	877	492.9	247.7	248.7	107	135.1
Bulls	9,085.6	1,304.7	687.8	455.6	190.1	107.5	22.7	17.6
Tangimoana	9,602.2	1,221.3	511.4	281.9	103.4	117.8	35.2	17.9
Hunterville	55,534.7	1,743.8	880.4	468.7	198.2	177.1	87.2	171.8
Shannon	7,725	414.8	483.9	521.4	220.8	94.3	12.4	9.1
Koitiata	908.1	107.7	89.8	86.1	38.4	11	1.6	2.6
Ōhau	2,857.8	244.8	182.5	121	48.1	36.8	12.1	4.8
Hokio Beach	2,923.4	306.6	273.2	242.7	74.2	47.1	2.3	3.7
Bunnythorpe	8,837.9	773.1	360.5	254.5	123.4	93	25.2	3.7
Eketāhuna	37,977.3	2,169.1	1,068	471.4	171.6	141.3	56	25.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	727.6	287.9	110.9	37.6	35.5	22.1	74.2
Ōwhango	21,112.2	372.9	158.5	78.4	35.1	27.1	12	32
Ōhura	24,006.2	719.3	426.4	219.2	90.2	84.2	45.9	69.1
Pohangina	26,177.4	960.2	553.6	347.1	134.8	116.5	44.1	27.5
Pongaroa	57,773.7	1,331.1	578.5	239.3	109.6	135.7	80	124.9
Mangamutu	1,464.7	94.5	76.9	66.3	39.5	48.3	9.1	28.5
Pahiatua	56,300.9	2,037	1,248.2	628.8	265.6	228.3	102.5	88.1
Ashhurst	9,723	642.9	410.2	239	124.2	103.5	40.9	31.5
Himatangi Beach	1,181.1	161.7	166.4	80.4	25	33.3	0.2	-
Taihape	66,124.7	1,817	971.9	437.9	165.9	144.3	65.9	83
Waitārere Beach	13.3	0.7	1.6	1.1	0.3	-	-	-
Raetihi	153,110.1	859.2	384.3	174.4	65.5	52.4	19.2	30.3
Manakau	5,969.4	497.9	252.3	186.1	83.2	51.6	4.5	0.1
Sanson	3,977.1	260.1	172.1	105.1	42.1	24.7	6	1.5
Linton	9,076.6	503.4	313.2	170.2	53.7	66.2	52.1	11.7
Ohakea	1,988.8	345.6	134	82.7	63.8	30.2	3.1	0.5
Norsewood	5,388.4	484.8	148.9	58.7	23	21.9	10.1	10.1
Tokomaru	5,474	351.2	209.7	226.2	182.3	115.4	10.3	3.9
Waiouru	2,552.9	139	61.8	24.9	8.5	7.6	3.3	2.1
National Park	4,186.3	246.5	61.2	23	14.2	12	4.8	6.7
Waikawa Beach	270	33.1	24.5	13.4	5.1	2.8	1	-
Mangatainoka	2,846.3	133	88.9	66	33.7	43.4	36.4	639.2
Ormondville	15,472.3	586	209.9	107.5	47.3	62.1	39.4	74.2
Rongotea	9,950.9	1,226.6	585.1	362	206.2	223.7	88.8	5.6
Rātana	1,699.3	130.6	86.2	73.2	33.2	24.7	9.2	13.4
Halcombe	20,547.4	1,338.8	785.9	560.9	300.4	275.8	85.7	70.3
Kimbolton	9,408.6	408.8	220.8	123.7	50.1	42.1	16.2	19.8
Rangataua	6,946.1	183.4	43.3	27	9.7	6.7	0.7	0.2
Raurimu	2,159.8	113.4	42.9	19.7	10.5	10.2	5.1	9.7
Kai Iwi	9,060.1	335.9	217.9	149	68.1	51.6	29	41.7
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	98.8	49.1	35.9	18.9	25.2	14	15
Palmerston North	5,568.9	235.1	155.9	100.5	59	91	48.7	33.3
Feilding	476.3	56.6	26.9	28	10	3	0.6	0.4
Marton	1,724.2	60.5	33	15.4	4.1	3.2	2.2	2.5
Ohakune	2,300.5	25.8	10.2	8.7	4.5	5.5	1.4	0.2
Longburn	36.4	6.8	1.3	0.5	0.9	0.2	-	0
Kairanga	29.9	2.4	0.1	0.2	0.3	0.2	0	0
Levin	495.8	108	18.1	7.9	3.9	10.2	1.8	0.3
Woodville	73.1	14.3	0.7	0.4	0.5	0.7	0.1	17.4
Foxton	594.5	84.1	57.8	31.8	4.1	1.9	0.7	0.1
Foxton Beach	309.8	26.9	26.2	16.4	13.6	6.6	0	-
Taumarunui	503.9	10.9	6.3	6.6	7	2.7	4.4	8.4
Dannevirke	855.3	68.5	12.3	12.7	3.4	3.7	1.4	0.3
Bulls	223.2	28.5	10.3	4.7	3.4	5.9	2.1	0.4
Tangimoana	421.8	36	21.3	5.7	1.1	3.6	1	1.2
Hunterville	2,173.7	26.3	13.7	8.2	3.6	4.1	3.2	4.2
Shannon	2,594	28.3	15.2	5.5	2.3	2.3	1.1	0.6
Koitiata	64.1	13.6	12.3	2.4	1	0.1	-	-
Ōhau	35.6	2.6	1.1	0.6	0.1	-	-	-
Hokio Beach	857.5	105.9	178.1	40.7	15.8	56.7	12.1	0.2
Bunnythorpe	80.9	9.2	2.2	1	0.6	0.8	0.6	0.1
Eketāhuna	1,475.7	8	2.9	1.7	0.7	0.9	1.2	1.1
Mangaweka	252	10	1.8	0.9	0.4	0.5	0.3	2.9
Ōwhango	1,328.7	0.6	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.4	4.5	1.4	0.4	1	0.7	0.6
Pohangina	882.3	32.1	16.8	8.2	4.5	4.3	0.5	0.1
Pongaroa	3,913	138	56.6	17.1	8.3	7.7	5.1	10.2
Mangamutu	26	0.7	0.9	0.4	-	-	-	-
Pahiatua	2,893.9	22.8	12.1	4.4	1.5	1.9	1.1	1.1
Ashhurst	115.4	8.5	3	3	1.8	1	0.5	-
Himatangi Beach	59.4	1.6	0.7	0.6	0.5	0.5	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	85.3	39.5	18.9	5.5	5	3.1	2.1
Waitārere Beach	24.3	1.2	0.9	0.4	0.4	-	-	-
Raetihi	8,257	12	10.2	5.4	1.7	2.3	0.3	0.3
Manakau	138	5.6	2.6	3.3	1.3	0.6	0	-
Sanson	55.8	3	1.1	0.2	0	-	0	-
Linton	426.8	59.3	11.4	7.8	5.4	10.6	10.4	13.1
Ohakea	56.4	4.9	1.6	1.2	0.2	0	-	-
Norsewood	148.5	3	1	0.9	0.3	0.4	0.3	0.5
Tokomaru	1,681.2	27.2	16.5	5.6	1.2	0.9	0.3	0.2
Waiouru	2.1	0.1	0.2	0.1	-	0	0	-
National Park	1,051.5	15.3	4.6	1.4	1	0.4	0.1	0
Waikawa Beach	4.2	0.3	0.4	0.3	0.1	0.2	0.4	-
Mangatainoka	178	5.5	3.9	1.6	0.9	1.1	2.6	1.2
Ormondville	889.7	28.3	13.1	22.6	19.2	8.6	3	4.4
Rongotea	137.6	1.1	1.3	1	0.5	0	-	-
Rātana	25.6	1.8	0.6	0.3	0.2	0.2	0.1	0.2
Halcombe	913.2	54.1	22.1	21.4	10.9	7.3	2.2	9.4
Kimbolton	334.7	0.7	0.5	-	-	-	0.5	0.1
Rangataua	766.7	26.1	13.1	7.7	3.7	2.8	1.2	0.3
Raurimu	190.1	8.3	4.1	3.8	0.6	0.1	0.2	0.1
Kai Iwi	148.2	4.9	4.5	4.3	1.7	2.3	0.3	0.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.8: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	196.9	95.4	56.8	19.5	10.4	4.8	2.2
Palmerston North	3,060.7	301.7	164.9	82.6	37.4	36.9	8.8	3.3
Feilding	1,015.1	181.2	41	9.6	5.6	3.3	0.3	0.3
Marton	365.7	48	19.6	4.6	1.4	1.5	0.6	0.2
Ohakune	272.9	23.8	9.3	4.6	1.5	1.1	0.3	-
Longburn	46.1	4.5	6.4	3	0.8	0.8	-	-
Kairanga	45.4	8.6	9.6	3.3	1.7	0.1	0.6	0
Levin	1,280.1	312	48	8	1.5	1.4	0.2	-
Woodville	119.2	14.5	4.9	5.3	5	8.8	6.7	12.5
Foxton	227.8	37.8	28.4	14.1	1.4	0.3	0.1	-
Foxton Beach	182.5	30.9	18.9	4.4	0.9	0.3	-	-
Taumarunui	292.6	22	13.2	7.8	3.4	3	1.1	2.4
Dannevirke	346.6	33.7	5.1	1.6	0.6	0.4	0	0
Bulls	172.2	28.7	12.1	4.8	0.8	0.3	0.1	0
Tangimoana	38.6	2.9	7.2	13	2.8	0.2	-	-
Hunterville	163.2	11.6	10.1	5.7	2.1	0.9	0.2	0
Shannon	118.1	6.8	1.7	0.8	0.4	0.6	0	-
Koitiata	9.2	0.6	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	21.4	3.2	1.5	0.5	0.4	0	-
Hokio Beach	64	6.1	4	1.9	0.7	0.2	-	-
Bunnythorpe	132.8	9.3	4	1.6	0.3	0.5	0.1	-
Eketāhuna	91.5	9.2	1.8	0.3	0.1	0.1	0	0
Mangaweka	21.7	3.5	0.6	0	0.1	0.1	-	-
Ōwhango	24.1	2.8	0.3	0.6	0.3	0.4	0.1	-
Ōhura	31.9	3.5	3.1	1.9	0.3	0	-	-
Pohangina	23.7	2.7	0.3	0.2	0	0	-	-
Mangamutu	13.6	1.8	0.5	0	-	-	-	-
Pahiatua	213.1	39	15.1	4	0.7	0.2	0.1	0.2
Ashhurst	179.3	28.6	5.3	0.8	0.2	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	5.1	2.8	0.5	-	-	-	-
Taihape	297.3	10.6	3.6	1.4	0.7	0.4	0.2	0.6
Waitārere Beach	111.8	8.2	6.9	8.1	4	1.6	-	-
Raetihi	101.9	9.8	4.8	2.9	1.9	1	0	-
Manakau	115.9	18.1	5.5	2.1	0.5	0.1	0	-
Sanson	58.6	5.5	2	0.8	1.2	0	-	-
Linton	44.7	3.2	1.2	0.7	0.4	0.1	0.1	-
Ohakea	9.9	1.6	0.6	0.1	0	-	-	-
Norsewood	27.5	2.6	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.1	0.8	0.7	0.3	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3.1	2.2	0.8	0.5	0.8	0.8	0.1
Waikawa Beach	59.7	5.4	4.6	1.3	0.1	0	-	-
Mangatainoka	20.2	1.5	1.3	0.7	0.1	-	0	1.2
Ormondville	40.5	4.8	0.6	0.3	0	0	-	-
Rongotea	110	10.6	5.7	3.5	0.2	0.8	0	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.6	6.4	1.3	0.4	0.1	-	-
Kimbolton	52.5	2.7	2.4	0.2	-	0.7	-	-
Rangataua	28.5	2.7	0.7	0	-	-	-	-
Raurimu	16.9	1.2	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.4	1.1	0.3	1	0.2	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	52.6	32.9	15.3	3.5	6	6.9	0.1
Palmerston North	686.1	92.5	45.8	31.6	5.9	7.9	9.2	11.7
Feilding	170.9	47.3	25.9	9.4	1.6	1.3	0	-
Marton	213.9	17.3	8.7	21.9	39.7	23.3	2	2.3
Ohakune	22.4	2.5	1.5	0.7	0.2	0.2	0	-
Longburn	60.8	9.1	18.2	17.6	1.8	0.9	0	0
Kairanga	8	1.6	1.4	0.2	0.1	-	-	-
Levin	180.9	103.9	7.9	0.9	0.7	0.6	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	0.9	0.3	0.5	0.7	0.7	1.2	3.5
Foxton	41.4	8.1	5.5	1.7	0.7	0.3	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.3	1.5	0.4	0.1	0.1	0.1	0.1
Dannevirke	129.7	14	3.8	1.8	1.1	1.1	0.7	0.5
Bulls	53.9	6.9	4.1	2.9	1.7	2.1	0.2	0.6
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	4.8	1.3	0.6	0.1	0.1	-	-
Shannon	24.9	1.4	0.7	1	1.4	4.6	0.1	0
Ōhau	7.2	0.9	0.2	0.1	0.1	0.2	0.7	0.1
Hokio Beach	50	8.2	4.2	1.6	-	-	-	-
Bunnythorpe	20.9	2.8	0.5	0.1	0	-	-	-
Eketāhuna	14	2	0.3	0	-	-	-	-
Mangaweka	10.3	2.7	0.8	0.2	0.1	0.1	0	0
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	0	0	-	-
Mangamutu	15.3	3.5	1.8	0.6	0	-	-	-
Pahiatua	17.7	3.6	1.2	0.1	-	-	-	-
Ashhurst	19.8	3.6	2.8	2	0.1	0.4	0.3	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.5	0.6	0.2	0.1	0.2	0	-
Waitārere Beach	0.4	0.1	0.1	0	-	-	-	-
Raetihi	13.2	1.5	0.4	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0.1	-	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.4	0.2	0.1	-	-	-	-
National Park	18.3	0.7	0.6	1	0.4	-	-	-
Mangatainoka	4.7	0.7	0.1	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.5	1.2	2.1	3.6	2.4	0.6	1.8
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	874.2	463.5	306.8	146.8	87.5	20.5	10.8
Palmerston North	14,029.6	846.1	675.9	538.1	306.5	342.2	144.1	157.1
Feilding	7,528	817	482.9	287.4	135.2	100.1	23.5	7.6
Marton	27,105.7	2,349.3	1,072.9	539.8	265.3	236.5	61.4	63.9
Ohakune	44,184.2	767.6	336	172.2	60.6	43.7	13.2	6.3
Longburn	1,302.6	197	289.8	233.3	41.7	72.5	38.5	27.8
Kairanga	6,733.2	937.2	1,025.3	733.4	291.4	459.6	327.1	442.4
Levin	7,837.6	1,062.2	215.3	138.7	81.9	62.1	9.6	2
Woodville	10,615.9	576.7	272.2	146.1	87.5	126.9	138.6	2,016
Foxton	11,957.6	2,131.8	973.9	635.8	300.4	374.2	119.4	22.2
Foxton Beach	861.7	108	110.6	186.6	29.7	13.4	0.1	4.6
Taumarunui	12,241.3	286.4	164	80.7	41.5	61.9	40.6	89
Dannevirke	34,395.2	2,721.4	881.8	497	248	249.2	107.1	135.3
Bulls	9,085.6	1,296	689.3	470.5	225.3	122.8	22.1	16.9
Tangimoana	9,602.2	1,231.2	516.1	290.7	116.7	98	14.8	7.2
Hunterville	55,534.7	1,745.7	906.2	487.8	204.4	175.2	80.5	158.2
Shannon	7,725	345.5	339.1	362.2	157.2	553.5	87.5	15.7
Koitiata	908.1	107.5	89.7	85.9	38	10.5	1.6	2.6
Ōhau	2,857.8	249.7	187.1	123.2	40.9	29.2	7.9	3.7
Hokio Beach	2,923.4	306.6	273.2	242.7	74.2	47.1	2.3	3.7
Bunnythorpe	8,837.9	770.7	379.3	255.6	116.9	90.5	25.2	3.2
Eketāhuna	37,977.3	2,168.7	1,067.5	470.9	171.5	141.3	56	25.3
Mangaweka	25,542.3	728.1	287.5	110.9	37.5	35.6	22.1	74.3
Ōwhango	21,112.2	372.9	158.5	78.4	35.1	27.1	12	32
Ōhura	24,006.2	719.3	426.2	219.2	90.2	84.2	46	69.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	959	553.6	346.9	134.7	116.4	44	27.5
Pongaroa	57,773.7	0.9	0.3	-	-	-	-	-
Mangamutu	1,464.7	91.2	76.4	67.5	41.8	51	9.6	28
Pahiatua	56,300.9	2,035	1,227	612.7	259.6	226.5	103.2	88
Ashhurst	9,723	642.7	412.3	289	172.1	127.4	41.4	35.1
Himatangi Beach	1,181.1	161.7	166.4	80.4	25	33.3	0.2	-
Taihape	66,124.7	1,817.2	971.4	438.1	165.9	143.9	66.2	83.1
Waitārere Beach	13.3	0.7	1.6	1.1	0.3	-	-	-
Raetihi	153,110.1	858.5	384.2	174.4	65.5	52.4	19.2	30.2
Manakau	5,969.4	498.1	252.2	185.4	83.2	51.6	4.5	0.1
Sanson	3,977.1	260	172	105.1	42.1	24.7	6	1.5
Linton	9,076.6	510.6	317.6	179.3	92.5	114.7	26.6	8.6
Ohakea	1,988.8	348.2	130.3	87.2	60.8	23.2	2.8	0.4
Norsewood	5,388.4	484.6	149.1	58.6	23	21.9	10.1	10.1
Tokomaru	5,474	293.1	182.5	267.9	190.6	242.3	57.3	5.7
Waiouru	2,552.9	139	61.8	24.9	8.5	7.6	3.3	2.1
National Park	4,186.3	246.5	61.2	23	14.2	12	4.8	6.7
Waikawa Beach	270	33.1	24.5	13.4	5.1	2.8	1	-
Mangatainoka	2,846.3	133.1	88.8	66.3	33.8	43.2	36.5	639.1
Ormondville	15,472.3	585.2	210.2	107	47.3	62.1	39.4	74.3
Rongotea	9,950.9	1,166.6	681.9	515	249.6	257.3	166.2	44.1
Rātana	1,699.3	130.6	86.1	73.3	33.1	24.7	9.2	13.4
Halcombe	20,547.4	1,342	787.3	561.9	307	265.4	84	69.3
Kimbolton	9,408.6	410.2	221.6	124.1	50.2	42.1	16.2	19.8
Rangataua	6,946.1	183.4	43.3	27	9.7	6.7	0.7	0.2
Raurimu	2,159.8	113.4	42.9	19.7	10.5	10.2	5.1	9.7
Kai Iwi	9,060.1	335.5	218.4	149	68.1	51.6	29	41.7
Other property use type								
Whanganui	1,392.5	98.8	49.1	35.7	17.9	25.4	14.7	15.1
Palmerston North	5,568.9	225.3	152.6	114.2	71.6	106.8	70.2	50.2
Feilding	476.3	63.5	39.3	21.3	6.3	2.4	0.5	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	60.4	33.3	15.5	4.1	3.2	2.2	2.5
Ohakune	2,300.5	25.8	10.2	8.7	4.5	5.5	1.4	0.2
Longburn	36.4	3.9	5.7	0.5	0.2	0.1	-	0
Kairanga	29.9	2.5	0.1	0.2	0.3	0.2	0	0
Levin	495.8	108	18.1	7.9	3.9	10.2	1.8	0.3
Woodville	73.1	13.8	0.7	0.4	0.5	0.6	0.1	17.5
Foxton	594.5	84.4	58.1	31.6	3.7	0.4	0	0
Foxton Beach	309.8	27.6	21.4	14.1	13.6	6.1	-	-
Taumarunui	503.9	10.7	6.2	7.5	4.6	2.2	4.4	8.4
Dannevirke	855.3	68.4	12.4	12.8	3.4	3.7	1.3	0.4
Bulls	223.2	28.5	10.3	4.7	3.4	5.9	2.1	0.4
Tangimoana	421.8	35.8	20.8	7.1	1.7	3.4	1.3	0.2
Hunterville	2,173.7	25.7	14.2	8.7	3.7	4.3	3.3	4.3
Shannon	2,594	28.1	18	5.9	2.3	2.6	1.1	0.6
Koitiata	64.1	13.6	12.3	2.4	1	0.1	-	-
Ōhau	35.6	2.6	1.1	0.6	0.1	-	-	-
Hokio Beach	857.5	105.9	178.1	40.7	15.8	56.7	12.1	0.2
Bunnythorpe	80.9	9.3	2.4	1.3	0.7	0.9	0.6	0.1
Eketāhuna	1,475.7	8.1	2.9	1.7	0.7	0.9	1.2	1.1
Mangaweka	252	10	1.8	0.9	0.4	0.5	0.3	2.9
Ōwhango	1,328.7	0.6	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.4	4.5	1.4	0.4	1	0.7	0.6
Pohangina	882.3	32.1	16.8	8.2	4.5	4.3	0.5	0.1
Mangamutu	26	0.7	0.9	0.4	-	-	-	-
Pahiatua	2,893.9	22.9	12.2	4.1	1.6	1.9	1.1	1.1
Ashhurst	115.4	8.5	2.9	3.1	1.8	1	0.5	-
Himatangi Beach	59.4	1.6	0.7	0.6	0.5	0.5	0.1	-
Taihape	2,174.7	85.4	39.4	18.9	5.5	5	3.1	2.1
Waitārere Beach	24.3	1.2	0.9	0.4	0.4	-	-	-
Raetihi	8,257	12	10.2	5.4	1.7	2.3	0.3	0.3
Manakau	138	5.6	2.6	3.3	1.3	0.6	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	3	1.1	0.2	0	-	0	-
Linton	426.8	59.3	11.3	8.1	6.4	10.4	10.1	11.6
Ohakea	56.4	4.9	1.6	1.2	0.2	0	-	-
Norsewood	148.5	3	1	0.9	0.3	0.4	0.3	0.5
Tokomaru	1,681.2	27.2	16.5	5.6	1.2	0.9	0.3	0.2
Waiouru	2.1	0.1	0.2	0.1	-	0	0	-
National Park	1,051.5	15.3	4.6	1.4	1	0.4	0.1	0
Waikawa Beach	4.2	0.3	0.4	0.3	0.1	0.2	0.4	-
Mangatainoka	178	5.5	4	1.6	0.9	1.1	2.7	1.2
Ormondville	889.7	28.2	13.1	22.6	19.2	8.6	3	4.4
Rongotea	137.6	0.3	2.1	1	0.4	-	-	-
Rātana	25.6	1.8	0.6	0.3	0.2	0.2	0.1	0.2
Halcombe	913.2	54.2	21.8	21.1	10.9	7.3	2.2	9.4
Kimbolton	334.7	0.7	0.5	-	-	-	0.5	0.1
Rangataua	766.7	26.1	13.1	7.7	3.7	2.8	1.2	0.3
Raurimu	190.1	8.3	4.1	3.8	0.6	0.1	0.2	0.1
Kai Iwi	148.2	4.9	4.5	4.3	1.7	2.3	0.3	0.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.9: Total hectares of property use type flooded for town/settlement for 0.2% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	187.4	111.6	93.6	46.4	28.2	9.4	6
Palmerston North	3,060.7	289.4	170.8	100.9	35.4	21.9	2.8	0.6
Feilding	1,015.1	152.6	20	8.4	8.6	3.2	0.4	0.3
Marton	365.7	48.9	27.1	7.7	1.9	2	0.8	0.5
Ohakune	272.9	25	9.8	5	1.8	1.1	0.5	-
Longburn	46.1	5.5	3.1	1.7	0.5	0.8	0	-
Kairanga	45.4	7.3	9.1	2	0.2	0.6	0.1	0
Levin	1,280.1	321.8	51.1	8	1.6	1.6	0.2	-
Woodville	119.2	13	4.5	3.5	3.9	9.8	8.9	20.4
Foxton	227.8	39.7	30.8	14.7	1.3	0.5	0	0
Foxton Beach	182.5	30.2	23.2	5.5	1.1	0.6	-	-
Taumarunui	292.6	22.8	15.7	11.3	4.3	3.4	2.1	2.7
Dannevirke	346.6	35.1	5.5	1.7	0.7	0.4	0.1	0
Bulls	172.2	28.3	19.4	9.3	2.4	0.6	0	-
Tangimoana	38.6	3.1	3.6	14.4	6.9	0.8	-	-
Hunterville	163.2	11.3	8.6	5.4	2	1.4	0.2	0
Shannon	118.1	7.1	1.8	0.8	0.2	0.2	-	-
Koitiata	9.2	0.7	0.8	1.1	0.5	0.1	-	-
Ōhau	223.5	22.8	3.4	2.1	0.6	0.4	0	-
Hokio Beach	64	6.1	4.1	2.2	0.7	0.3	-	-
Bunnythorpe	132.8	9.4	3.7	2.1	0.3	0.6	0.1	0
Eketāhuna	91.5	9.5	1.9	0.3	0.1	0	0	0
Mangaweka	21.7	3.1	1.1	0.1	0.1	0.1	-	-
Ōwhango	24.1	2.8	0.3	0.6	0.3	0.4	0.1	-
Ōhura	31.9	3.5	3	2.1	0.6	0.1	-	-
Pohangina	23.7	3.1	0.4	0.3	0	0	-	-
Pongaroa	16.6	1.7	1.3	0.5	0.4	0.2	0.1	0.3
Mangamutu	13.6	1.7	0.4	0	-	-	-	-
Pahiatua	213.1	39.5	16.2	4.2	1.1	0.5	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	33.1	6.7	0.9	0.3	0	-	-
Himatangi Beach	50.7	5.5	3.6	0.6	0	-	-	-
Taihape	297.3	8.8	2	1.3	0.8	0.5	0.4	0.7
Waitārere Beach	111.8	8	7.9	8.4	4.6	2	0	-
Raetihi	101.9	10	4.9	2.8	2.1	1	0.1	-
Manakau	115.9	18.6	6.4	2.2	0.6	0.2	0	-
Sanson	58.6	5.6	1.8	1.2	0.4	0.8	0	-
Linton	44.7	3.2	0.9	0.7	0.4	0.1	-	-
Ohakea	9.9	1.1	0.9	1.6	0.1	0	-	-
Norsewood	27.5	2.8	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.2	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.6	0.3	0.1	-	-	-	-
National Park	139.3	3.4	2.3	0.8	0.4	0.8	1	0.1
Waikawa Beach	59.7	5.5	4.8	1.5	0.2	0	-	-
Mangatainoka	20.2	1.7	1.4	0.7	0.3	-	-	1.3
Ormondville	40.5	4.9	0.7	0.3	0	0	-	-
Rongotea	110	11.5	6.1	2.9	0.6	0.3	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.5	6.1	3	1.1	0.5	-	-
Kimbolton	52.5	2.7	2.2	0.3	-	0.7	-	-
Rangataua	28.5	2.9	0.7	0	-	-	-	-
Raurimu	16.9	1.2	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.5	1.1	0.6	0.6	0.2	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	52.5	34.4	22.3	7.5	6.9	9.8	0.1
Palmerston North	686.1	89.2	49.8	32.2	14.5	10.1	10.3	13
Feilding	170.9	40.9	19.2	9.2	2	0.3	0.2	0
Marton	213.9	20.7	12	12.4	33.9	39.4	3.6	3.2
Ohakune	22.4	2.7	1.5	0.8	0.2	0.2	0	-
Longburn	60.8	11.6	18.6	8.7	0.7	0.8	0	0
Kairanga	8	1.5	1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	106.1	9.1	0.9	0.7	0.6	-	-
Woodville	12.5	0.8	0.6	0.7	0.5	1.3	0.6	5
Foxton	41.4	9	5.2	0.8	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.5	1.6	0.6	0.3	0.1	0.1	0.1
Dannevirke	129.7	14.3	4.2	2.1	1.1	1.3	0.7	0.7
Bulls	53.9	7.9	6.4	3.2	2.4	4.1	1.1	0.7
Tangimoana	4.1	0.7	0.5	0.1	-	-	-	-
Hunterville	23.4	4.4	1.6	0.3	0.1	0.1	-	-
Shannon	24.9	2.6	1.9	0.4	0	-	-	0
Ōhau	7.2	1	0.2	0.1	0.2	0.2	0.5	0.4
Hokio Beach	50	8.4	4.4	1.7	-	-	-	-
Bunnythorpe	20.9	2.9	0.5	0.1	0	-	-	-
Eketāhuna	14	2	0.3	0	-	-	-	-
Mangaweka	10.3	2.3	1.4	0.3	0.1	0.2	0.1	0
Ōwhango	2.4	0.3	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	0	0	-	-
Pongaroa	2.5	0.2	0.6	0.1	0.1	-	-	-
Mangamutu	15.3	4.2	2.6	0.5	0	-	-	-
Pahiatua	17.7	3.7	1.3	0.1	0	-	-	-
Ashhurst	19.8	2.5	2.9	3.5	1.6	0.4	0.4	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2	0.8	0.3	0.1	0.2	0.1	-
Waitārere Beach	0.4	0	0.2	0	-	-	-	-
Raetihi	13.2	1.5	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.5	0.7	0.2	0.1	0.1	-	-
Linton	5.2	0.4	0.1	0.1	0	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.6	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0.2	1	0.8	-	-	-
Mangatainoka	4.7	0.6	0.2	0.1	-	-	-	-
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.5	0.6	0	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.4	0.9	1.4	1.7	5.1	2.9	2.2
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	896.1	469.5	302.4	149.2	129.5	31.9	14.7
Palmerston North	14,029.6	897.6	639.9	476.6	261.3	290.4	162.2	186.5
Feilding	7,528	808.8	483.5	312.7	149.1	110.4	30.7	10.6
Marton	27,105.7	2,243.2	1,120.8	547	314.4	335.1	117.6	95.3
Ohakune	44,184.2	782.3	345.7	189.3	65.7	52.4	15.8	7.4
Longburn	1,302.6	221.3	227.2	149.1	26.2	62	42.8	37.1
Kairanga	6,733.2	1,007.9	1,067.2	715.8	303.3	408.6	330	210.3
Levin	7,837.6	1,102.2	226.3	144.2	87.3	69.1	12.4	2.9
Woodville	10,615.9	566.6	284.2	152.3	99.9	101	98.8	2,156.2
Foxton	11,957.6	2,268.4	1,125.5	607	215.2	286.6	232	203.7
Foxton Beach	861.7	99.2	95.3	112.1	138.5	29.6	1.6	4.8
Taumarunui	12,241.3	287	168.6	88.4	41	64.4	47.9	108.8
Dannevirke	34,395.2	2,817.5	903.9	518.7	264.2	280.5	123.3	158
Bulls	9,085.6	1,299.6	725.6	516.5	242.3	192.2	34.3	26.4
Tangimoana	9,602.2	1,420	677.5	342	156.5	164.2	74.9	34.3
Hunterville	55,534.7	1,808.2	845.5	428.1	203	189.8	92.8	197.4
Shannon	7,725	385.2	450	573.6	253.5	121.9	14	9.4
Koitiata	908.1	115.5	86.2	94.5	49.7	23.6	1.7	2.9
Ōhau	2,857.8	246.2	179.7	137.8	56	44.5	15.7	5.9
Hokio Beach	2,923.4	305.4	273.9	254.5	82.5	54.8	3.2	3.8
Bunnythorpe	8,837.9	804.7	375.4	255.4	128	103.6	33	5.8
Eketāhuna	37,977.3	2,205.4	1,117.9	504	178.7	148.4	59.5	30.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	681.2	155.2	70.7	33.6	37.5	23	83.7
Ōwhango	21,112.2	378.2	162.1	82.4	36.5	29.8	12.3	35.8
Ōhura	24,006.2	722.2	447.7	252.9	111.7	98.5	49.8	82.7
Pohangina	26,177.4	971.5	554.6	383.9	156.8	125.5	50.5	33.2
Pongaroa	57,773.7	1,382.1	593	252.4	118.6	140.9	86.9	144.8
Mangamutu	1,464.7	89.7	72.8	68.3	42.3	58	11.6	35.2
Pahiatua	56,300.9	2,075.9	1,317.5	680.9	299.2	271.1	110.2	105.7
Ashhurst	9,723	649	422.2	256.1	136.1	117	44.5	34.7
Himatangi Beach	1,181.1	180.5	202.7	95	27.7	37.1	0.2	-
Taihape	66,124.7	1,610.1	519.8	274.7	128.6	131.1	65	114
Waitārere Beach	13.3	0.6	1.5	1.2	0.4	0	-	-
Raetihi	153,110.1	868.6	402.1	184.4	72.5	57.7	22.8	36.5
Manakau	5,969.4	505.9	263.2	197	96.1	64.6	6.2	0.2
Sanson	3,977.1	273.4	145.1	79.5	28.3	15.3	2.4	1.5
Linton	9,076.6	522.6	321.8	178.9	54.8	65.7	57.2	14.2
Ohakea	1,988.8	363.7	227.1	145.1	80.1	94.1	7.7	1.6
Norsewood	5,388.4	496.8	157	60.4	23.9	22.9	10.5	10.6
Tokomaru	5,474	357	209.2	201.2	178.4	165.8	13	4.6
Waiouru	2,552.9	136.6	37.6	15.7	7.1	7.2	3.2	2.1
National Park	4,186.3	253.4	64.3	23.3	15.4	12.5	5.5	7.3
Waikawa Beach	270	33.2	28.5	14.7	5.5	3.9	1	0.3
Mangatainoka	2,846.3	131.7	83.8	68.7	42.2	53.1	33.2	673.9
Ormondville	15,472.3	597.4	209.1	104.8	50.1	64.7	42.6	79.8
Rongotea	9,950.9	1,268.3	652.8	388.1	192.2	235.3	122.7	7.5
Rātana	1,699.3	125.7	75.4	69	45.9	39.1	10.2	16.4
Halcombe	20,547.4	1,394.2	665.4	451.5	246.2	294.9	96.8	98.5
Kimbolton	9,408.6	427.5	211	125	50.8	47.6	17.5	20.8
Rangataua	6,946.1	192.8	44.8	28.5	10.7	7.6	0.8	0.2
Raurimu	2,159.8	115.8	44	21.8	10.6	11	5.7	10.8
Kai Iwi	9,060.1	359.4	209	139.3	67.3	56.4	29.9	51.8
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	101.7	50.8	39.3	25.2	20.7	17.4	28
Palmerston North	5,568.9	237.9	161.2	102.2	62.3	90.7	54.1	38.9
Feilding	476.3	60.2	26.5	29.4	12.4	3.8	0.6	0.5
Marton	1,724.2	56.9	32.4	15.1	6.8	12.6	1.8	4
Ohakune	2,300.5	27.2	10.3	8.6	5.3	6.2	1.6	0.4
Longburn	36.4	6.1	2.5	0.3	0.5	0.9	-	0
Kairanga	29.9	2.5	0.1	0.2	0.2	0.2	0	0
Levin	495.8	110.8	18.9	8.5	3.4	11	2.3	0.5
Woodville	73.1	13.5	0.3	0.8	0.8	1.4	0.3	17.5
Foxton	594.5	85.4	63.8	36.1	10.2	1.9	0.7	0.1
Foxton Beach	309.8	26.9	27.7	17.1	8.7	12.8	-	-
Taumarunui	503.9	9.6	6.1	6.3	4.8	10.1	2.9	10.9
Dannevirke	855.3	71	13	14.1	3.7	4	1.5	0.8
Bulls	223.2	29.3	13.2	6.6	3.2	5.3	5.1	1.2
Tangimoana	421.8	44.6	28.2	11.5	3.2	3	2.9	1.6
Hunterville	2,173.7	27.1	13.9	7.7	3.2	4	2.7	5.6
Shannon	2,594	28.7	16	5.7	2.5	2.4	1.1	0.6
Koitiata	64.1	12.7	14	2.9	1.1	0.2	-	-
Ōhau	35.6	2.9	1.2	0.8	0.2	0	-	-
Hokio Beach	857.5	76.7	155.4	113.6	16	55.5	15.8	0.2
Bunnythorpe	80.9	9.9	2.2	1	0.7	0.8	0.6	0.2
Eketāhuna	1,475.7	8.2	2.7	1.8	0.7	0.9	1.2	1.3
Mangaweka	252	8.2	1.7	0.8	0.5	0.4	0.3	3.1
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	11.7	5.8	1.4	0.5	0.9	0.7	0.8
Pohangina	882.3	32.5	17.1	8.4	4.7	5	0.6	0.1
Pongaroa	3,913	140.1	61.1	17.9	8.2	10.1	5.5	12.7
Mangamutu	26	0.8	0.9	0.4	-	-	-	-
Pahiatua	2,893.9	22.4	12.1	6	1.6	1.9	0.9	1.4
Ashhurst	115.4	8	3.2	3	2.2	1.4	0.7	-
Himatangi Beach	59.4	1.6	0.9	0.6	0.5	0.5	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	92	17	6	2.8	2.9	1.9	3.1
Waitārere Beach	24.3	1.2	1	0.3	0.4	0.1	-	-
Raetihi	8,257	12.4	10.5	5.4	1.9	2.6	0.3	0.5
Manakau	138	5.4	3.8	3.5	1.3	0.7	0	-
Sanson	55.8	3.6	1.3	0.4	0.1	0	-	0
Linton	426.8	61.5	11.7	7.7	5.6	10.3	9.7	14.7
Ohakea	56.4	6.5	2.9	1.9	0.6	0.1	-	-
Norsewood	148.5	3.1	1	0.9	0.3	0.4	0.4	0.5
Tokomaru	1,681.2	27.9	16.9	5.8	0.9	1.2	0.4	0.3
Waiouru	2.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
National Park	1,051.5	15.8	4.8	1.5	0.9	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.5	0.3	0.2	0.2	0.5	-
Mangatainoka	178	5.7	4.2	2.2	0.9	1.1	2	2.4
Ormondville	889.7	28.9	13.8	20.1	21.6	9.7	3.3	4.9
Rongotea	137.6	1	1.7	1	0.5	0	-	-
Rātana	25.6	1.9	0.5	0.5	0.2	0.3	0.2	0.3
Halcombe	913.2	43.6	23.5	16.8	5.3	4.1	2.1	3.8
Kimbolton	334.7	1	0.5	-	-	-	0.5	0.1
Rangataua	766.7	26.8	13.5	7.8	4	3	1.3	0.5
Raurimu	190.1	8.4	4.8	4	0.2	0.1	0.5	0.2
Kai Iwi	148.2	5.4	5.3	4.2	1.6	1.9	1	0.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.10: Total hectares of property use type flooded for town/settlement for 0.1% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	184.2	104.2	92.8	66	54.5	18.1	10.9
Palmerston North	3,060.7	296.1	175.7	105.8	37.4	26.6	3.3	0.7
Feilding	1,015.1	157.3	21.8	8.7	8.4	4.1	0.5	0.4
Marton	365.7	50.6	29.8	8.4	2.1	2.1	0.9	0.6
Ohakune	272.9	26	10.4	5.3	2	1.2	0.6	-
Longburn	46.1	5.5	5.8	2	0.6	0.9	0	-
Kairanga	45.4	7	9.3	3.2	1.3	0.2	0.4	0
Levin	1,280.1	326.8	54.2	8.1	1.7	1.6	0.2	-
Woodville	119.2	11.9	4.1	5.1	3.2	7.5	9.9	26.4
Foxton	227.8	40.3	31.3	14.9	1.4	0.5	0	0
Foxton Beach	182.5	29.7	25.5	6.1	1.2	0.7	0	-
Taumarunui	292.6	19.1	19.7	21.3	8.5	5.1	2.5	3.1
Dannevirke	346.6	36	5.7	1.7	0.7	0.5	0.1	0
Bulls	172.2	28.2	19.7	10.1	3.3	1	0	-
Tangimoana	38.6	2.8	1.9	10.3	12.1	2.5	-	-
Hunterville	163.2	11.4	8.9	6.8	3.3	1.5	0.5	0
Shannon	118.1	7.5	1.9	0.8	0.2	0.2	-	-
Koitiata	9.2	0.7	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	23.3	3.5	2.2	0.6	0.4	0	-
Hokio Beach	64	6.1	4.3	2.4	0.8	0.3	-	-
Bunnythorpe	132.8	9.7	3.5	2.4	0.3	0.6	0.2	0
Eketāhuna	91.5	9.8	2	0.3	0	0.1	0	0
Mangaweka	21.7	3.2	1.3	0.1	0.1	0.1	0	-
Ōwhango	24.1	2.9	0.3	0.6	0.2	0.5	0.1	-
Ōhura	31.9	3.5	2.9	2.2	0.7	0.1	-	-
Pohangina	23.7	3.1	0.5	0.3	0	0	-	-
Pongaroa	16.6	1.7	1.1	0.8	0.4	0.2	0.1	0.3
Mangamutu	13.6	2.6	0.4	0	-	-	-	-
Pahiatua	213.1	39.8	16.7	4.2	1.3	0.7	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	34	7	1	0.3	0	-	-
Himatangi Beach	50.7	5.4	4.1	0.7	0	-	-	-
Taihape	297.3	9.2	2	1.4	0.8	0.6	0.4	0.8
Waitārere Beach	111.8	8.2	8	8.8	4.8	2.1	0	-
Raetihi	101.9	10.2	5.1	2.7	2.3	1.2	0.1	-
Manakau	115.9	18.7	6.9	2.3	0.8	0.2	0	-
Sanson	58.6	5.7	1.8	1.3	0.4	0.8	0	-
Linton	44.7	3.4	0.9	0.7	0.4	0.1	-	-
Ohakea	9.9	1.1	0.6	1.6	0.5	0.1	-	-
Norsewood	27.5	2.8	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.3	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.6	0.3	0.1	-	-	-	-
National Park	139.3	3.4	2.3	0.8	0.5	0.9	1	0.1
Waikawa Beach	59.7	5.6	4.9	1.7	0.2	0	-	-
Mangatainoka	20.2	1.8	1.5	0.9	0.4	0	-	1.3
Ormondville	40.5	4.9	0.7	0.3	0	0	-	-
Rongotea	110	11.7	6.4	3.1	0.6	0.4	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	12.3	5.4	3.8	1.2	0.5	-	-
Kimbolton	52.5	2.6	2.4	0.3	-	0.7	-	-
Rangataua	28.5	3.1	0.7	0	-	-	-	-
Raurimu	16.9	1.3	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.6	1.1	0.6	0.6	0.2	0.2	0
Commerical/Industrial property use type								
Whanganui	401.8	45.9	27.6	33.3	16.6	10.9	10.2	2.7
Palmerston North	686.1	90.9	51.4	32.4	16	11.8	10.1	14.7
Feilding	170.9	42.3	18.9	11.6	2.8	0.5	0.2	0
Marton	213.9	21.6	11.9	7.2	25.9	52.2	4.8	4.1
Ohakune	22.4	2.9	1.5	0.8	0.3	0.2	0	-
Longburn	60.8	10.5	17.2	14.8	1.5	0.9	0.1	0
Kairanga	8	1.6	1.1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	108.6	9.9	0.9	0.7	0.6	-	-
Woodville	12.5	0.9	0.4	0.8	0.7	1	1.2	5.4
Foxton	41.4	8.8	5.4	0.8	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.7	1.9	0.8	0.5	0.2	0.1	0.1
Dannevirke	129.7	14.6	4.3	2.4	1.3	1.4	0.8	0.9
Bulls	53.9	7.7	5.1	4.4	1.9	4.6	1.9	0.8
Tangimoana	4.1	0.8	0.7	0.4	-	-	-	-
Hunterville	23.4	5	2.7	0.6	0.1	0.1	-	-
Shannon	24.9	2.6	2.1	0.5	0	-	-	0
Ōhau	7.2	1	0.2	0.1	0.1	0.2	0.5	0.5
Hokio Beach	50	8.5	4.4	1.8	-	-	-	-
Bunnythorpe	20.9	3	0.5	0.1	0	-	-	-
Eketāhuna	14	2.1	0.3	0	-	-	-	-
Mangaweka	10.3	2.3	1.6	0.3	0.1	0.2	0.1	0.1
Ōwhango	2.4	0.4	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0	0.1	0	0	-	-
Pongaroa	2.5	0.3	0.6	0.1	0.1	-	-	-
Mangamutu	15.3	4.3	3.2	1	0	-	-	-
Pahiatua	17.7	3.7	1.4	0.1	0	-	-	-
Ashhurst	19.8	2.4	2.8	3.7	1.8	0.3	0.5	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.1	0.8	0.3	0.1	0.2	0.1	0
Waitārere Beach	0.4	0	0.2	0.1	-	-	-	-
Raetihi	13.2	1.5	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.5	0.8	0.2	0	0.1	-	-
Linton	5.2	0.4	0.1	0.1	0	0	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.6	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0	1.2	0.8	-	-	-
Mangatainoka	4.7	0.6	0.2	0.1	-	-	-	-
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.5	0.6	0	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.3	0.8	1.3	1.7	4.4	3.9	2.3
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	903.4	483.2	308	144.9	128.8	61.3	18.6
Palmerston North	14,029.6	889.2	656.4	522.5	304.9	334.4	183.2	208.3
Feilding	7,528	804	501.9	339.4	158.2	114.5	33.1	12.3
Marton	27,105.7	2,309.2	1,158.4	552	307.1	374.5	138.2	118.2
Ohakune	44,184.2	791.9	344.9	199.3	70	57.6	18.8	8.6
Longburn	1,302.6	208.7	265.4	194.3	32.1	58.4	48.7	41.9
Kairanga	6,733.2	958.3	1,016.8	759.9	306.4	481.1	312.4	407
Levin	7,837.6	1,127.2	231.5	145.1	90.5	73.8	14.1	3.6
Woodville	10,615.9	569.1	288.5	155.2	99.8	121.7	77.2	2,215.7
Foxton	11,957.6	2,288.4	1,142.9	627.9	215.9	292.5	236.6	225.8
Foxton Beach	861.7	100.7	100.4	98.8	154.7	32.6	1.7	4.8
Taumarunui	12,241.3	288.9	165.4	93.8	42	61.6	53.2	123.7
Dannevirke	34,395.2	2,876.6	915.3	537.3	275.4	299	136.5	173.5
Bulls	9,085.6	1,313.9	718.3	534.2	252.2	234.7	46.4	29.9
Tangimoana	9,602.2	1,436.7	691.9	354.8	168	176.3	87.4	39.1
Hunterville	55,534.7	1,849	877.8	442.3	220	203.8	102	219.8
Shannon	7,725	371	421.3	601.4	281.1	140.1	14.8	9.7
Koitiata	908.1	108.9	86	95.5	53.8	36.7	2.4	3
Ōhau	2,857.8	248.8	179.4	150.6	58	50.4	17.8	6.7
Hokio Beach	2,923.4	305.2	274.6	261.8	87	61.2	3.6	3.9
Bunnythorpe	8,837.9	824.5	385.5	253.2	132.8	113.5	37.1	7.1
Eketāhuna	37,977.3	2,223.8	1,151.2	523.3	184.5	155.1	62	32.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	700.6	158.8	73.7	35.7	40.4	22.8	90.8
Ōwhango	21,112.2	381.5	165.6	84.9	37.3	31	13.1	37.4
Ōhura	24,006.2	726.4	460.2	273.7	134.2	112.5	53.2	91.6
Pohangina	26,177.4	981.1	547.5	401.5	170.7	135.7	53.5	30.3
Pongaroa	57,773.7	1,407	603.7	266.3	127.2	147.7	89.3	159.2
Mangamutu	1,464.7	88	66.4	62	45.7	62.2	34.1	38.8
Pahiatua	56,300.9	2,101.3	1,357	715.3	313.2	308.4	123.5	116
Ashhurst	9,723	648.6	433.5	267.8	135.6	136.4	48.2	39.5
Himatangi Beach	1,181.1	178.4	204.4	100.9	29	39.6	0.3	-
Taihape	66,124.7	1,654.5	530.6	282.6	131.4	136.6	67.6	127.2
Waitārere Beach	13.3	0.5	1.5	1.1	0.6	0	-	-
Raetihi	153,110.1	877.5	416.3	190.2	76.5	62.3	24.9	40.3
Manakau	5,969.4	511.6	270	203.5	104.2	72.7	7.6	0.5
Sanson	3,977.1	285.9	147.1	83.5	28.7	17.9	2.4	1.6
Linton	9,076.6	529.2	326.6	184.7	59.7	61.6	62.6	18.8
Ohakea	1,988.8	364.3	221.4	143.8	89.7	112.6	11.9	2.1
Norsewood	5,388.4	504.8	160.5	60.8	24.6	23.1	10.8	10.8
Tokomaru	5,474	360.2	208.8	198.8	171.9	186.5	14.8	5.4
Waiouru	2,552.9	139.6	38.7	16.3	6.8	7.5	3.4	2.4
National Park	4,186.3	258.3	65.2	23.5	15.7	13.6	5.5	7.7
Waikawa Beach	270	31.6	29.3	18.1	6	4.4	1	0.5
Mangatainoka	2,846.3	131	81.6	62.5	42.1	64	36.6	691.8
Ormondville	15,472.3	601.7	211.6	105.8	50.2	65	45	84
Rongotea	9,950.9	1,297.8	670.6	436.2	200.5	254.3	142	11.7
Rātana	1,699.3	126.6	66.8	63.1	45.3	54.6	12	17.9
Halcombe	20,547.4	1,436.2	670.7	448.8	247.6	311	122.2	109.2
Kimbolton	9,408.6	434.3	215.1	128.9	52.6	50.8	18.3	23.3
Rangataua	6,946.1	197.4	46	28.9	11.5	7.8	1.1	0.2
Raurimu	2,159.8	115.5	46.1	22.2	10.9	11.6	5.9	11.6
Kai Iwi	9,060.1	368.6	207.8	140.9	66.8	61.2	31.9	54.8
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	102.9	50.6	38.6	21.1	31.4	16.1	35.3
Palmerston North	5,568.9	238.9	161.5	105.7	64.6	85.9	63.5	44.8
Feilding	476.3	61.4	27.3	30.1	13.6	4.4	0.7	0.6
Marton	1,724.2	57.9	32.8	15.9	7.3	13.4	2.1	4.4
Ohakune	2,300.5	28.1	10.5	9	5.4	6.5	1.9	0.4
Longburn	36.4	4.2	4.7	0.2	0.5	1.1	-	0
Kairanga	29.9	2.5	0	0.2	0.2	0.3	0	0
Levin	495.8	113.4	19.3	8.8	3.5	11.2	2.5	0.8
Woodville	73.1	13.9	0.4	0.2	0.4	1.9	0.9	17.6
Foxton	594.5	86.4	63.7	37.4	11.2	2	0.8	0.1
Foxton Beach	309.8	26.4	28	18.1	8.4	13.8	-	-
Taumarunui	503.9	9	4.5	5	6	11.2	4.2	12.6
Dannevirke	855.3	71.8	13.6	14.7	3.7	4.3	1.7	1.1
Bulls	223.2	29.9	13.1	6.4	3	5.4	6	1.6
Tangimoana	421.8	44.1	28.2	14.5	3.9	3.3	3.1	1.8
Hunterville	2,173.7	27.8	14.2	8.2	3.3	4.2	2.7	6.4
Shannon	2,594	28.7	16.4	6.1	2.5	2.4	1.2	0.6
Koitiata	64.1	12.2	14.3	3.6	1.1	0.2	-	-
Ōhau	35.6	2.9	1.4	0.9	0.3	0	-	-
Hokio Beach	857.5	60.6	150.9	144.1	16.8	54.8	18.3	0.2
Bunnythorpe	80.9	10.4	2.4	1	0.6	0.9	0.6	0.3
Eketāhuna	1,475.7	8.5	2.8	1.8	0.7	0.8	1.1	1.5
Mangaweka	252	8.4	1.9	0.8	0.5	0.5	0.3	3.2
Ōwhango	1,328.7	0.6	0.3	0.1	0.1	0.1	-	0
Ōhura	891.6	11.6	6.4	1.9	0.5	0.9	0.7	1
Pohangina	882.3	31.7	18.1	8.3	4.8	5.3	0.7	0.1
Pongaroa	3,913	141.4	63	20.9	8.1	11.6	5.7	14.6
Mangamutu	26	0.7	1	0.5	-	-	-	-
Pahiatua	2,893.9	23.1	12.5	5.5	2.2	1.9	0.8	1.6
Ashhurst	115.4	8.9	3.3	3.4	2.7	2.1	0.8	-
Himatangi Beach	59.4	1.5	1.2	0.6	0.5	0.5	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	94.7	17.2	6.2	3	2.9	2	3.4
Waitārere Beach	24.3	1.1	1	0.4	0.5	0.1	-	-
Raetihi	8,257	12.5	10.1	5.9	2.2	2.6	0.5	0.5
Manakau	138	5.6	4.7	3.6	1.3	0.7	0.1	-
Sanson	55.8	3.8	1.3	0.4	0.1	0	-	0
Linton	426.8	60.4	14.1	7.6	5.6	9.9	8.6	17.4
Ohakea	56.4	6.7	3.1	2	0.6	0.1	-	-
Norsewood	148.5	3.1	0.9	1	0.4	0.4	0.4	0.5
Tokomaru	1,681.2	27.8	16.9	6.2	0.8	1.2	0.5	0.4
Waiouru	2.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
National Park	1,051.5	16	4.9	1.5	0.9	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.5	0.2	0.2	0.1	0.6	-
Mangatainoka	178	5.8	4.5	2.9	1	1.2	1.4	3.1
Ormondville	889.7	29.1	13.9	19.1	23.1	10	3.5	5
Rongotea	137.6	0.9	1.9	1	0.1	0.4	-	-
Rātana	25.6	1.9	0.5	0.5	0.3	0.2	0.2	0.3
Halcombe	913.2	45.5	20.6	18.2	7.7	4.3	2.1	3.9
Kimbolton	334.7	0.9	0.7	-	-	-	0.5	0.1
Rangataua	766.7	27.2	13.7	8	4.2	3.4	1.4	0.6
Raurimu	190.1	8.5	4.6	3.8	1.1	0.4	0.3	0.6
Kai Iwi	148.2	5.2	5.5	4.1	1.9	2	0.8	0.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.11: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +1°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	193.6	112.3	83.7	32.9	22	7.3	4.5
Palmerston North	3,060.7	289	171.1	100.2	36.1	23.1	3	0.6
Feilding	1,015.1	150.4	19.4	8.9	8.1	3	0.4	0.3
Marton	365.7	48.8	20.3	4.6	1.4	1.6	0.7	0.3
Ohakune	272.9	25	9.8	5	1.8	1.1	0.5	-
Longburn	46.1	5.3	5.1	1.9	0.5	0.9	0	-
Kairanga	45.4	7.6	8.3	2.6	0.2	0.5	0.2	0
Levin	1,280.1	323	52	8	1.6	1.6	0.2	-
Woodville	119.2	14.9	6	5.8	4.6	8	6.2	8.8
Foxton	227.8	38.7	29.5	14.7	1.3	0.5	0	0
Foxton Beach	182.5	30.1	22.7	5.8	1	0.6	-	-
Taumarunui	292.6	22.5	18.2	12.3	4.7	3.6	2.2	2.7
Dannevirke	346.6	35	5.5	1.7	0.7	0.4	0.1	0
Bulls	172.2	30.3	12.8	6.2	1.3	0.3	0	-
Tangimoana	38.6	5.7	10.5	7.4	0.8	0.1	-	-
Hunterville	163.2	11.4	10.2	4.6	1.6	1	0.2	0
Shannon	118.1	7.2	1.8	0.8	0.2	0.2	-	-
Koitiata	9.2	0.7	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	22.9	3.3	2.1	0.6	0.4	0	-
Hokio Beach	64	6.1	4.1	2.2	0.7	0.3	-	-
Bunnythorpe	132.8	9.3	3.6	2.2	0.3	0.6	0.1	0
Eketāhuna	91.5	9.5	1.9	0.3	0.1	0.1	0	0
Mangaweka	21.7	3.5	0.7	0	0	0.1	-	-
Ōwhango	24.1	2.9	0.3	0.6	0.3	0.4	0.1	-
Ōhura	31.9	3.5	2.9	2.1	0.7	0.1	-	-
Pohangina	23.7	3	0.4	0.3	0	0	-	-
Pongaroa	16.6	1.7	1.3	0.5	0.4	0.1	0.1	0.3
Mangamutu	13.6	1.6	0.4	0	-	-	-	-
Pahiatua	213.1	39.4	16.4	4.1	1.2	0.6	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	33.2	6.7	0.9	0.3	0	-	-
Himatangi Beach	50.7	5	3.3	0.5	-	-	-	-
Taihape	297.3	10.6	3.6	1.5	0.7	0.5	0.3	0.6
Waitārere Beach	111.8	8.1	7.7	8.3	4.5	1.7	0	-
Raetihi	101.9	10.1	4.8	2.8	2.1	1	0.1	-
Manakau	115.9	18.7	6.5	2.2	0.6	0.2	0	-
Sanson	58.6	5.8	2	0.8	0.8	0.4	-	-
Linton	44.7	3.2	0.9	0.7	0.4	0.1	-	-
Ohakea	9.9	1	0.8	1.1	0	-	-	-
Norsewood	27.5	2.8	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.3	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3.4	2.3	0.9	0.4	0.9	0.9	0.1
Waikawa Beach	59.7	5.5	4.8	1.5	0.2	0	-	-
Mangatainoka	20.2	1.6	1.4	0.7	0.3	0	0.1	1.1
Ormondville	40.5	4.9	0.7	0.3	0	0	-	-
Rongotea	110	10.9	5.1	2.8	0.5	0.3	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.3	6.9	1.4	0.3	0.1	-	-
Kimbolton	52.5	2.7	2.2	0.3	-	0.7	-	-
Rangataua	28.5	2.9	0.7	0	-	-	-	-
Raurimu	16.9	1.3	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.4	1.1	0.3	0.6	0.6	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	51.6	33.6	22.5	7.5	5.1	10.8	0.1
Palmerston North	686.1	89	51.1	30.5	14.1	9.3	10.2	14
Feilding	170.9	40.6	19.2	8.6	1.9	0.3	0.2	0
Marton	213.9	19.1	11.2	23.4	36.4	22	2.5	2.7
Ohakune	22.4	2.7	1.5	0.8	0.2	0.2	0	-
Longburn	60.8	10.6	19	12.1	1.1	0.8	0	0
Kairanga	8	1.6	1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	106.6	9.1	0.9	0.7	0.6	-	-
Woodville	12.5	1.1	0.3	0.7	0.3	1.4	0.6	3.2
Foxton	41.4	8.9	5.2	0.8	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.6	1.6	0.7	0.3	0.1	0.1	0.1
Dannevirke	129.7	14.3	4.2	2.1	1.1	1.3	0.8	0.6
Bulls	53.9	7.8	5.1	2.1	2.6	3	0.4	0.7
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	3.6	1.3	0.4	0.1	0.1	-	-
Shannon	24.9	2.6	1.8	0.4	0	-	-	0
Ōhau	7.2	1	0.2	0.1	0.2	0.2	0.5	0.4
Hokio Beach	50	8.4	4.4	1.7	-	-	-	-
Bunnythorpe	20.9	2.9	0.5	0.1	0	-	-	-
Eketāhuna	14	2.1	0.3	0	-	-	-	-
Mangaweka	10.3	2.6	1	0.3	0.1	0.1	0.1	0
Ōwhango	2.4	0.4	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	0	0	-	-
Pongaroa	2.5	0.2	0.6	0.1	0.1	-	-	-
Mangamutu	15.3	4.2	2.6	0.5	0	-	-	-
Pahiatua	17.7	3.7	1.3	0.1	0	-	-	-
Ashhurst	19.8	2.4	2.8	3.6	1.6	0.4	0.4	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.5	0.7	0.2	0.1	0.2	0	-
Waitārere Beach	0.4	0	0.2	0	-	-	-	-
Raetihi	13.2	1.5	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.1	0.1	0	0	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.1	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0.6	0.6	0.8	-	-	-
Mangatainoka	4.7	0.6	0.2	0.1	-	-	-	-
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.4	1	1.6	1.4	5.6	1.9	2
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	886.9	464.3	308.4	147.5	123.2	27.3	12.8
Palmerston North	14,029.6	873.8	640.3	505.4	284.2	316.3	173.8	200.4
Feilding	7,528	810	475.8	308.6	143.5	110	26.9	9.7
Marton	27,105.7	2,404.7	1,093	543.2	274.1	262.9	81.6	76.7
Ohakune	44,184.2	784	345.5	188	64.8	51.2	15.1	7.3
Longburn	1,302.6	220.6	249.1	165	27.6	59.5	46.9	40
Kairanga	6,733.2	1,004.4	1,048.1	690	291.9	436.2	313.3	275.1
Levin	7,837.6	1,103.8	226.8	145.5	86.7	68.5	12.1	3
Woodville	10,615.9	583.5	281.6	149.1	102.1	147.6	170.9	1,928.5
Foxton	11,957.6	2,182.1	1,019.9	588.9	203.3	288.7	235.8	219.6
Foxton Beach	861.7	97.5	93.6	60.9	181.1	37	2.5	4.9
Taumarunui	12,241.3	287.1	167.8	89.5	41.6	64.4	48.2	110.8
Dannevirke	34,395.2	2,814.5	900.8	516.1	259.5	275.8	120.2	153
Bulls	9,085.6	1,321.2	703.5	473.5	212.4	135.7	26.1	20.6
Tangimoana	9,602.2	1,254.5	518.8	308.4	112.6	132.3	43.5	23.4
Hunterville	55,534.7	1,777.9	897.2	484.6	217.1	195	98.5	189.9
Shannon	7,725	384.6	453.2	572.7	248.7	120.8	13.9	9.4
Koitiata	908.1	108.5	89.8	91.8	45.3	17.7	1.6	2.8
Ōhau	2,857.8	247.8	179.8	138.2	56.1	45.2	16	6.1
Hokio Beach	2,923.4	307.6	274.1	253.3	81	53.5	2.8	3.8
Bunnythorpe	8,837.9	803.6	374.9	254	128	99.6	30.6	5.5
Eketāhuna	37,977.3	2,219.7	1,132.7	513.7	185.3	160	67.8	35.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	750.1	295.3	115.2	39.5	36.8	22.1	79.3
Ōwhango	21,112.2	380	162.7	82.5	36.8	30.2	12.3	36
Ōhura	24,006.2	723.6	450.6	255.8	116.8	100.7	50.4	84.4
Pohangina	26,177.4	967.6	554.2	377.8	151.7	122	49.3	31.7
Pongaroa	57,773.7	1,381.8	593.4	251.6	116.4	139.9	86.8	143.3
Mangamutu	1,464.7	90.1	75.2	69.6	43.5	57.4	11.8	25.4
Pahiatua	56,300.9	2,079.1	1,327	682	295.2	260.6	113.4	102.8
Ashhurst	9,723	645.6	425.6	249	128.7	122.4	44.7	37
Himatangi Beach	1,181.1	159.8	169.3	87.7	25.6	37	0.2	-
Taihape	66,124.7	1,850.3	991.5	440.2	179.3	153.8	72.2	100.6
Waitārere Beach	13.3	0.7	1.5	1.2	0.3	-	-	-
Raetihi	153,110.1	867.5	399.3	183.9	69.7	57.2	22.1	35.5
Manakau	5,969.4	508.8	264.3	197.2	97	64.4	6.3	0.2
Sanson	3,977.1	265.4	173	109.5	43.4	26.9	7.3	1.6
Linton	9,076.6	522.7	320.2	178.2	57	61.9	61.4	16
Ohakea	1,988.8	341	151.4	104	77.4	48.7	4.1	0.8
Norsewood	5,388.4	499	157.1	60.1	23.8	22.8	10.5	10.5
Tokomaru	5,474	355.8	208.8	201.4	174.9	168.8	12.8	4.7
Waiouru	2,552.9	141	63.4	26	8.4	8.2	3.4	2.4
National Park	4,186.3	252.8	65.7	21.7	15.3	13	5	7.3
Waikawa Beach	270	33.4	28.5	14.7	5.5	3.9	1	0.3
Mangatainoka	2,846.3	138.1	87.2	68	40.1	51.6	40.1	625
Ormondville	15,472.3	599.1	210.3	104.1	49.7	63.8	42.3	78.8
Rongotea	9,950.9	1,251.3	620.4	387.4	210.6	239.5	115.3	6.7
Rātana	1,699.3	126.2	80.4	70.1	42.5	32.7	9.6	15.5
Halcombe	20,547.4	1,372.1	779.5	545.6	302.8	313.8	94.9	81
Kimbolton	9,408.6	422.4	223.2	126.8	53	45.8	17.3	19.6
Rangataua	6,946.1	193	44.5	28.2	10.6	7.4	0.8	0.2
Raurimu	2,159.8	116.2	44.1	21.7	10.8	10.9	5.7	10.9
Kai Iwi	9,060.1	344.3	219.8	149.6	68	57.1	29.9	44.4
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	99.5	51.4	39.8	22.7	19.5	19.1	24
Palmerston North	5,568.9	235.5	159.8	102.7	62.8	86.8	61.1	42.4
Feilding	476.3	59.2	26.6	29.3	11.7	3.5	0.6	0.5
Marton	1,724.2	60.2	34.4	16.2	4.2	3.2	1.9	3.3
Ohakune	2,300.5	27.1	10.3	8.7	5.2	6.2	1.6	0.3
Longburn	36.4	4.5	4.3	0.3	0.5	1	-	0
Kairanga	29.9	2.5	0.1	0.2	0.2	0.2	0	0
Levin	495.8	111.3	19.1	8.6	3.5	10.9	2.3	0.6
Woodville	73.1	15.1	0.5	0.3	0.3	0.4	0.1	17.5
Foxton	594.5	83.9	59.7	32.8	4.6	1.9	0.7	0.1
Foxton Beach	309.8	26	26.6	16.7	8.9	12.4	0	-
Taumarunui	503.9	9.4	6	6.2	4.8	10.8	2.5	11.4
Dannevirke	855.3	70.8	12.7	14	3.6	4	1.5	0.7
Bulls	223.2	28.7	11.2	4.2	4.4	4.5	4	0.8
Tangimoana	421.8	36.9	21.8	6.5	0.9	4	0.9	1.5
Hunterville	2,173.7	25.7	14.1	8.7	4.1	4.3	3.1	5.2
Shannon	2,594	28.4	15.9	5.6	2.5	2.4	1.1	0.6
Koitiata	64.1	12.9	13.6	2.7	1	0.1	-	-
Ōhau	35.6	2.8	1.3	0.8	0.2	0	-	-
Hokio Beach	857.5	83.1	161.1	97.3	16	55.7	15.2	0.2
Bunnythorpe	80.9	9.8	2.2	1.1	0.6	0.8	0.6	0.2
Eketāhuna	1,475.7	8.2	2.8	1.8	0.7	0.8	1.2	1.4
Mangaweka	252	10.8	1.9	0.8	0.5	0.4	0.3	3
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	11.7	6.1	1.4	0.5	0.9	0.7	0.9
Pohangina	882.3	32.4	17.4	8.4	4.3	5	0.6	0.1
Pongaroa	3,913	139.8	61.3	17.6	8.2	10	5.3	12.6
Mangamutu	26	0.8	1	0.4	-	-	-	-
Pahiatua	2,893.9	22.6	12.1	6	1.6	1.9	0.9	1.4
Ashhurst	115.4	8.4	3	3.2	2.1	1.5	0.7	-
Himatangi Beach	59.4	1.6	0.9	0.6	0.4	0.5	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	88	40.8	18.3	6.6	4.9	3.6	2.9
Waitārere Beach	24.3	1.2	0.9	0.4	0.5	-	-	-
Raetihi	8,257	12.2	10.6	5.5	1.7	2.7	0.2	0.5
Manakau	138	5.4	3.9	3.5	1.3	0.7	0	-
Sanson	55.8	3.2	1.1	0.2	0	-	0	-
Linton	426.8	61.5	11.7	7.7	5.5	9.9	8.9	16.6
Ohakea	56.4	5	1.8	1.2	0.2	0	-	-
Norsewood	148.5	3.1	1	0.9	0.3	0.4	0.4	0.5
Tokomaru	1,681.2	27.5	16.7	5.8	1	1.1	0.4	0.3
Waiouru	2.1	0.1	0.1	0.1	-	0	0	-
National Park	1,051.5	15.8	4.8	1.5	0.9	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.5	0.3	0.2	0.1	0.6	-
Mangatainoka	178	5.8	4.2	2.2	0.9	1.1	1.2	3.3
Ormondville	889.7	28.8	13.7	20.7	21.1	9.4	3.2	4.8
Rongotea	137.6	0.8	1.6	1	0.5	0	-	-
Rātana	25.6	2	0.5	0.4	0.2	0.2	0.1	0.2
Halcombe	913.2	54.6	24.2	20.8	11.6	8.3	2.3	9.4
Kimbolton	334.7	0.9	0.5	-	-	-	0.5	0.1
Rangataua	766.7	26.8	13.3	7.8	4	2.9	1.3	0.4
Raurimu	190.1	8.5	4.8	4	0.2	0.6	0.1	0.2
Kai Iwi	148.2	4.8	4.1	4.8	1.5	2.4	0.5	0.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.12: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +1°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	193.5	113.3	84.1	32.7	21.9	7.2	4.6
Palmerston North	3,060.7	323.4	190.7	109.3	45.3	48.3	18.8	5.6
Feilding	1,015.1	185.3	46	10.8	5.8	3.8	0.3	0.3
Marton	365.7	49.2	20.9	5.1	1.4	1.7	0.7	0.3
Ohakune	272.9	25	9.8	5	1.8	1.1	0.5	-
Longburn	46.1	3.5	6.8	4.3	1	0.9	0	-
Kairanga	45.4	8.2	9.9	3.6	2	0.5	0.6	0
Levin	1,280.1	323	52	8	1.6	1.6	0.2	-
Woodville	119.2	13.2	4.3	4.1	4.3	9.9	8.6	18.4
Foxton	227.8	38.7	29.3	14.6	1.5	0.3	0.1	-
Foxton Beach	182.5	30.2	20.3	4.8	1.1	0.4	-	-
Taumarunui	292.6	21.7	20.6	15.5	5	3.7	2.2	2.7
Dannevirke	346.6	35	5.5	1.7	0.7	0.4	0.1	0
Bulls	172.2	30.4	12.9	6.3	1.3	0.3	0.1	0
Tangimoana	38.6	2.5	3.9	14.1	6.1	0.4	-	-
Hunterville	163.2	11.2	11.6	6.2	2.5	1.1	0.3	0
Shannon	118.1	7.2	1.7	0.8	0.4	0.7	0	-
Koitiata	9.2	0.7	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	22.9	3.3	1.7	0.4	0.4	0	-
Hokio Beach	64	6.1	4.1	2.2	0.7	0.3	-	-
Bunnythorpe	132.8	9.3	3.6	2.2	0.3	0.6	0.1	0
Eketāhuna	91.5	9.6	1.9	0.3	0.1	0	0	0
Mangaweka	21.7	3.5	0.7	0	0	0.1	-	-
Ōwhango	24.1	2.9	0.3	0.6	0.3	0.4	0.1	-
Ōhura	31.9	3.5	2.9	2.1	0.7	0.1	-	-
Pohangina	23.7	3	0.4	0.3	0	0	-	-
Mangamutu	13.6	1.7	0.4	0	-	-	-	-
Pahiatua	213.1	39.6	16.3	4.2	1	0.2	0.1	0.3
Ashhurst	179.3	30	5.8	0.8	0.2	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	5	3.3	0.5	-	-	-	-
Taihape	297.3	10.6	3.6	1.5	0.7	0.5	0.3	0.6
Waitārere Beach	111.8	8.1	7.7	8.3	4.5	1.7	0	-
Raetihi	101.9	10.1	4.8	2.8	2.1	1	0.1	-
Manakau	115.9	18.7	6.5	2.2	0.6	0.2	0	-
Sanson	58.6	5.8	2	0.8	0.8	0.4	-	-
Linton	44.7	3.4	1.3	0.7	0.4	0.1	0.1	-
Ohakea	9.9	1.1	0.9	1	0.1	0	-	-
Norsewood	27.5	2.8	1.1	0.4	-	-	-	-
Tokomaru	58.1	4.2	0.5	0.9	0.3	0	0.1	-
Waiouru	8.4	0.7	0.1	0	-	-	-	-
National Park	139.3	3.4	2.3	0.9	0.4	0.9	0.9	0.1
Waikawa Beach	59.7	5.5	4.8	1.5	0.2	0	-	-
Mangatainoka	20.2	1.6	1.4	0.7	0.3	0	-	1.3
Ormondville	40.5	4.9	0.7	0.3	0	0	-	-
Rongotea	110	11	6.2	3.6	0.2	0.9	0	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.3	6.9	1.4	0.3	0.1	-	-
Kimbolton	52.5	2.7	2.2	0.3	-	0.7	-	-
Rangataua	28.5	2.9	0.7	0	-	-	-	-
Raurimu	16.9	1.3	0.2	0.1	0	0.1	-	-
Kai Iwi	38.6	2.4	1.1	0.3	0.6	0.6	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	49.3	32.2	27.4	9.9	5.2	10.8	0.1
Palmerston North	686.1	95.4	45.8	37.3	6.6	8.2	10.3	12.5
Feilding	170.9	47.2	26.4	11.3	1.9	2	0.1	-
Marton	213.9	17.7	8.6	11.1	37.1	36.2	3.9	2.6
Ohakune	22.4	2.7	1.5	0.8	0.2	0.2	0	-
Longburn	60.8	6.5	17	23	2.7	1	0.1	0
Kairanga	8	1.7	1.5	0.2	0.1	-	-	-
Levin	180.9	106.6	9.1	0.9	0.7	0.6	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	0.9	0.5	0.5	0.5	1.2	0.8	4.6
Foxton	41.4	8.2	5.5	1.8	0.7	0.4	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.5	1.9	0.7	0.3	0.1	0.1	0.1
Dannevirke	129.7	14.3	4.2	2.1	1.1	1.3	0.8	0.6
Bulls	53.9	7.8	5	2.1	2.6	2.9	0.4	0.7
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	5.3	1.9	0.8	0.1	0.1	-	-
Shannon	24.9	1.4	0.6	1	0.8	4.6	1.2	0
Ōhau	7.2	1	0.2	0.1	0.2	0.2	0.5	0.4
Hokio Beach	50	8.4	4.4	1.7	-	-	-	-
Bunnythorpe	20.9	2.9	0.5	0.1	0	-	-	-
Eketāhuna	14	2.1	0.3	0	-	-	-	-
Mangaweka	10.3	2.6	1	0.3	0.1	0.1	0.1	0
Ōwhango	2.4	0.4	0.1	0	0	-	-	-
Ōhura	1.2	0.1	0.1	0.1	0	0	-	-
Mangamutu	15.3	3.2	2.3	0.8	0	-	-	-
Pahiatua	17.7	3.7	1.3	0.1	-	-	-	-
Ashhurst	19.8	3.5	2.9	2.4	0.1	0.4	0.3	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.5	0.7	0.2	0.1	0.2	0	-
Waitārere Beach	0.4	0	0.2	0	-	-	-	-
Raetihi	13.2	1.5	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2	0.2	0.1	0	-	-	-
Linton	5.2	0.4	0.2	0.1	0	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.1	0.1	-	-	-	-
National Park	18.3	0.7	0.6	0.6	0.8	-	-	-
Mangatainoka	4.7	0.6	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.7	1.4	1.7	3.5	3	0.6	1.9
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	887.5	464.7	308.5	147.5	123.4	27.3	12.8
Palmerston North	14,029.6	857	682.6	592.5	336.8	377	168.3	174.3
Feilding	7,528	830.1	514.2	310.1	139.3	109.8	26.9	9.8
Marton	27,105.7	2,395.9	1,083.5	533.6	290	276.2	89	76.1
Ohakune	44,184.2	784	345.5	188	64.8	51.2	15.1	7.3
Longburn	1,302.6	177.9	303.1	299.6	61.7	73	44.9	31.6
Kairanga	6,733.2	911.1	1,013.8	800.7	302.3	463.3	358.4	502.1
Levin	7,837.6	1,104.8	226.4	142.4	85.9	68.3	12.1	3
Woodville	10,615.9	576.4	284	156	92.2	101.1	108.4	2,128.4
Foxton	11,957.6	2,188.1	1,006	614.3	343.8	387.6	137.3	23.5
Foxton Beach	861.7	109.5	114.9	189.9	32.4	14.5	0.1	4.6
Taumarunui	12,241.3	287.4	168.5	88.8	41.2	64.2	48.2	110.8
Dannevirke	34,395.2	2,816.6	906	520.7	260.1	276.1	120.4	153.2
Bulls	9,085.6	1,312.2	704.9	485.8	244.5	155.6	25.8	19.8
Tangimoana	9,602.2	1,263.9	529.9	319.1	125.4	113.5	17.2	8.4
Hunterville	55,534.7	1,779.2	923.5	506.8	224.4	190.9	91.9	175.6
Shannon	7,725	296.7	241.7	389.1	267.9	407.9	333.5	19.8
Koitiata	908.1	108	89.8	91.8	44.8	17.2	1.6	2.8
Ōhau	2,857.8	254.2	187.9	142.3	48.8	33.5	10.3	4.6
Hokio Beach	2,923.4	307.6	274.1	253.3	81	53.5	2.8	3.8
Bunnythorpe	8,837.9	801	393.9	259.2	122.7	94.7	30.8	4.8
Eketāhuna	37,977.3	2,216.9	1,121.7	502.4	178.2	148.4	59.7	29.9
Mangaweka	25,542.3	750.3	295.1	115.2	39.5	36.8	22.1	79.3
Ōwhango	21,112.2	380.1	162.8	82.5	36.8	30.2	12.3	36
Ōhura	24,006.2	723.8	450.6	255.8	116.8	100.7	50.4	84.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	967.5	554.6	377.6	151.6	122	49.2	31.7
Pongaroa	57,773.7	1	0.3	-	-	-	-	-
Mangamutu	1,464.7	89.5	73.9	70.5	44.4	56.8	9.6	33.5
Pahiatua	56,300.9	2,081	1,297.6	654.8	289.8	259.4	110.8	103.4
Ashhurst	9,723	640.6	417.5	291.8	187	162.2	45.6	40.2
Himatangi Beach	1,181.1	159.8	169.4	87.7	25.6	37	0.2	-
Taihape	66,124.7	1,850	992	440.2	179.4	153.7	72.2	100.6
Waitārere Beach	13.3	0.7	1.5	1.2	0.3	-	-	-
Raetihi	153,110.1	867.7	399.3	183.9	69.7	57.2	22.1	35.5
Manakau	5,969.4	509.2	264.1	196.6	97	64.4	6.3	0.2
Sanson	3,977.1	265.5	172.8	109.5	43.4	26.9	7.3	1.6
Linton	9,076.6	525.2	325.8	186	89.7	125	30.5	9.5
Ohakea	1,988.8	344.7	152.6	105	75.9	40.6	3.5	0.6
Norsewood	5,388.4	498.8	157.1	60.1	23.8	22.8	10.5	10.5
Tokomaru	5,474	292.8	172.5	219.3	209.3	254.5	128.4	8.1
Waiouru	2,552.9	141	63.4	26	8.4	8.2	3.4	2.4
National Park	4,186.3	252.8	65.7	21.7	15.3	13	5	7.3
Waikawa Beach	270	33.4	28.5	14.7	5.5	3.9	1	0.3
Mangatainoka	2,846.3	132.7	86.2	69.4	41.6	49.3	32.2	667.4
Ormondville	15,472.3	598.7	209.9	104.1	50	64	42.6	79.5
Rongotea	9,950.9	1,193.5	692	528.2	263.8	266.7	168.6	50.4
Rātana	1,699.3	126.2	80.5	70.1	42.5	32.6	9.6	15.5
Halcombe	20,547.4	1,372.6	781.7	547	307.9	307.7	91.4	79.9
Kimbolton	9,408.6	421.1	222.3	126.7	53	45.8	17.3	19.6
Rangataua	6,946.1	193	44.5	28.1	10.6	7.4	0.8	0.2
Raurimu	2,159.8	116.2	44.1	21.7	10.8	11	5.7	10.9
Kai Iwi	9,060.1	344.1	219.9	149.5	68.1	57.1	29.9	44.4
Other property use type								
Whanganui	1,392.5	99.3	51.1	40.3	22.8	18.4	19.5	24.8
Palmerston North	5,568.9	230.6	154.3	111.7	78.2	107.3	83.3	68.4
Feilding	476.3	65.1	39.4	24.4	7.9	2.7	0.6	0.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	60.7	35	16.6	4.2	3.2	1.9	3.3
Ohakune	2,300.5	27.1	10.3	8.7	5.2	6.2	1.6	0.3
Longburn	36.4	2.7	6.5	0.8	0.2	0.1	-	0
Kairanga	29.9	2.6	0.1	0.2	0.3	0.3	0	0
Levin	495.8	111.3	19.1	8.6	3.5	10.9	2.3	0.6
Woodville	73.1	13.3	0.6	0.9	0.9	0.9	0.3	17.5
Foxton	594.5	84.3	60.1	32.5	4.1	0.5	0	0
Foxton Beach	309.8	27	21.6	14.1	8.8	12.1	-	-
Taumarunui	503.9	9.3	5.4	6.7	5.3	10.9	2.6	11.4
Dannevirke	855.3	70.8	12.6	14.2	3.6	4	1.5	0.7
Bulls	223.2	28.8	11.3	4.2	4.3	4.5	3.9	0.8
Tangimoana	421.8	36.8	21.3	7.2	2.6	2.9	1.8	0.3
Hunterville	2,173.7	25.2	14.1	9.2	4.2	4.5	3.2	5.2
Shannon	2,594	28	15.8	9.6	2.6	2.7	1.1	0.6
Koitiata	64.1	12.8	13.6	2.7	1	0.1	-	-
Ōhau	35.6	2.8	1.3	0.8	0.2	0	-	-
Hokio Beach	857.5	83.1	161.1	97.3	16	55.7	15.2	0.2
Bunnythorpe	80.9	9.8	2.4	1.4	0.7	1	0.6	0.1
Eketāhuna	1,475.7	8.3	2.8	1.8	0.7	0.9	1.2	1.3
Mangaweka	252	10.8	1.9	0.8	0.5	0.4	0.3	3
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	11.7	6.1	1.4	0.5	0.9	0.7	0.9
Pohangina	882.3	32.4	17.4	8.4	4.3	5	0.6	0.1
Mangamutu	26	0.8	1	0.4	-	-	-	-
Pahiatua	2,893.9	23.7	12.4	4.7	1.6	1.9	0.9	1.4
Ashhurst	115.4	8.4	2.8	3.3	2.1	1.5	0.7	-
Himatangi Beach	59.4	1.6	0.9	0.6	0.4	0.5	0.1	-
Taihape	2,174.7	88	40.8	18.3	6.6	4.9	3.6	2.9
Waitārere Beach	24.3	1.2	0.9	0.4	0.5	-	-	-
Raetihi	8,257	12.2	10.6	5.5	1.7	2.7	0.2	0.5
Manakau	138	5.4	3.9	3.5	1.3	0.7	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	3.2	1.1	0.2	0	-	0	-
Linton	426.8	61.8	11.5	7.9	5.9	10.8	9.5	13.7
Ohakea	56.4	5	1.8	1.2	0.2	0	-	-
Norsewood	148.5	3.1	1	0.9	0.3	0.4	0.4	0.5
Tokomaru	1,681.2	27.3	16.7	5.8	1	1.1	0.4	0.3
Waiouru	2.1	0.1	0.1	0.1	-	0	0	-
National Park	1,051.5	15.8	4.8	1.5	0.9	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.5	0.3	0.2	0.1	0.6	-
Mangatainoka	178	5.8	4.2	2.2	0.9	1.1	2.1	2.1
Ormondville	889.7	28.7	13.7	20.7	21.1	9.4	3.3	4.8
Rongotea	137.6	0.4	2.1	1	0.4	-	-	-
Rātana	25.6	2	0.5	0.4	0.2	0.2	0.1	0.2
Halcombe	913.2	54.8	23.9	20.2	11.6	8.3	2.3	9.4
Kimbolton	334.7	0.9	0.5	-	-	-	0.5	0.1
Rangataua	766.7	26.8	13.3	7.8	4	2.9	1.3	0.4
Raurimu	190.1	8.5	4.8	4	0.2	0.6	0.1	0.2
Kai Iwi	148.2	4.8	4.1	4.8	1.5	2.4	0.5	0.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.13: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +2°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	185.2	106.3	95.2	59.2	47.7	17.1	9.6
Palmerston North	3,060.7	301.3	182.9	106.2	39.1	30	3.7	0.8
Feilding	1,015.1	157.6	21.8	8.7	8.5	3.7	0.4	0.4
Marton	365.7	49.6	22	5.2	1.5	1.8	0.7	0.4
Ohakune	272.9	26.3	10.5	5.4	2	1.2	0.6	-
Longburn	46.1	4.2	7.2	2.9	0.8	1	0	-
Kairanga	45.4	7.2	8.6	3.1	1.9	0.5	0.6	0
Levin	1,280.1	331.1	57.5	8.2	1.7	1.6	0.2	-
Woodville	119.2	12.2	4.7	4.5	3	7.9	10.1	25.3
Foxton	227.8	39.5	30.4	15.1	1.5	0.5	0	0
Foxton Beach	182.5	29.8	25.2	6.4	1.1	0.7	0	-
Taumarunui	292.6	18.1	17.7	24.6	11.9	7.8	2.6	3.5
Dannevirke	346.6	36.4	5.9	1.7	0.7	0.5	0.1	0
Bulls	172.2	29.6	14.5	7.3	2	0.4	0	-
Tangimoana	38.6	4.4	9.5	10.7	1.5	0.2	-	-
Hunterville	163.2	11.7	10.7	6.3	2.3	1.1	0.3	0
Shannon	118.1	7.7	2	0.8	0.2	0.2	-	-
Koitiata	9.2	0.6	0.8	1.2	0.5	0.1	-	-
Ōhau	223.5	23.9	3.7	2.2	0.7	0.4	0	-
Hokio Beach	64	6	4.3	2.4	0.8	0.3	-	-
Bunnythorpe	132.8	9.8	3.7	2.2	0.3	0.6	0.2	0
Eketāhuna	91.5	10	2	0.3	0	0.1	0	0
Mangaweka	21.7	3.5	0.7	0.1	-	0.2	-	-
Ōwhango	24.1	3	0.3	0.6	0.2	0.5	0.1	-
Ōhura	31.9	3.5	2.9	2.2	0.9	0.1	-	-
Pohangina	23.7	3.1	0.5	0.3	0	0	-	-
Pongaroa	16.6	1.7	1.1	0.8	0.4	0.2	0.1	0.3
Mangamutu	13.6	3.1	0.6	0	-	-	-	-
Pahiatua	213.1	39.6	17.4	4.3	1.4	0.7	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	34.8	7.6	1	0.3	0	-	-
Himatangi Beach	50.7	4.9	3.8	0.8	0	-	-	-
Taihape	297.3	10.7	3.8	1.6	0.7	0.5	0.3	0.7
Waitārere Beach	111.8	8.1	8	8.7	4.7	2.1	0	-
Raetihi	101.9	10.1	5.2	2.7	2.3	1.2	0.1	-
Manakau	115.9	18.8	7.5	2.4	0.8	0.2	0	-
Sanson	58.6	6.1	1.9	0.8	0.8	0.4	-	-
Linton	44.7	3.5	1	0.7	0.4	0.1	-	-
Ohakea	9.9	1.1	0.3	1.7	0.1	0	-	-
Norsewood	27.5	2.5	1.3	0.4	-	-	-	-
Tokomaru	58.1	4.4	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.8	0.1	0	-	-	-	-
National Park	139.3	3.4	2.3	0.8	0.5	0.9	1	0.1
Waikawa Beach	59.7	5.6	5	1.7	0.2	0	-	-
Mangatainoka	20.2	1.8	1.8	1	0.4	0.1	-	1.3
Ormondville	40.5	5.5	0.7	0.3	0.1	0	-	-
Rongotea	110	11.4	5.7	2.9	0.5	0.4	-	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.3	7.1	1.9	0.3	0.2	-	-
Kimbolton	52.5	2.6	2.4	0.3	-	0.7	-	-
Rangataua	28.5	3.1	0.7	0	-	-	-	-
Raurimu	16.9	1.4	0.2	0.1	0	0	0	-
Kai Iwi	38.6	2.6	1.1	0.6	0.6	0.2	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	45.8	26.1	32.7	17.3	10.6	7.5	5.4
Palmerston North	686.1	91.3	52.2	33.4	15.4	10.8	8.9	16.8
Feilding	170.9	42.1	19.1	10.8	2.7	0.4	0.2	0
Marton	213.9	19	9.9	14.3	33.4	36.2	3.7	3
Ohakune	22.4	2.8	1.5	0.9	0.3	0.2	0	-
Longburn	60.8	8.4	16.4	20.7	2.3	1	0.1	0
Kairanga	8	1.6	1.1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	108.7	10.8	0.9	0.7	0.6	-	-
Woodville	12.5	0.8	0.4	0.8	0.7	1.1	1.1	5.3
Foxton	41.4	8.9	5.6	0.9	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.9	2	0.9	0.6	0.5	0.1	0.1
Dannevirke	129.7	14.7	4.3	2.4	1.3	1.4	0.7	0.9
Bulls	53.9	7.1	5.7	2.4	2.6	3.6	0.9	0.7
Tangimoana	4.1	0.8	0.1	0	-	-	-	-
Hunterville	23.4	5.3	1.5	0.6	0.1	0.1	-	-
Shannon	24.9	2.7	2.2	0.6	0	-	-	0
Ōhau	7.2	1	0.2	0.1	0.1	0.2	0.4	0.6
Hokio Beach	50	8.8	4.4	1.8	-	-	-	-
Bunnythorpe	20.9	3	0.5	0.1	0	-	-	-
Eketāhuna	14	2.3	0.4	0	-	-	-	-
Mangaweka	10.3	2.7	1.1	0.2	0.1	0.2	0.1	0
Ōwhango	2.4	0.4	0.2	0	0	-	-	-
Ōhura	1.2	0.1	0	0.1	0	0	-	-
Pongaroa	2.5	0.2	0.6	0.1	0.1	-	-	-
Mangamutu	15.3	3.8	3.8	1.5	0	-	-	-
Pahiatua	17.7	3.8	1.5	0.1	0	-	-	-
Ashhurst	19.8	2.4	2.6	3.6	2.1	0.4	0.5	0
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.6	0.7	0.3	0.1	0.2	0.1	-
Waitārere Beach	0.4	0	0.2	0.1	-	-	-	-
Raetihi	13.2	1.5	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.2	0.2	0.1	0	0	-	-
Linton	5.2	0.5	0.1	0.1	0	0	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0	1.2	0.8	-	-	-
Mangatainoka	4.7	0.6	0.2	0.1	-	-	-	-
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.4	0.9	1.6	1.4	5	2.9	2.1
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	903.8	482.5	303	142.4	122.4	57	16.4
Palmerston North	14,029.6	869.8	634.3	548.6	343.9	372.5	198	233
Feilding	7,528	814.3	500.5	335.3	152.1	116.8	32.7	11.8
Marton	27,105.7	2,454.3	1,116.8	532.8	290.3	298.2	104.8	89.7
Ohakune	44,184.2	799.6	346.4	198.8	70.6	57.2	18.6	8.6
Longburn	1,302.6	191.2	291.1	222.6	38.1	53.2	55.6	46.3
Kairanga	6,733.2	947.6	1,002	721.6	297.6	476.8	359.1	494.7
Levin	7,837.6	1,149	235.7	147.2	91.7	74.1	14.8	4
Woodville	10,615.9	571.2	290.3	151.6	101.3	117.1	79.6	2,207.8
Foxton	11,957.6	2,225.4	1,038.3	625.1	237.3	261.6	265.5	243.5
Foxton Beach	861.7	99.8	98.6	62.3	182.6	40.7	2.8	4.9
Taumarunui	12,241.3	291.8	166.2	98.3	42.1	58.1	56.7	134.5
Dannevirke	34,395.2	2,910.6	920.5	538.8	275.3	299.1	135.9	173.2
Bulls	9,085.6	1,333.1	715.9	481.6	232.8	169.7	29.9	24.1
Tangimoana	9,602.2	1,281.9	536.7	323.1	129	140.6	53.9	29.6
Hunterville	55,534.7	1,809.8	918.3	490.8	230.3	209.2	102.7	210.1
Shannon	7,725	366.6	409.8	612.4	289.8	145.6	14.7	9.9
Koitiata	908.1	110.3	89.8	92.9	50.4	24.9	1.8	2.9
Ōhau	2,857.8	250.9	180	155.2	58.8	54.7	19.3	7.4
Hokio Beach	2,923.4	308.3	276.1	262.2	87	60.4	3.6	3.8
Bunnythorpe	8,837.9	832.1	387.1	255.7	131.1	108.1	34.9	6.7
Eketāhuna	37,977.3	2,255.6	1,179.7	536.4	188.6	159.3	63.5	34.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	768.8	303.8	120	44.6	38	22.3	86.7
Ōwhango	21,112.2	388	166.8	86.3	38.1	32	13.5	38.4
Ōhura	24,006.2	728.7	468.6	285.5	147.3	128	56.7	99
Pohangina	26,177.4	975.4	544.7	397.1	169.7	134.6	52.9	29.8
Pongaroa	57,773.7	1,418.7	609.3	269.3	129.4	149.1	90.2	161.9
Mangamutu	1,464.7	88.2	68.3	64.9	47.2	62.5	30.9	38.3
Pahiatua	56,300.9	2,121	1,381.9	731.9	320.6	314	122.8	117.3
Ashhurst	9,723	646.8	440.3	273.8	131.8	137.5	51.4	42.8
Himatangi Beach	1,181.1	159.7	171.8	93.7	27	40.4	0.3	-
Taihape	66,124.7	1,882.8	1,009.4	451.5	184.6	160.9	77	118.1
Waitārere Beach	13.3	0.6	1.4	1.2	0.5	0	-	-
Raetihi	153,110.1	880.6	414.8	189.3	76.9	60.9	24.7	39.3
Manakau	5,969.4	519.1	275.2	206.9	107.2	76.8	8.1	0.6
Sanson	3,977.1	273.8	175.7	110.2	45	31.5	7.6	2.1
Linton	9,076.6	529.1	331.2	186.4	60.9	59.7	66.2	22.3
Ohakea	1,988.8	342.3	143.5	119.9	83.9	73.4	5.7	1.4
Norsewood	5,388.4	512.1	162.7	61	25	23.5	10.9	10.9
Tokomaru	5,474	362.6	209.9	198.1	171.3	192.3	15.4	5.6
Waiouru	2,552.9	141.7	64.7	26.8	8.3	9.2	3.6	2.4
National Park	4,186.3	262.5	66	23.1	15.7	13.3	5.5	7.7
Waikawa Beach	270	31.4	28.6	20.2	6.1	4.7	1.1	0.5
Mangatainoka	2,846.3	133.4	82.5	65.5	42.8	63.7	35.6	689.1
Ormondville	15,472.3	612.3	214.3	105.1	50.9	65.1	45.9	85.4
Rongotea	9,950.9	1,276.5	652.4	428.1	218.4	258.1	137.3	9.3
Rātana	1,699.3	128.9	72.5	68.3	47.3	43.2	10.5	16.6
Halcombe	20,547.4	1,396	772	546.9	303.8	347.2	110.8	95
Kimbolton	9,408.6	431.9	223.8	130.9	55.9	48.2	18.7	20.9
Rangataua	6,946.1	199.6	46.1	29.2	11.2	7.9	0.9	0.2
Raurimu	2,159.8	117.3	46.3	22.6	11	11.9	6.1	12.3
Kai Iwi	9,060.1	366.7	209.1	141.7	66.5	58.8	30.2	52.8
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	100.4	52.4	38.2	22.1	28.5	16	34.1
Palmerston North	5,568.9	238.7	161.2	108.6	64.9	85	66.9	52.7
Feilding	476.3	60.8	27.3	29.8	13.3	4.3	0.6	0.5
Marton	1,724.2	61.9	34.1	18.2	4.4	3.5	1.5	3.9
Ohakune	2,300.5	28.3	10.8	9.1	5.4	6.5	1.9	0.4
Longburn	36.4	2.9	6	0.4	0.5	1.2	0	0
Kairanga	29.9	2.5	0	0.2	0.2	0.3	0	0
Levin	495.8	115.5	19.6	8.9	3.8	11.1	2.6	1
Woodville	73.1	14.1	0.4	0.1	0.6	1.9	0.7	17.6
Foxton	594.5	84.7	59.1	36.2	4.7	2	0.8	0.1
Foxton Beach	309.8	25.1	27.4	17.5	8.5	13.7	0	-
Taumarunui	503.9	8.9	4	3.3	4.8	9.7	9.3	13.1
Dannevirke	855.3	73	13.7	14.6	3.7	4.4	1.7	1.1
Bulls	223.2	28.9	9.9	5.5	3.3	5.1	5	1.2
Tangimoana	421.8	38.7	22	7.6	1.2	3.5	1.5	1.7
Hunterville	2,173.7	25.6	15.1	9.1	4.1	4.4	3.2	5.8
Shannon	2,594	28.5	16.6	6	2.5	2.5	1.2	0.6
Koitiata	64.1	12.9	13.8	3.3	1.1	0.1	-	-
Ōhau	35.6	3	1.4	1	0.4	0.1	-	-
Hokio Beach	857.5	62.5	154	138.5	16.6	55	18.3	0.2
Bunnythorpe	80.9	10.5	2.4	1	0.6	0.9	0.6	0.3
Eketāhuna	1,475.7	8.7	2.8	1.8	0.8	0.8	1.1	1.6
Mangaweka	252	11.2	2	0.7	0.6	0.4	0.3	3.2
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	11.5	6.4	2.6	0.5	0.9	0.7	1.1
Pohangina	882.3	31.7	17.8	8.5	4.7	5.3	0.7	0.1
Pongaroa	3,913	142.8	63.4	21.4	7.9	11.8	5.7	14.9
Mangamutu	26	0.6	1	0.7	0	-	-	-
Pahiatua	2,893.9	23.2	12.3	6	1.9	1.9	0.8	1.7
Ashhurst	115.4	8.8	3.3	3.5	2.6	2.5	0.8	-
Himatangi Beach	59.4	1.4	1.2	0.6	0.5	0.6	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	90.9	40.7	18.8	6.3	6.5	2.9	4.1
Waitārere Beach	24.3	1.2	0.9	0.4	0.4	0.1	-	-
Raetihi	8,257	12.6	10.1	6	2	2.6	0.5	0.5
Manakau	138	5.5	5.3	3.2	1.7	0.7	0.1	-
Sanson	55.8	3.3	1.3	0.3	0	-	0	-
Linton	426.8	62.5	12	10.1	5.7	9.3	8	19.2
Ohakea	56.4	5.2	1.9	1.2	0.3	0.1	-	-
Norsewood	148.5	3.1	1	1	0.4	0.4	0.4	0.5
Tokomaru	1,681.2	27.9	16.6	6.4	0.8	1.1	0.6	0.4
Waiouru	2.1	0.1	0.1	0.1	0.1	0	0	-
National Park	1,051.5	16.1	5	1.5	1	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.6	0.2	0.3	0.1	0.6	-
Mangatainoka	178	5.8	4.8	3	1.1	1.2	1.4	3.1
Ormondville	889.7	29.5	13.9	19.4	22.8	10	3.6	5.2
Rongotea	137.6	0.7	1.9	1.1	0.5	0	-	-
Rātana	25.6	1.9	0.4	0.5	0.3	0.3	0.2	0.3
Halcombe	913.2	55.9	26.7	22.1	11	9.1	2.3	9.5
Kimbolton	334.7	0.8	0.7	-	-	-	0.5	0.1
Rangataua	766.7	27.2	13.7	7.8	4.2	3.3	1.4	0.6
Raurimu	190.1	8	4.8	4.6	0.9	0.4	0.1	0.6
Kai Iwi	148.2	5.6	5.3	4.2	1.6	1.9	1	0.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.14: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +2°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	185.3	106.5	95.1	59.2	47.6	17	9.6
Palmerston North	3,060.7	350.7	267.4	156.2	58.6	60.2	25.3	8.6
Feilding	1,015.1	190.4	51.3	11.2	6.3	4.2	0.4	0.3
Marton	365.7	49.8	22.6	5.7	1.6	1.8	0.7	0.4
Ohakune	272.9	26.3	10.5	5.4	2	1.2	0.6	-
Longburn	46.1	2.6	6.7	5.6	1.2	1	0	-
Kairanga	45.4	7.7	10.4	3.9	2	1.2	0.5	0.1
Levin	1,280.1	331.1	57.5	8.2	1.7	1.6	0.2	-
Woodville	119.2	12.3	4.6	4.3	3.5	8	10.2	25.3
Foxton	227.8	39.5	30.2	15	1.6	0.4	0.1	-
Foxton Beach	182.5	30	21.6	5.3	1.2	0.4	-	-
Taumarunui	292.6	18.8	19.5	25.8	11.6	7.2	2.6	3.5
Dannevirke	346.6	36.4	5.9	1.7	0.7	0.5	0.1	0
Bulls	172.2	29.5	14.6	7.4	1.9	0.5	0.1	0
Tangimoana	38.6	2.5	2.2	11.6	10.2	1.5	-	-
Hunterville	163.2	10.4	12.1	7.9	3.1	1.7	0.4	0
Shannon	118.1	7.5	1.8	1.1	0.4	0.6	0.3	0
Koitiata	9.2	0.6	0.8	1.2	0.5	0.1	-	-
Ōhau	223.5	23.9	3.6	1.8	0.5	0.4	0	-
Hokio Beach	64	6	4.3	2.4	0.8	0.3	-	-
Bunnythorpe	132.8	9.8	3.7	2.2	0.3	0.6	0.2	0
Eketāhuna	91.5	10	2	0.3	0	0.1	0	0
Mangaweka	21.7	3.5	0.7	0.1	-	0.2	-	-
Ōwhango	24.1	3	0.3	0.6	0.2	0.5	0.1	-
Ōhura	31.9	3.5	2.9	2.2	0.9	0.1	-	-
Pohangina	23.7	3.1	0.5	0.3	0	0	-	-
Mangamutu	13.6	3.6	0.7	0	-	-	-	-
Pahiatua	213.1	39.9	17.3	4.3	1.4	0.5	0.1	0.3
Ashhurst	179.3	31.4	6.6	1	0.3	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	4.9	3.8	0.8	0	-	-	-
Taihape	297.3	10.7	3.8	1.6	0.7	0.5	0.3	0.7
Waitārere Beach	111.8	8.1	8	8.7	4.7	2.1	0	-
Raetihi	101.9	10.1	5.2	2.7	2.3	1.2	0.1	-
Manakau	115.9	18.8	7.5	2.4	0.8	0.2	0	-
Sanson	58.6	6.1	1.9	0.8	0.8	0.4	-	-
Linton	44.7	3.6	1.3	0.8	0.4	0.1	0.1	-
Ohakea	9.9	1.1	0.6	1.5	0.1	0	-	-
Norsewood	27.5	2.5	1.3	0.4	-	-	-	-
Tokomaru	58.1	4.4	0.5	0.9	0.3	0	0.1	-
Waiouru	8.4	0.8	0.1	0	-	-	-	-
National Park	139.3	3.4	2.3	0.8	0.5	0.9	1	0.1
Waikawa Beach	59.7	5.6	5	1.7	0.2	0	-	-
Mangatainoka	20.2	1.8	1.8	1	0.3	0.2	-	1.3
Ormondville	40.5	5.5	0.7	0.3	0.1	0	-	-
Rongotea	110	11.6	6.2	3.6	0.2	0.9	0	-
Rātana	17.4	1.7	0.6	1.1	-	-	-	-
Halcombe	132.9	11.3	7.1	1.9	0.3	0.2	-	-
Kimbolton	52.5	2.6	2.4	0.3	-	0.7	-	-
Rangataua	28.5	3.1	0.7	0	-	-	-	-
Raurimu	16.9	1.4	0.2	0.1	0	0	0	-
Kai Iwi	38.6	2.6	1.1	0.6	0.6	0.2	0.1	0
Commerical/Industrial property use type								
Whanganui	401.8	45.3	23.1	30.4	22.8	13	7.3	5.5
Palmerston North	686.1	94.8	52.4	42	9.2	8.4	10.5	13.7
Feilding	170.9	46.3	28.2	12.7	3	2.3	0.1	-
Marton	213.9	18.4	8.7	5.8	28.2	48.9	6.2	3
Ohakune	22.4	2.8	1.5	0.9	0.3	0.2	0	-
Longburn	60.8	5.2	15.3	26.3	4	1.1	0.1	0
Kairanga	8	1.8	1.5	0.3	0.1	-	-	-
Levin	180.9	108.7	10.8	0.9	0.7	0.6	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	0.8	0.4	0.8	0.7	1.1	1.1	5.3
Foxton	41.4	8.1	5.8	1.9	0.7	0.4	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.6	1.9	1	0.6	0.5	0.1	0.1
Dannevirke	129.7	14.7	4.3	2.4	1.3	1.4	0.7	0.9
Bulls	53.9	7.1	5.7	2.4	2.7	3.5	0.8	0.7
Tangimoana	4.1	0.8	0.2	0	-	-	-	-
Hunterville	23.4	5.5	2.4	0.9	0.1	0.1	-	-
Shannon	24.9	1.3	0.5	0.8	1	3.9	2.3	0
Ōhau	7.2	1	0.2	0.1	0.1	0.2	0.4	0.6
Hokio Beach	50	8.8	4.4	1.8	-	-	-	-
Bunnythorpe	20.9	3	0.5	0.1	0	-	-	-
Eketāhuna	14	2.3	0.4	0	-	-	-	-
Mangaweka	10.3	2.7	1.1	0.2	0.1	0.2	0.1	0
Ōwhango	2.4	0.4	0.2	0	0	-	-	-
Ōhura	1.2	0.1	0	0.1	0	0	-	-
Mangamutu	15.3	3.7	3.6	1.5	0.1	-	-	-
Pahiatua	17.7	3.8	1.4	0.1	0	-	-	-
Ashhurst	19.8	3.5	2.9	2.6	0.2	0.4	0.4	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.6	0.7	0.3	0.1	0.2	0.1	-
Waitārere Beach	0.4	0	0.2	0.1	-	-	-	-
Raetihi	13.2	1.5	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.2	0.2	0.1	0	0	-	-
Linton	5.2	0.4	0.2	0.1	0	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.2	0.1	-	-	-	-
National Park	18.3	0.7	0	1.2	0.8	-	-	-
Mangatainoka	4.7	0.6	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.7	1.4	1.5	2.8	4.2	0.6	1.9
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	903.6	483.1	303	142.5	122.7	56.8	16.4
Palmerston North	14,029.6	850.5	668.9	632.3	378.2	414.1	193.7	189.7
Feilding	7,528	836.8	532.6	337.3	146.4	116.8	32.7	11.8
Marton	27,105.7	2,444.2	1,107.8	516	302.2	318.9	107.3	96.2
Ohakune	44,184.2	799.6	346.4	198.8	70.6	57.2	18.6	8.6
Longburn	1,302.6	150.4	293.5	340.4	102.9	74	48.3	35.2
Kairanga	6,733.2	870	1,004.8	879	314.2	463.8	387.5	557.8
Levin	7,837.6	1,149.7	236	144.3	90.5	73.9	14.8	4
Woodville	10,615.9	578.5	291.1	153.8	102.1	115.4	79.2	2,208.7
Foxton	11,957.6	2,241.2	1,025.2	620.9	354	408.1	154	24.6
Foxton Beach	861.7	110.4	120.9	193.3	36.4	15.5	0.1	4.6
Taumarunui	12,241.3	292	165.9	98.3	42	58.1	56.7	134.6
Dannevirke	34,395.2	2,913.1	925.9	543.6	275.9	299.5	136	173.4
Bulls	9,085.6	1,324.3	714.9	497.1	260	193.6	29.3	23.2
Tangimoana	9,602.2	1,290.4	551	335.4	143.3	126.6	22.7	9.1
Hunterville	55,534.7	1,808.4	940.5	513.1	236.8	204.7	96	195
Shannon	7,725	271.4	173.2	247.3	361.6	434	512	29.9
Koitiata	908.1	109.5	90.1	92.7	51	26.5	1.8	2.9
Ōhau	2,857.8	257.9	189.4	159.4	55.1	40	12.8	5.4
Hokio Beach	2,923.4	308.3	276.1	262.2	87	60.4	3.6	3.8
Bunnythorpe	8,837.9	831	404.9	266.3	125.8	101.1	34.9	5.8
Eketāhuna	37,977.3	2,254.5	1,179.8	534.4	188.4	159.3	63.6	34.9
Mangaweka	25,542.3	768.5	304.1	119.9	44.5	38	22.3	86.7
Ōwhango	21,112.2	387.9	166.9	86.3	38.1	32	13.5	38.4
Ōhura	24,006.2	728.8	468.6	285.6	147.3	128	56.7	99

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	974.9	545.2	396.9	169.6	134.4	52.9	29.8
Pongaroa	57,773.7	1	0.3	-	-	-	-	-
Mangamutu	1,464.7	86.5	67.2	67.3	48.6	65	31.9	37.8
Pahiatua	56,300.9	2,128.8	1,370.4	703.5	313.7	308.9	124	117.7
Ashhurst	9,723	639	421.2	301.4	190.7	198.6	51.7	45.6
Himatangi Beach	1,181.1	159.7	171.8	93.7	27	40.4	0.3	-
Taihape	66,124.7	1,882.7	1,009.2	451.1	185.1	160.8	77.2	118.1
Waitārere Beach	13.3	0.6	1.4	1.2	0.5	0	-	-
Raetihi	153,110.1	880.6	414.8	189.3	76.9	60.9	24.7	39.3
Manakau	5,969.4	519.2	275.4	206.2	107.1	76.5	8.1	0.6
Sanson	3,977.1	274	175.4	110.2	44.9	31.5	7.6	2.1
Linton	9,076.6	528	339.6	191.5	90.9	130	33	12
Ohakea	1,988.8	344.8	148.2	119.7	86.2	61.9	4.7	0.9
Norsewood	5,388.4	512	162.7	61	25	23.5	10.9	10.9
Tokomaru	5,474	291	163.7	180.3	201.4	289.7	194.1	16.6
Waiouru	2,552.9	141.6	64.6	26.8	8.3	9.2	3.6	2.4
National Park	4,186.3	262.5	66	23.1	15.7	13.3	5.5	7.7
Waikawa Beach	270	31.5	28.5	20.1	6	4.7	1.1	0.5
Mangatainoka	2,846.3	133.2	82	65.6	42.9	63.9	35.6	689.1
Ormondville	15,472.3	612.1	213.8	105.1	50.9	65	46	85.4
Rongotea	9,950.9	1,224.4	709.6	537	276.5	271.8	172.8	57.1
Rātana	1,699.3	128.7	72.5	68.4	47.4	43.3	10.5	16.6
Halcombe	20,547.4	1,399.7	773.3	547.4	307.6	345.9	104.4	93.6
Kimbolton	9,408.6	431.7	224.2	130.5	55.9	48.2	18.7	20.9
Rangataua	6,946.1	199.6	46.1	29.2	11.2	7.9	0.9	0.2
Raurimu	2,159.8	117.3	46.3	22.6	11	11.9	6.1	12.3
Kai Iwi	9,060.1	366.7	209.2	141.7	66.5	58.8	30.2	52.8
Other property use type								
Whanganui	1,392.5	100.3	52.6	38	22.4	28.3	15.1	35.2
Palmerston North	5,568.9	237.4	173.8	127.6	76.7	109.7	94.7	82.3
Feilding	476.3	66.2	41.1	25.8	9.7	3.2	0.6	0.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	61.4	35	19.2	4.8	3.5	1.5	3.9
Ohakune	2,300.5	28.3	10.8	9.1	5.4	6.5	1.9	0.4
Longburn	36.4	1.8	7.2	1	0.2	0.2	-	0
Kairanga	29.9	2.5	0.2	0.2	0.2	0.3	0	0
Levin	495.8	115.5	19.6	8.9	3.8	11.1	2.6	1
Woodville	73.1	14	0.4	0.2	0.5	1.9	0.8	17.6
Foxton	594.5	85.2	59.4	36.1	4.2	0.6	0	0
Foxton Beach	309.8	26.3	22.3	14.7	8.2	13.4	-	-
Taumarunui	503.9	8.8	4.1	3.2	4.5	9.5	9.8	13.1
Dannevirke	855.3	73	13.7	14.8	3.7	4.3	1.7	1.1
Bulls	223.2	28.9	9.9	5.5	3.4	5	5	1.2
Tangimoana	421.8	38.1	22.2	8.2	3.3	2.5	2.6	0.3
Hunterville	2,173.7	25.3	14.9	9.5	4.3	4.5	3.2	5.9
Shannon	2,594	27.9	15.7	10.4	3.3	2.9	1.2	0.6
Koitiata	64.1	12.8	13.8	3.3	1.1	0.1	-	-
Ōhau	35.6	3	1.4	1	0.4	0.1	-	-
Hokio Beach	857.5	62.6	154	138.4	16.6	55	18.3	0.2
Bunnythorpe	80.9	10.5	2.4	1.5	0.7	1	0.6	0.2
Eketāhuna	1,475.7	8.7	2.8	1.8	0.8	0.8	1.1	1.6
Mangaweka	252	11.2	2	0.7	0.6	0.4	0.3	3.2
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	-	0
Ōhura	891.6	11.4	6.4	2.6	0.5	0.9	0.7	1.1
Pohangina	882.3	31.7	17.8	8.5	4.7	5.3	0.7	0.1
Mangamutu	26	0.6	1	0.7	0	-	-	-
Pahiatua	2,893.9	24.3	12.4	5.8	2	1.9	0.8	1.7
Ashhurst	115.4	8.8	3.2	3.6	2.6	2.5	0.8	-
Himatangi Beach	59.4	1.4	1.2	0.6	0.5	0.6	0.1	-
Taihape	2,174.7	90.9	40.7	18.8	6.3	6.5	2.9	4.1
Waitārere Beach	24.3	1.2	0.9	0.4	0.4	0.1	-	-
Raetihi	8,257	12.6	10.1	6	2	2.6	0.5	0.5
Manakau	138	5.5	5.2	3.2	1.7	0.7	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	3.3	1.3	0.3	0	-	0	-
Linton	426.8	65	12.1	7.8	6.1	10.5	8.7	15.8
Ohakea	56.4	5.2	1.9	1.2	0.3	0.1	-	-
Norsewood	148.5	3.1	1	1	0.4	0.4	0.4	0.5
Tokomaru	1,681.2	27.9	16.6	6.4	0.8	1.1	0.6	0.4
Waiouru	2.1	0.1	0.1	0.1	0.1	0	0	-
National Park	1,051.5	16.1	5	1.5	1	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.6	0.2	0.3	0.1	0.6	-
Mangatainoka	178	5.8	4.8	3	1.1	1.2	1.4	3.1
Ormondville	889.7	29.4	14	19.3	22.7	10.1	3.6	5.2
Rongotea	137.6	0.4	2.3	1	0.4	-	-	-
Rātana	25.6	1.9	0.4	0.5	0.3	0.3	0.2	0.3
Halcombe	913.2	56.1	26.3	21.3	10.9	9.1	2.3	9.5
Kimbolton	334.7	0.8	0.7	-	-	-	0.5	0.1
Rangataua	766.7	27.2	13.7	7.8	4.2	3.3	1.4	0.6
Raurimu	190.1	8	4.8	4.6	0.9	0.4	0.1	0.6
Kai Iwi	148.2	5.6	5.3	4.2	1.6	1.9	1	0.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.15: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +3°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	179.1	104.9	89	73.1	95.7	22	18.6
Palmerston North	3,060.7	310.9	209.3	121.3	42.5	39.1	7.6	1.7
Feilding	1,015.1	164.3	23.7	9.3	8.1	4.5	0.7	0.4
Marton	365.7	51.7	23.4	5.8	1.6	1.9	0.8	0.5
Ohakune	272.9	27.4	11.4	5.7	2.1	1.4	0.7	0
Longburn	46.1	2.6	7.7	4.8	1.2	1.1	0	-
Kairanga	45.4	7.2	8.6	3	1.8	2.4	0.3	0.3
Levin	1,280.1	340.7	62.5	8.7	1.8	1.7	0.2	-
Woodville	119.2	13.4	4.9	3.6	4.2	9.4	9	19.6
Foxton	227.8	39.9	30.9	15.7	1.6	0.5	0	0
Foxton Beach	182.5	28.7	27.4	7.2	1.2	0.7	0	-
Taumarunui	292.6	17.1	16.4	24.2	17.4	13.9	3.6	4.7
Dannevirke	346.6	37.5	6.5	1.7	0.7	0.5	0.1	0
Bulls	172.2	29.9	14.8	8.3	2.9	0.8	0	-
Tangimoana	38.6	2.9	6.1	14.1	3.9	0.5	-	-
Hunterville	163.2	11.2	11	6.6	3.8	2.1	0.5	0
Shannon	118.1	8.3	2	1	0.3	0.2	-	-
Koitiata	9.2	0.6	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	25.9	4.2	2.1	0.9	0.4	0	-
Hokio Beach	64	6.2	4.5	2.5	0.8	0.4	-	-
Bunnythorpe	132.8	10	3.7	2.4	0.3	0.6	0.1	0
Eketāhuna	91.5	10.4	2	0.4	0	0.1	0.1	0
Mangaweka	21.7	3.8	0.7	0.1	0	0.2	-	-
Ōwhango	24.1	3.1	0.3	0.6	0.2	0.5	0.1	-
Ōhura	31.9	3.6	2.9	2.1	1.2	0.1	-	-
Pohangina	23.7	3	0.6	0.3	0	0	-	-
Pongaroa	16.6	1.9	0.9	0.9	0.4	0.2	0.1	0.3
Mangamutu	13.6	4	1.8	0	0	-	-	-
Pahiatua	213.1	41	18.2	4.4	1.6	0.8	0.4	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	35.5	8.7	1	0.4	0.1	-	-
Himatangi Beach	50.7	4.9	4.1	1	0	-	-	-
Taihape	297.3	10.8	3.8	1.7	0.8	0.5	0.4	0.7
Waitārere Beach	111.8	8.4	8.3	9.1	4.8	2.4	0	-
Raetihi	101.9	10.8	5.1	3	2.5	1.3	0.1	0
Manakau	115.9	19.6	8.1	2.6	1	0.2	0	-
Sanson	58.6	6.5	1.9	0.8	0.8	0.5	-	-
Linton	44.7	3.6	1.1	0.8	0.4	0.2	0	-
Ohakea	9.9	1	0.1	1.4	0.7	0	-	-
Norsewood	27.5	2.6	1.3	0.4	-	-	-	-
Tokomaru	58.1	4.6	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.8	0.1	0	-	-	-	-
National Park	139.3	3.5	2.3	0.8	0.6	0.9	1	0.3
Waikawa Beach	59.7	5.6	5.4	2	0.2	0	-	-
Mangatainoka	20.2	2	2.5	1.4	0.7	0.3	-	1.3
Ormondville	40.5	5.6	0.8	0.3	0.1	0	-	-
Rongotea	110	11.3	6.4	3.1	0.5	0.4	-	-
Rātana	17.4	1.9	0.6	1.1	-	-	-	-
Halcombe	132.9	11.9	6.7	2.6	0.3	0.2	-	-
Kimbolton	52.5	2.6	2.4	0.3	-	0.7	-	-
Rangataua	28.5	3.2	0.7	0	-	-	-	-
Raurimu	16.9	1.4	0.2	0.1	0	0	0	-
Kai Iwi	38.6	2.6	1.1	0.6	0.6	0.2	0.2	0
Commerical/Industrial property use type								
Whanganui	401.8	44	23.5	20.5	27.5	28.4	6.4	10.7
Palmerston North	686.1	93.1	53.8	37.2	17.2	14.3	7.3	19.4
Feilding	170.9	43.8	19.7	13.7	2.4	1.5	0.2	0
Marton	213.9	19.9	9.7	7.2	27.4	48.9	5.1	4
Ohakune	22.4	3.2	1.5	0.9	0.3	0.3	0.1	-
Longburn	60.8	6.7	16	25.9	4.6	1.1	0.1	0
Kairanga	8	1.7	1.1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	109.9	13.7	0.9	0.7	0.6	-	-
Woodville	12.5	1.1	0.4	0.8	0.4	1.3	0.7	4.8
Foxton	41.4	9.1	5.9	1.1	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.6	2.4	1.5	0.5	1	0.2	0.2
Dannevirke	129.7	14.9	4.8	3	1.5	1.6	0.8	1.1
Bulls	53.9	6.6	4.3	3.8	1.7	4.7	1.6	0.7
Tangimoana	4.1	0.8	0.6	0	-	-	-	-
Hunterville	23.4	5.5	1.9	0.8	0.1	0.1	-	-
Shannon	24.9	2.9	1.9	1.2	0	-	-	0
Ōhau	7.2	1.1	0.2	0.1	0.1	0.2	0.3	0.8
Hokio Beach	50	9.1	4.4	1.9	-	-	-	-
Bunnythorpe	20.9	3	0.5	0.1	0	-	-	-
Eketāhuna	14	2.4	0.4	0	-	-	-	-
Mangaweka	10.3	2.9	1.2	0.3	0.1	0.2	0.1	0.1
Ōwhango	2.4	0.4	0.2	0	0	-	-	-
Ōhura	1.2	0.1	0	0.1	0	0	-	-
Pongaroa	2.5	0.2	0.6	0.2	0.1	0	-	-
Mangamutu	15.3	2.8	4.8	2.5	0.3	-	-	-
Pahiatua	17.7	3.9	1.6	0.2	0	-	-	-
Ashhurst	19.8	2.4	2.3	3.7	2.5	0.5	0.5	0
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.6	0.8	0.3	0.1	0.2	0.1	-
Waitārere Beach	0.4	0	0.2	0.1	-	-	-	-
Raetihi	13.2	1.6	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.2	0.2	0.1	0.1	0	-	-
Linton	5.2	0.5	0.2	0.1	0	0	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0	1.2	0.8	-	-	-
Mangatainoka	4.7	0.7	0.2	0.1	0.1	-	-	-
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.3	0.9	1.2	1.7	4.4	3.7	2.3
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	913.1	487.9	311.4	147.3	123.4	61.6	38.6
Palmerston North	14,029.6	851	621.2	566.8	391.9	441	225.8	266.4
Feilding	7,528	817.2	516.3	360.4	160.7	119.2	37.2	13.1
Marton	27,105.7	2,499.8	1,143.6	523.2	304.5	329	127.5	104.3
Ohakune	44,184.2	817	350.4	215	76.6	64.7	20.7	10.6
Longburn	1,302.6	155.3	290.5	292.3	85.6	52.9	60.8	52
Kairanga	6,733.2	875.1	956	797.1	296.1	457.1	449.2	693.3
Levin	7,837.6	1,188.9	247.2	149.4	95.8	79.5	17.6	5.3
Woodville	10,615.9	588.2	302.7	162.4	99.1	111.7	103.7	2,148.3
Foxton	11,957.6	2,260.5	1,053.1	642.7	286.9	230.4	304	262.4
Foxton Beach	861.7	97.2	108.2	64.6	181.9	45.1	3	4.9
Taumarunui	12,241.3	292.9	165.4	101.8	54.8	52.1	52.5	164.6
Dannevirke	34,395.2	2,999.4	938.6	549.7	291.7	319.6	152.7	199.3
Bulls	9,085.6	1,338.6	716.5	497.3	239.8	209.2	36.1	27.8
Tangimoana	9,602.2	1,304.4	556.5	340.9	150.1	148.3	66.1	35.4
Hunterville	55,534.7	1,834.9	934.4	505.2	244.2	221.4	113.8	229.9
Shannon	7,725	357.2	355.6	642.3	331.5	175.9	15.9	10.6
Koitiata	908.1	105.1	89.9	94.6	53.5	35.7	2.3	3
Ōhau	2,857.8	251.1	184	169.5	62	63.1	21.4	9.1
Hokio Beach	2,923.4	309.6	276	269.8	94	67	4.2	3.9
Bunnythorpe	8,837.9	851.3	403.9	249.5	138.6	119.7	38.1	8.1
Eketāhuna	37,977.3	2,280.2	1,237.3	589	210	179.3	76	47.7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	789.1	310.8	126.5	46.6	44.3	22.5	94.5
Ōwhango	21,112.2	395.3	170.8	89.1	39.4	34.6	13.8	41.6
Ōhura	24,006.2	723.2	479.9	311.5	164.3	163	65.9	114.5
Pohangina	26,177.4	972.2	537.7	412.7	190.2	143.9	58.2	33.7
Pongaroa	57,773.7	1,454.4	621.1	281.1	141.1	164.7	97.3	182.8
Mangamutu	1,464.7	87.8	73.7	75.5	49.9	65.6	14.8	35
Pahiatua	56,300.9	2,138.7	1,458.2	810	349.4	335.7	123.8	137.7
Ashhurst	9,723	645.8	441.3	296.1	142	153.3	60.4	48.6
Himatangi Beach	1,181.1	160.2	175.8	99.9	29.1	43	0.5	-
Taihape	66,124.7	1,907.2	1,015.3	462.7	187.4	170	84	131.9
Waitārere Beach	13.3	0.5	1.5	1.2	0.6	0	-	-
Raetihi	153,110.1	896.6	426.8	194.2	82.3	64.9	26.4	44.1
Manakau	5,969.4	529.5	279.9	218	114.5	91.5	9.5	1.3
Sanson	3,977.1	280.2	181.5	110.9	47.3	33.2	8	3
Linton	9,076.6	541.6	340.2	194.6	64.5	56.6	68.6	28.6
Ohakea	1,988.8	353.9	133	119.5	92.2	96.7	8.9	1.9
Norsewood	5,388.4	529.1	170.3	61.4	26	23.9	11.3	11.3
Tokomaru	5,474	369.1	216.6	200.8	170.2	207.6	19	6.5
Waiouru	2,552.9	144.2	64.4	29.3	8.8	9.6	3.8	2.7
National Park	4,186.3	268	69	23.5	16	14.2	5.4	8.1
Waikawa Beach	270	31	27.4	24.7	6.6	5.4	1.4	0.5
Mangatainoka	2,846.3	140.6	90.2	77.1	46.7	58.4	36.2	673.7
Ormondville	15,472.3	624	217.8	106.2	52.1	64.7	49	91.2
Rongotea	9,950.9	1,303.8	664.5	466.9	232.5	276.9	151.5	15.5
Rātana	1,699.3	128	68.2	60.6	47.4	55	12.1	17.9
Halcombe	20,547.4	1,408.1	793.2	542.2	300.1	372.8	135	111.2
Kimbolton	9,408.6	439.9	225.8	134.8	58.2	50	19.8	23.1
Rangataua	6,946.1	209.2	47.1	28.9	12.4	8.6	1.2	0.2
Raurimu	2,159.8	118.2	45.7	24	11.8	12.8	6.7	14.1
Kai Iwi	9,060.1	373.3	212.8	140.8	67.7	62.2	31.7	55.3
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	103	54.2	37.5	22.8	29.3	23.9	37.8
Palmerston North	5,568.9	240.5	165.8	114.8	69.8	93.6	67.6	65
Feilding	476.3	62.7	28.3	30.1	14.5	5.1	0.7	0.6
Marton	1,724.2	63.4	33.3	20.5	4.6	3.7	1.7	4.1
Ohakune	2,300.5	29.8	11.2	9.4	5.7	6.8	2.3	0.6
Longburn	36.4	1.5	7.4	0.7	0.4	1.2	0.1	0
Kairanga	29.9	2.6	0.1	0.2	0.2	0.2	0.1	0
Levin	495.8	118.2	20.5	8.6	4.3	11.2	2.8	1.4
Woodville	73.1	14.6	0.6	0.8	0.7	1.1	0.5	17.5
Foxton	594.5	86	59.9	37.2	5.6	2	0.8	0.1
Foxton Beach	309.8	24.9	27.3	18.7	8.7	14.5	0	-
Taumarunui	503.9	9.1	3.7	2.4	2.7	6.5	9.4	20.4
Dannevirke	855.3	74.3	13.9	15.8	3.9	4.5	2	1.4
Bulls	223.2	29.6	9.9	5	3.2	5	5.9	1.7
Tangimoana	421.8	38.5	22.8	9.5	2.2	2.6	2.5	1.9
Hunterville	2,173.7	26.4	15.1	9.3	4.2	4.5	3.2	6.5
Shannon	2,594	28.3	17.4	6.6	2.6	2.6	1.3	0.7
Koitiata	64.1	12.6	14.3	3.7	1.1	0.1	-	-
Ōhau	35.6	3	1.6	1.2	0.5	0.2	-	-
Hokio Beach	857.5	59.7	127.8	180.7	17.2	53.6	21.5	0.2
Bunnythorpe	80.9	11.3	2.7	1.1	0.6	1	0.6	0.4
Eketāhuna	1,475.7	9	2.9	1.7	0.9	0.7	0.9	2.1
Mangaweka	252	11.4	2.1	0.7	0.6	0.5	0.3	3.3
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	0	0
Ōhura	891.6	11.4	6.4	3.2	0.6	0.9	0.7	1.3
Pohangina	882.3	31.7	18.9	8	4.5	6.1	0.8	0.2
Pongaroa	3,913	145.8	64.3	24.3	9.4	12.3	7	17.5
Mangamutu	26	0.9	0.7	0.7	0.1	0	-	-
Pahiatua	2,893.9	22.3	13.8	6.1	2.2	2	0.8	1.8
Ashhurst	115.4	9.3	3.1	3.9	2.9	3	1.2	0
Himatangi Beach	59.4	1.4	1.5	0.7	0.5	0.6	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	93.5	40.5	20.2	6.7	6.2	3.3	4.9
Waitārere Beach	24.3	1.4	0.8	0.4	0.4	0.2	-	-
Raetihi	8,257	12.4	9.9	6.2	2.2	2.9	0.6	0.5
Manakau	138	5	6.2	3.4	1.9	0.8	0.1	-
Sanson	55.8	3.3	1.3	0.3	0	-	0	-
Linton	426.8	65.5	12	7.9	8.3	8.3	8.4	20.7
Ohakea	56.4	5.6	1.9	1.3	0.3	0.1	-	-
Norsewood	148.5	3.2	1	1	0.4	0.4	0.4	0.5
Tokomaru	1,681.2	27.6	17	6.6	1	1.1	0.5	0.5
Waiouru	2.1	0.1	0.1	0.1	0	0	0	-
National Park	1,051.5	17.2	5.1	1.5	1	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.7	0.3	0.3	0.1	0.7	0
Mangatainoka	178	6.4	4.8	4.2	1.4	1.4	0.7	4.3
Ormondville	889.7	30.3	14.1	18.5	24	10.5	4	5.5
Rongotea	137.6	0.8	1.9	1.2	0.1	0.4	-	-
Rātana	25.6	2.3	0.4	0.5	0.3	0.3	0.2	0.3
Halcombe	913.2	54.1	27.8	26.2	11.1	9.8	2.3	9.6
Kimbolton	334.7	0.9	0.7	-	-	-	0.5	0.1
Rangataua	766.7	27.8	14.1	8	4.4	3.6	1.5	0.7
Raurimu	190.1	8.6	4.7	4.5	0.7	0.8	0.1	0.8
Kai Iwi	148.2	5.2	5.5	4.2	1.7	2	0.9	0.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.16: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +3°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	179.2	104.3	89.1	73.4	95.8	21.8	18.6
Palmerston North	3,060.7	321.4	313.7	217.8	82.2	72.1	31.9	11.5
Feilding	1,015.1	195.1	56.9	12.2	6.2	4.7	0.7	0.3
Marton	365.7	52	24.4	6.1	1.7	1.9	0.8	0.5
Ohakune	272.9	27.4	11.4	5.7	2.1	1.4	0.7	0
Longburn	46.1	2.1	6.5	6.6	1.4	1.1	0	-
Kairanga	45.4	7.3	10.3	4	2.2	1.9	0.4	0.2
Levin	1,280.1	340.7	62.5	8.7	1.8	1.7	0.2	-
Woodville	119.2	11.7	3.5	4.3	3.9	7.1	9	33
Foxton	227.8	40	30.6	15.7	1.6	0.4	0.1	-
Foxton Beach	182.5	29.6	22.3	6.1	1.2	0.5	-	-
Taumarunui	292.6	17.1	17.1	25.7	17.2	13.2	3.8	4.7
Dannevirke	346.6	37.5	6.5	1.7	0.7	0.5	0.1	0
Bulls	172.2	30	14.9	8.3	2.8	0.8	0.1	0
Tangimoana	38.6	2.4	1.5	7.3	13.5	3.7	-	-
Hunterville	163.2	10.1	11.7	7.8	4.2	2.3	0.6	0
Shannon	118.1	8	1.9	1	0.5	0.5	0.4	0
Koitiata	9.2	0.6	0.8	1.1	0.6	0.1	-	-
Ōhau	223.5	26	4.2	1.9	0.5	0.4	0	-
Hokio Beach	64	6.2	4.5	2.5	0.8	0.4	-	-
Bunnythorpe	132.8	10.1	3.7	2.4	0.3	0.6	0.1	0
Eketāhuna	91.5	10.4	2	0.4	0.1	0.1	0	0
Mangaweka	21.7	3.8	0.7	0.1	0	0.2	-	-
Ōwhango	24.1	3.1	0.3	0.6	0.2	0.5	0.1	-
Ōhura	31.9	3.6	2.9	2.1	1.2	0.1	-	-
Pohangina	23.7	3	0.6	0.3	0	0	-	-
Mangamutu	13.6	3.8	2.5	0.1	0	-	-	-
Pahiatua	213.1	41	18	4.2	1.7	0.8	0.1	0.3
Ashhurst	179.3	32.2	7.7	1.1	0.3	0.1	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	4.9	4.1	1	0	-	-	-
Taihape	297.3	10.8	3.8	1.6	0.8	0.5	0.4	0.7
Waitārere Beach	111.8	8.4	8.3	9.1	4.8	2.4	0	-
Raetihi	101.9	10.8	5.1	3	2.5	1.3	0.1	0
Manakau	115.9	19.6	8.1	2.6	1	0.2	0	-
Sanson	58.6	6.5	1.9	0.8	0.8	0.5	-	-
Linton	44.7	3.7	1.4	0.9	0.5	0.1	0.1	-
Ohakea	9.9	1.1	0.1	1.5	0.5	0	-	-
Norsewood	27.5	2.6	1.3	0.4	-	-	-	-
Tokomaru	58.1	4.6	0.5	0.9	0.3	0.1	0.1	-
Waiouru	8.4	0.8	0.1	0	-	-	-	-
National Park	139.3	3.5	2.3	0.8	0.6	0.9	1	0.3
Waikawa Beach	59.7	5.6	5.4	2	0.2	0	-	-
Mangatainoka	20.2	2	2.5	1.5	0.6	0.3	-	1.3
Ormondville	40.5	5.6	0.8	0.3	0.1	0	-	-
Rongotea	110	11.6	6.9	3.6	0.2	0.9	0	-
Rātana	17.4	1.9	0.6	1.1	-	-	-	-
Halcombe	132.9	11.8	6.7	2.6	0.3	0.2	-	-
Kimbolton	52.5	2.6	2.4	0.3	-	0.7	-	-
Rangataua	28.5	3.2	0.7	0	-	-	-	-
Raurimu	16.9	1.4	0.2	0.1	0	0	0	-
Kai Iwi	38.6	2.6	1.1	0.6	0.6	0.2	0.2	0
Commerical/Industrial property use type								
Whanganui	401.8	43.4	23.4	19.2	26.3	32.1	6.5	10.7
Palmerston North	686.1	95.9	51.8	49.1	13.7	8.2	10.6	14.9
Feilding	170.9	45.6	29.1	13.6	4.2	2.5	0.1	-
Marton	213.9	19.5	9.4	3.9	17.3	58.8	9	4
Ohakune	22.4	3.2	1.5	0.9	0.3	0.3	0.1	-
Longburn	60.8	5.2	12.5	29.6	6.2	1.2	0.1	0
Kairanga	8	1.9	1.5	0.3	0.1	-	-	-
Levin	180.9	109.9	13.7	0.9	0.7	0.6	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	0.7	0.4	0.7	0.5	1.6	1	6.1
Foxton	41.4	8.4	5.9	1.9	0.6	0.5	-	-
Foxton Beach	0.8	0.1	0.1	0	-	-	-	-
Taumarunui	37.9	4.6	2.4	1.5	0.7	1	0.2	0.2
Dannevirke	129.7	14.9	4.8	3	1.5	1.6	0.8	1.1
Bulls	53.9	6.6	4.4	3.8	1.7	4.7	1.5	0.7
Tangimoana	4.1	0.8	0.7	0.1	-	-	-	-
Hunterville	23.4	5.5	2.7	1	0.1	0.1	0	-
Shannon	24.9	1.3	0.4	0.9	0.8	3.3	3.3	0
Ōhau	7.2	1.1	0.2	0.1	0.1	0.2	0.3	0.8
Hokio Beach	50	9.1	4.4	1.9	-	-	-	-
Bunnythorpe	20.9	3	0.5	0.1	0	-	-	-
Eketāhuna	14	2.4	0.4	0	-	-	-	-
Mangaweka	10.3	2.9	1.2	0.3	0.1	0.2	0.1	0.1
Ōwhango	2.4	0.4	0.2	0	0	-	-	-
Ōhura	1.2	0.1	0	0.1	0	0	-	-
Mangamutu	15.3	3	4.5	2.6	0.3	-	-	-
Pahiatua	17.7	3.9	1.6	0.2	0	-	-	-
Ashhurst	19.8	3.5	2.8	3	0.2	0.3	0.5	-
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.6	0.8	0.3	0.1	0.2	0.1	-
Waitārere Beach	0.4	0	0.2	0.1	-	-	-	-
Raetihi	13.2	1.6	0.5	0.1	0	0	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.2	0.2	0.1	0.1	0	-	-
Linton	5.2	0.5	0.2	0.1	0	-	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.2	0.1	-	-	-	-
National Park	18.3	0.7	0	1.2	0.8	-	-	-
Mangatainoka	4.7	0.7	0.2	0.1	0.1	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Halcombe	28.3	1.7	1.4	1.6	2.1	5.2	0.7	2
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	913.1	488	311.3	147.3	123.5	61.5	38.5
Palmerston North	14,029.6	833.9	651.9	660.8	413.6	454.2	219.8	207.6
Feilding	7,528	840.2	542.8	365.7	153.8	119.2	36.9	13.2
Marton	27,105.7	2,490.3	1,133.1	501.1	306.5	356.4	131.5	113.1
Ohakune	44,184.2	817.1	350.4	215	76.6	64.7	20.7	10.6
Longburn	1,302.6	119.8	278.3	357.9	168.6	80.3	50.4	38.2
Kairanga	6,733.2	845.4	971.6	963.4	337.1	459.7	417.9	611.4
Levin	7,837.6	1,189.6	248.1	147.1	93.9	79.3	17.6	5.3
Woodville	10,615.9	579	294.6	155.7	99.4	132.2	78.1	2,261
Foxton	11,957.6	2,286.4	1,051.4	632.9	312.6	460.9	183.7	25.6
Foxton Beach	861.7	106.9	130.2	196.5	39.8	16.6	0.1	4.6
Taumarunui	12,241.3	293.2	165.3	101.5	54.3	52.1	52.7	164.3
Dannevirke	34,395.2	3,001.7	944.4	554.6	291.8	320.5	152.7	199.7
Bulls	9,085.6	1,328.6	714.8	510.1	264.1	239.4	35.3	27.1
Tangimoana	9,602.2	1,313.2	568.6	354.1	164.1	140.8	29.9	10
Hunterville	55,534.7	1,834.9	951.1	522.8	250.7	216.4	106.1	213.8
Shannon	7,725	267.9	155.4	150	254.7	596.1	570.4	72.3
Koitiata	908.1	104.5	89.5	94.7	53.9	36.9	2.5	3
Ōhau	2,857.8	257.1	193.6	174.6	60.2	48	15.4	6.3
Hokio Beach	2,923.4	309.6	276	269.8	94	67	4.2	3.9
Bunnythorpe	8,837.9	849.9	420.8	264.8	133	110.6	38.1	7
Eketāhuna	37,977.3	2,279	1,226	571.9	202.4	168.7	67.5	40.5
Mangaweka	25,542.3	789.1	311	126.4	46.6	44.4	22.4	94.5
Ōwhango	21,112.2	395.1	170.8	89.1	39.4	34.6	13.8	41.6
Ōhura	24,006.2	723	479.8	311.6	164.3	163	65.8	114.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	972.3	538	412.8	189.9	143.8	58.2	33.7
Pongaroa	57,773.7	1	0.3	-	-	-	-	-
Mangamutu	1,464.7	80.5	63.7	58.3	43.9	73.6	47.8	55.3
Pahiatua	56,300.9	2,151.8	1,442.9	767	332.4	340	147.5	136.8
Ashhurst	9,723	638.5	417.5	308.2	191	230.7	62.2	50.3
Himatangi Beach	1,181.1	160.2	175.8	99.9	29.1	43	0.5	-
Taihape	66,124.7	1,907.4	1,015.2	462.8	187.2	170.3	84.1	131.4
Waitārere Beach	13.3	0.5	1.5	1.2	0.6	0	-	-
Raetihi	153,110.1	896.5	426.7	194.3	82.3	64.9	26.4	44.1
Manakau	5,969.4	529.4	281.1	216.9	114.2	90.7	9.5	1.3
Sanson	3,977.1	280.2	181.4	110.9	47.2	33.2	8	3
Linton	9,076.6	539.1	351.9	197.6	90	134.2	35.3	13.8
Ohakea	1,988.8	355.6	139.2	120.1	96.8	83.8	6.2	1.5
Norsewood	5,388.4	529	170.2	61.4	26	23.9	11.3	11.3
Tokomaru	5,474	293.1	163.1	161.3	177.6	326.3	207.9	50.6
Waiouru	2,552.9	144.2	64.4	29.3	8.8	9.6	3.8	2.7
National Park	4,186.3	268.1	69	23.5	16	14.2	5.4	8.1
Waikawa Beach	270	31	27.6	24.6	6.5	5.3	1.3	0.5
Mangatainoka	2,846.3	136.2	80.9	61.7	38.9	65.6	48.2	711.6
Ormondville	15,472.3	622.8	217.6	105.8	52.5	65	49.3	92.2
Rongotea	9,950.9	1,247.1	718	545.7	293.5	281.2	173	64.1
Rātana	1,699.3	128	68	60.7	47.5	55.1	12.2	17.9
Halcombe	20,547.4	1,412.8	794.5	542.5	302.2	377.5	124.9	109.7
Kimbolton	9,408.6	442.2	226.5	135.2	58.3	50	19.8	23.1
Rangataua	6,946.1	209.2	47.1	28.8	12.4	8.6	1.2	0.2
Raurimu	2,159.8	118.2	45.7	24.1	11.8	12.8	6.7	14.1
Kai Iwi	9,060.1	373.7	212.8	140.8	67.7	62.2	31.7	55.3
Other property use type								
Whanganui	1,392.5	102.8	54.2	37.8	22.8	29.6	22.8	38.8
Palmerston North	5,568.9	228.2	185.4	143.8	80.7	114.2	102.8	93.8
Feilding	476.3	67.4	42.5	27.7	11.1	3.8	0.7	0.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	63.2	33.8	21.6	5.3	3.8	1.7	4.1
Ohakune	2,300.5	29.8	11.2	9.4	5.7	6.8	2.3	0.6
Longburn	36.4	1.1	7.4	1.4	0.6	0.3	-	0
Kairanga	29.9	2.6	0.3	0.2	0.2	0.3	0	0
Levin	495.8	118.2	20.5	8.6	4.3	11.2	2.8	1.4
Woodville	73.1	14.4	0.7	0.7	0.1	1.4	1.5	18
Foxton	594.5	86.4	60.3	37.1	5	0.6	0	0
Foxton Beach	309.8	26.4	22.2	15.7	8.1	14.1	-	-
Taumarunui	503.9	9.1	3.8	2.3	2.9	5.7	9.6	20.8
Dannevirke	855.3	74.2	13.9	15.9	4	4.5	2	1.4
Bulls	223.2	29.6	9.9	5	3.4	4.9	5.9	1.7
Tangimoana	421.8	38	22.4	11	3.3	3	3.3	0.3
Hunterville	2,173.7	26.5	14.8	9.7	4.3	4.6	3.2	6.5
Shannon	2,594	28	16.1	7.2	6.9	3.2	1.4	0.7
Koitiata	64.1	12.6	14.2	3.7	1.1	0.1	-	-
Ōhau	35.6	3	1.6	1.2	0.5	0.2	-	-
Hokio Beach	857.5	59.7	127.8	180.6	17.2	53.6	21.5	0.2
Bunnythorpe	80.9	11.4	2.6	1.5	0.8	1.1	0.6	0.2
Eketāhuna	1,475.7	9	2.9	1.7	0.9	0.7	0.9	2
Mangaweka	252	11.4	2.1	0.7	0.6	0.5	0.3	3.3
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	0	0
Ōhura	891.6	11.5	6.4	3.2	0.6	0.9	0.7	1.3
Pohangina	882.3	31.7	18.9	8	4.5	6.1	0.8	0.2
Mangamutu	26	1	0.8	0.6	0.1	0	-	-
Pahiatua	2,893.9	24.1	13.3	6	2.3	1.9	0.8	1.8
Ashhurst	115.4	9.3	3	4	2.9	3.1	1.1	0
Himatangi Beach	59.4	1.4	1.5	0.7	0.5	0.6	0.1	-
Taihape	2,174.7	93.5	40.5	20.2	6.7	6.2	3.3	4.9
Waitārere Beach	24.3	1.4	0.8	0.4	0.4	0.2	-	-
Raetihi	8,257	12.4	9.9	6.2	2.2	2.9	0.6	0.5
Manakau	138	5.2	5.9	3.4	1.8	0.8	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	3.3	1.3	0.3	0	-	0	-
Linton	426.8	65.8	14.7	7.6	6.5	10.3	7.8	17.5
Ohakea	56.4	5.6	1.9	1.3	0.3	0.1	-	-
Norsewood	148.5	3.2	1	1	0.4	0.4	0.4	0.5
Tokomaru	1,681.2	27.6	17	6.6	1	1.1	0.5	0.5
Waiouru	2.1	0.1	0.1	0.1	0	0	0	-
National Park	1,051.5	17.2	5.1	1.5	1	0.5	0.1	0
Waikawa Beach	4.2	0.4	0.6	0.3	0.3	0.1	0.7	-
Mangatainoka	178	6.5	4.8	4	1.4	1.4	0.9	3.8
Ormondville	889.7	30.2	14.2	18.5	24	10.5	4	5.5
Rongotea	137.6	0.6	2.1	1.2	0	0.4	-	-
Rātana	25.6	2.3	0.4	0.5	0.3	0.3	0.2	0.3
Halcombe	913.2	54.5	27.9	25.5	10.7	9.8	2.3	9.6
Kimbolton	334.7	0.9	0.7	-	-	-	0.5	0.1
Rangataua	766.7	27.8	14.1	8	4.4	3.6	1.5	0.7
Raurimu	190.1	8.6	4.7	4.5	0.7	0.8	0.1	0.8
Kai Iwi	148.2	5.2	5.5	4.2	1.7	2	0.9	0.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.3.17: Total hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +3°C + SLR, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	180.1	104.5	89.5	73.6	98.5	22.5	19.3
Palmerston North	3,060.7	310.9	209.3	121.3	42.5	39.1	7.6	1.7
Feilding	1,015.1	164.3	23.7	9.3	8.1	4.5	0.7	0.4
Marton	365.7	51.7	23.4	5.8	1.6	1.9	0.8	0.5
Ohakune	272.9	-	-	-	-	-	-	-
Longburn	46.1	2.6	7.6	4.8	1.2	1.1	0	-
Kairanga	45.4	7.2	8.6	3	1.8	2.4	0.3	0.3
Levin	1,280.1	340.7	62.5	8.7	1.8	1.7	0.2	-
Woodville	119.2	3.1	0.8	0.8	0.5	1.5	1.4	0.6
Foxton	227.8	39.9	30.9	15.7	1.5	0.5	-	0
Foxton Beach	182.5	28	28.7	10.1	2.4	0.8	0.1	-
Taumarunui	292.6	17.1	16.4	24.2	17.4	13.9	3.6	4.7
Dannevirke	346.6	0.2	-	-	-	-	-	-
Bulls	172.2	29.9	14.8	8.3	2.9	0.8	0	-
Tangimoana	38.6	2.9	6.1	14.2	3.9	0.5	-	-
Hunterville	163.2	11.2	11	6.6	3.8	2.1	0.5	0
Shannon	118.1	8.3	2	1	0.3	0.2	-	-
Koitiata	9.2	0.9	0.7	1.3	0.7	0.2	-	-
Ōhau	223.5	25.9	4.2	2.1	0.9	0.4	0	-
Hokio Beach	64	6.2	4.5	2.5	0.8	0.4	-	-
Bunnythorpe	132.8	10	3.7	2.4	0.3	0.6	0.1	0
Eketāhuna	91.5	2.3	0.3	0	-	0	-	-
Mangaweka	21.7	3.8	0.7	0.1	0	0.2	-	-
Ōwhango	24.1	3.1	0.3	0.6	0.2	0.5	0.1	-
Ōhura	31.9	3.6	2.9	2.1	1.2	0.1	-	-
Pohangina	23.7	3	0.6	0.3	0	0	-	-
Pongaroa	16.6	1.9	0.9	0.9	0.4	0.2	0.1	0.3
Mangamutu	13.6	-	-	-	-	-	-	-
Pahiatua	213.1	-	-	-	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	35.5	8.7	1	0.4	0.1	-	-
Himatangi Beach	50.7	4.8	4.1	0.9	0	-	-	-
Taihape	297.3	10.8	3.8	1.7	0.8	0.5	0.4	0.7
Waitārere Beach	111.8	8	8	9.1	4.8	2.4	0	-
Raetihi	101.9	-	-	-	-	-	-	-
Manakau	115.9	19.6	8.1	2.6	1	0.2	0	-
Sanson	58.6	6.5	1.9	0.8	0.8	0.5	-	-
Linton	44.7	3.6	1.1	0.8	0.4	0.2	0	-
Ohakea	9.9	1.1	0.1	1.4	0.7	0	-	-
Norsewood	27.5	2.5	1.3	0.4	-	-	-	-
Tokomaru	58.1	4.6	0.7	0.7	0.2	0	0.1	-
Waiouru	8.4	0.8	0.1	0	-	-	-	-
National Park	139.3	3.5	2.3	0.8	0.6	0.9	1	0.3
Waikawa Beach	59.7	5.7	5.5	2	0.2	0	-	-
Mangatainoka	20.2	0.1	0.1	0.2	0.1	-	-	0.2
Ormondville	40.5	5.6	0.8	0.3	0.1	0	-	-
Rongotea	110	11.3	6.4	3.1	0.5	0.4	-	-
Rātana	17.4	1.9	0.6	1.1	-	-	-	-
Halcombe	132.9	11.9	6.7	2.6	0.3	0.2	-	-
Kimbolton	52.5	2.6	2.4	0.3	-	0.7	-	-
Rangataua	28.5	1	0.2	0	-	-	-	-
Raurimu	16.9	1.4	0.2	0.1	0	0	0	-
Kai Iwi	38.6	2.7	1.1	0.6	0.6	0.2	0.2	0
Commerical/Industrial property use type								
Whanganui	401.8	43.2	22.8	16.8	20.6	42.9	7.3	12.1
Palmerston North	686.1	93.1	53.8	37.2	17.2	14.3	7.3	19.4
Feilding	170.9	43.8	19.7	13.7	2.4	1.5	0.2	0
Marton	213.9	19.9	9.7	7.2	27.4	48.9	5.1	4
Ohakune	22.4	-	-	-	-	-	-	-
Longburn	60.8	6.7	16	25.9	4.6	1.1	0.1	0
Kairanga	8	1.7	1.1	0.1	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	109.9	13.7	0.9	0.7	0.6	-	-
Woodville	12.5	0	0.1	0.3	0.2	0.1	0.3	0
Foxton	41.4	9.2	5.7	0.9	0	0	-	-
Foxton Beach	0.8	0.1	0.1	0.1	-	-	-	-
Taumarunui	37.9	4.6	2.4	1.5	0.5	1	0.2	0.2
Dannevirke	129.7	-	-	-	-	-	-	-
Bulls	53.9	6.6	4.3	3.8	1.7	4.7	1.6	0.7
Tangimoana	4.1	0.8	0.6	0	-	-	-	-
Hunterville	23.4	5.5	1.9	0.8	0.1	0.1	-	-
Shannon	24.9	2.9	1.9	1.2	0	-	-	0
Ōhau	7.2	1.1	0.2	0.1	0.1	0.2	0.3	0.8
Hokio Beach	50	9.1	4.4	1.9	-	-	-	-
Bunnythorpe	20.9	3	0.5	0.1	0	-	-	-
Eketāhuna	14	2	0.4	0	-	-	-	-
Mangaweka	10.3	2.9	1.2	0.3	0.1	0.2	0.1	0.1
Ōwhango	2.4	0.4	0.2	0	0	-	-	-
Ōhura	1.2	0.1	0	0.1	0	0	-	-
Pongaroa	2.5	0.2	0.6	0.2	0.1	0	-	-
Mangamutu	15.3	-	-	-	-	-	-	-
Pahiatua	17.7	-	-	-	-	-	-	-
Ashhurst	19.8	2.4	2.3	3.7	2.5	0.5	0.5	0
Himatangi Beach	0.1	0	-	-	-	-	-	-
Taihape	25.8	2.6	0.8	0.3	0.1	0.2	0.1	-
Waitārere Beach	0.4	0	0.2	0.1	-	-	-	-
Raetihi	13.2	-	-	-	-	-	-	-
Manakau	0.3	0	0	0	0	0	-	-
Sanson	10.2	2.2	0.2	0.1	0.1	0	-	-
Linton	5.2	0.5	0.2	0.1	0	0	-	-
Norsewood	1.9	0.5	0.1	0.1	-	-	-	-
Tokomaru	10	0.1	0	-	-	-	-	-
Waiouru	5.6	0.5	0.2	0.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	0.7	0	1.2	0.8	-	-	-
Mangatainoka	4.7	-	-	-	-	-	-	-
Ormondville	5.1	0.2	0.1	0	0	0.1	0	0.1
Rongotea	4.6	0.6	0.5	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	1.3	0.9	1.2	1.7	4.4	3.7	2.3
Kimbolton	0.9	-	0	-	-	-	-	-
Raurimu	1.2	0.1	0.1	0.1	0	0	-	-
Rural property use type								
Whanganui	9,193.7	912.4	485.9	312.1	150.1	123.9	62.9	41.8
Palmerston North	14,029.6	846.5	616.5	565.4	391.7	440.1	225.3	266.2
Feilding	7,528	817.4	516.3	360.4	160.7	119.2	37.2	13.1
Marton	27,105.7	2,499.8	1,143.6	523.2	304.5	329	127.5	104.3
Ohakune	44,184.2	7.2	0.9	0.9	0.4	0.2	-	-
Longburn	1,302.6	155.3	290.5	292.2	85.6	52.9	60.8	52
Kairanga	6,733.2	875.2	956	797.2	296	457.1	449.2	693.3
Levin	7,837.6	1,189.1	247.2	149.4	95.8	79.5	17.6	5.3
Woodville	10,615.9	180.2	100.8	67.3	66	145.4	156.6	999.3
Foxton	11,957.6	2,276.7	1,078.9	603.9	225.4	236.8	297.6	265.6
Foxton Beach	861.7	96.5	108.4	53.6	21.4	206.7	17.2	4.9
Taumarunui	12,241.3	292.9	165.4	101.8	54.8	52.1	52.5	164.6
Dannevirke	34,395.2	177	90.3	55.3	26.6	38.5	15.3	15.1
Bulls	9,085.6	1,335.9	711	504.7	242.1	210.8	36.1	27.8
Tangimoana	9,602.2	1,303.7	555.3	340.6	150.3	148.3	66.1	35.4
Hunterville	55,534.7	1,835.1	934.2	505.3	244.2	221.4	113.7	229.9
Shannon	7,725	357	353.7	643.2	333.5	175.6	15.9	10.5
Koitiata	908.1	104.4	89.4	93.1	55.8	36.1	2.3	3
Ōhau	2,857.8	251.1	184	169.6	62	63.2	21.4	9.1
Hokio Beach	2,923.4	308.5	275.4	272.6	98	68.4	4.3	2.1
Bunnythorpe	8,837.9	851.7	403.9	250.2	137.9	119.7	38.1	8.1
Eketāhuna	37,977.3	584.5	292.3	131.1	54.7	51.3	18.4	15.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	789.6	311	126.2	46.6	44.4	22.4	94.6
Ōwhango	21,112.2	395.3	170.8	89.1	39.4	34.6	13.8	41.6
Ōhura	24,006.2	723.2	479.9	311.5	164.3	163	65.9	114.5
Pohangina	26,177.4	972.6	538.1	412.4	190.3	143.9	58.3	33.7
Pongaroa	57,773.7	1,453	621.3	281.4	141.6	164.9	97.4	182.8
Mangamutu	1,464.7	0.3	-	-	-	-	-	-
Pahiatua	56,300.9	65.6	32.1	10.6	3.9	1.8	0.6	0.1
Ashhurst	9,723	645.8	441.3	296.1	142	153.3	60.4	48.6
Himatangi Beach	1,181.1	159.8	176.1	102.1	29.3	43.1	0.5	-
Taihape	66,124.7	1,907	1,015.3	462.7	187.2	170.1	84	131.8
Waitārere Beach	13.3	0.5	1.5	1.2	0.6	0	-	-
Raetihi	153,110.1	171.1	97	37.8	16.2	13.6	6.7	15.3
Manakau	5,969.4	529.1	279.1	218.6	114.4	92.7	9.6	1.3
Sanson	3,977.1	280.2	181.5	110.9	47.3	33.2	8	3
Linton	9,076.6	541.4	340.3	194.6	64.5	56.6	68.6	28.6
Ohakea	1,988.8	353.9	133	119.5	92.2	96.7	8.9	1.9
Norsewood	5,388.4	473.7	150.4	53	23.8	22.2	10.4	11
Tokomaru	5,474	368.9	216.6	200.8	170.2	207.9	19	6.5
Waiouru	2,552.9	144.2	64.4	29.3	8.8	9.6	3.8	2.7
National Park	4,186.3	268	69	23.5	16	14.2	5.4	8.1
Waikawa Beach	270	30.8	27.3	24.9	7.2	5.6	1.4	0.5
Mangatainoka	2,846.3	2.9	5.2	12.8	13.1	24.5	14.1	270.4
Ormondville	15,472.3	624	217.8	106.2	52.1	64.7	49	91.2
Rongotea	9,950.9	1,303.8	664.5	466.9	232.6	276.9	151.5	15.5
Rātana	1,699.3	127.7	67.7	56.9	50.3	55.6	13.8	17.9
Halcombe	20,547.4	1,408.6	792.8	542.2	300	372.9	135	111.2
Kimbolton	9,408.6	442.2	226.8	134.5	58.6	50	19.8	23.1
Rangataua	6,946.1	54.4	21.6	11.7	3.6	3.9	0.8	-
Raurimu	2,159.8	118.2	45.7	24	11.8	12.8	6.7	14.1
Kai Iwi	9,060.1	374.2	212.2	140.7	67.8	62.7	32.5	56.4
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	100.9	54.2	39.6	24.1	30.7	24.7	38
Palmerston North	5,568.9	238.6	164.3	114.8	69.8	93.6	67.6	65
Feilding	476.3	62.7	28.3	30.1	14.5	5.1	0.7	0.6
Marton	1,724.2	63.4	33.3	20.5	4.6	3.7	1.7	4.1
Ohakune	2,300.5	-	-	-	-	-	-	-
Longburn	36.4	1.5	7.4	0.7	0.4	1.2	0.1	0
Kairanga	29.9	2.6	0.1	0.2	0.2	0.2	0.1	0
Levin	495.8	118.2	20.4	8.7	4.3	11.2	2.8	1.4
Woodville	73.1	0.5	0.1	0.1	0	1.2	2.2	14.1
Foxton	594.5	83.6	60.7	36.4	5.2	2.1	0.8	0.1
Foxton Beach	309.8	18.9	25.9	28.6	12	14.6	0.8	-
Taumarunui	503.9	9.1	3.7	2.4	2.7	6.5	9.4	20.4
Dannevirke	855.3	-	-	-	-	-	-	-
Bulls	223.2	29.6	9.9	5	3.2	5	5.9	1.7
Tangimoana	421.8	38.6	22.7	9.4	2.3	2.6	2.5	1.9
Hunterville	2,173.7	26.4	15.1	9.3	4.2	4.5	3.1	6.5
Shannon	2,594	28.3	17.4	6.6	2.6	2.6	1.3	0.7
Koitiata	64.1	9.2	13.8	7.5	5.5	1.9	-	-
Ōhau	35.6	3	1.6	1.2	0.5	0.2	-	-
Hokio Beach	857.5	60	128	181.4	16.5	53.6	21.5	0.2
Bunnythorpe	80.9	11.3	2.7	1.1	0.6	1	0.6	0.4
Eketāhuna	1,475.7	0.8	0.2	0.1	0.1	0.1	0	-
Mangaweka	252	11.4	2.1	0.7	0.6	0.5	0.3	3.3
Ōwhango	1,328.7	0.6	0.2	0.1	0.1	0.1	0	0
Ōhura	891.6	11.4	6.4	3.2	0.6	0.9	0.7	1.3
Pohangina	882.3	31.7	18.9	8	4.5	6.1	0.8	0.2
Pongaroa	3,913	147.2	61.8	24.4	9.8	12.9	7.6	18.8
Mangamutu	26	-	-	-	-	-	-	-
Pahiatua	2,893.9	0.5	0.8	0	0	-	-	-
Ashhurst	115.4	9.3	3.1	3.9	2.9	3	1.2	0
Himatangi Beach	59.4	1.3	1.2	0.8	0.6	0.8	0.4	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	93.5	40.5	20.2	6.7	6.2	3.3	4.9
Waitārere Beach	24.3	1.2	1.1	0.6	0.5	0.3	0	0
Raetihi	8,257	0	0	-	-	0	-	-
Manakau	138	4.9	6.3	3.4	1.9	0.8	0.1	-
Sanson	55.8	3.3	1.3	0.3	0	-	0	-
Linton	426.8	65.5	12	7.9	8.3	8.3	8.4	20.7
Ohakea	56.4	5.6	1.9	1.3	0.3	0.1	-	-
Norsewood	148.5	3.2	1	1	0.4	0.4	0.4	0.5
Tokomaru	1,681.2	27.6	17	6.6	1	1.1	0.5	0.5
Waiouru	2.1	0.1	0.1	0.1	0	0	0	-
National Park	1,051.5	17.2	5.1	1.5	1	0.5	0.1	0
Waikawa Beach	4.2	0.2	0.7	0.8	0.4	0.2	0.6	0.1
Mangatainoka	178	-	-	-	-	-	-	-
Ormondville	889.7	30.3	14.1	18.5	24	10.5	4	5.5
Rongotea	137.6	0.8	1.9	1.2	0.1	0.4	-	-
Rātana	25.6	2.3	0.4	0.5	0.3	0.3	0.2	0.3
Halcombe	913.2	54.1	27.8	26.2	11.1	9.8	2.3	9.6
Kimbolton	334.7	0.9	0.7	-	-	-	0.5	0.1
Rangataua	766.7	0.3	0.2	0.1	0	0	-	-
Raurimu	190.1	8.6	4.7	4.5	0.7	0.8	0.1	0.8
Kai Iwi	148.2	5.2	5.5	4.2	1.7	2.1	0.9	0.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.1: Percentage of hectares of property use type flooded for town/settlement for 5% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	7.8	3.5	1.9	0.4	0.1	0.1	0
Palmerston North	3,060.7	8.4	4.9	2.2	0.7	0.4	0	0
Feilding	1,015.1	11.8	1.5	0.9	0.4	0.2	0	0
Marton	365.7	12.3	3.4	0.8	0.3	0.3	0.1	-
Ohakune	272.9	7.8	2.7	1.2	0.4	0.3	0	-
Longburn	46.1	6.4	2.5	0.2	-	-	-	-
Kairanga	45.4	19.6	4.9	1.1	0.1	0	-	-
Levin	1,280.1	22.7	2.6	0.5	0.1	0.1	0	-
Woodville	119.2	15	3.9	3.3	1.5	1.5	0.7	2.4
Foxton	227.8	16.1	11.1	5.3	0.5	0.1	0	0
Foxton Beach	182.5	15.6	9	1.9	0.4	0.1	-	-
Taumarunui	292.6	7	4	2	0.8	0.4	0.3	0.4
Dannevirke	346.6	8.7	1.2	0.4	0.2	0.1	0	-
Bulls	172.2	14.9	4.3	1.1	0.2	0	-	-
Tangimoana	38.6	19.1	16.3	3.7	0.2	-	-	-
Hunterville	163.2	6.6	3.5	1.4	0.3	0.2	0	0
Shannon	118.1	5	1.3	0.5	0.2	0.1	-	-
Koitiata	9.2	6.3	8.8	11.5	5.5	-	-	-
Ōhau	223.5	8.2	1.1	0.6	0.2	0.1	-	-
Hokio Beach	64	9	5.7	1.9	0.6	0	-	-
Bunnythorpe	132.8	6.1	2.4	1.2	0.4	0.1	0.1	-
Eketāhuna	91.5	9	1.8	0.3	0.1	0	0	0
Mangaweka	21.7	13.2	0.9	0.1	0.5	0.1	-	-
Ōwhango	24.1	10.5	1.2	2	1.1	1.7	0.4	-
Ōhura	31.9	10.4	8.5	4.4	0.8	0	-	-
Pohangina	23.7	6.7	1.7	0.5	0	0	-	-
Pongaroa	16.6	9.3	5.6	2.3	1.4	0.7	0.2	-
Mangamutu	13.6	10.8	2.9	-	-	-	-	-
Pahiatua	213.1	16.5	6.1	1.3	0.2	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	15.3	2.7	0.4	0.1	0	-	-
Himatangi Beach	50.7	9.5	3.7	0.6	-	-	-	-
Taihape	297.3	3.3	1.2	0.4	0.2	0.1	0.1	0.1
Waitārere Beach	111.8	5.8	6.1	5.2	0.8	0.1	-	-
Raetihi	101.9	8.8	3.7	3	1.2	0.7	0	-
Manakau	115.9	13.7	3.5	1.4	0.2	0.1	-	-
Sanson	58.6	8.7	3.3	2.4	0.2	0	-	-
Linton	44.7	5.5	2	1.9	0.4	0.1	-	-
Ohakea	9.9	12.2	0.5	-	-	-	-	-
Norsewood	27.5	9.4	3.8	1.5	-	-	-	-
Tokomaru	58.1	6.5	1.3	1.3	0	0	0.2	-
Waiouru	8.4	8.6	0.8	-	-	-	-	-
National Park	139.3	2.3	1.4	0.5	0.3	0.8	0.1	-
Waikawa Beach	59.7	9.5	6.2	1.2	0.1	-	-	-
Mangatainoka	20.2	7.9	6.5	3.1	1.4	1.6	0	2.9
Ormondville	40.5	11	1.2	0.6	0.1	0	-	-
Rongotea	110	8.5	4.4	1.7	0	0	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	7.9	3.8	0.8	0.1	0.1	-	-
Kimbolton	52.5	5.4	4.3	0.3	-	1.4	-	-
Rangataua	28.5	8.7	1.8	0	-	-	-	-
Raurimu	16.9	5.6	1.2	0.5	0.2	0.2	-	-
Kai Iwi	38.6	6	2.8	0.9	2.4	0.3	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	12.3	7.1	2.7	1.1	1.8	0	-
Palmerston North	686.1	12.1	6.4	3.3	1.3	1.4	0.3	1.4
Feilding	170.9	21.4	6.7	1.6	0.6	0.2	0.1	-
Marton	213.9	13.3	11.6	10.4	0.9	0.7	0.3	0.8
Ohakune	22.4	9.4	6.2	2.5	0.8	0.7	0	-
Longburn	60.8	16.2	5.1	1.3	0	0	0	0
Kairanga	8	16.1	8.2	1.5	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	51.2	3.2	0.3	0.5	0.2	-	-
Woodville	12.5	8	3.6	3.9	5.9	12.3	1.9	2.7
Foxton	41.4	18.5	10.7	1.4	0	0	-	-
Foxton Beach	0.8	8.8	7.5	0	-	-	-	-
Taumarunui	37.9	9.6	3.1	0.6	0.1	0.1	0.1	0
Dannevirke	129.7	9.5	2.5	1.1	0.6	0.7	0.1	0.1
Bulls	53.9	12.7	5.8	0.8	0.4	0.3	0.3	0.4
Tangimoana	4.1	17.8	1.5	0	-	-	-	-
Hunterville	23.4	12.2	3.2	0.5	0.1	0.2	-	-
Shannon	24.9	10.8	3.5	0.9	-	-	-	0.1
Ōhau	7.2	12.8	2.1	1.2	1.9	9.9	2.4	-
Hokio Beach	50	15.3	8	2	-	-	-	-
Bunnythorpe	20.9	12	2.4	0.2	-	-	-	-
Eketāhuna	14	13.4	1.4	0.1	-	-	-	-
Mangaweka	10.3	19.9	2.7	0.5	0.1	0	0	-
Ōwhango	2.4	14.2	2.9	0.4	0.4	-	-	-
Ōhura	1.2	6.7	4.2	3.3	0	-	-	-
Pongaroa	2.5	12.4	20	2.4	1.2	-	-	-
Mangamutu	15.3	20.6	12.5	3.9	-	-	-	-
Pahiatua	17.7	18.5	4.9	0.4	-	-	-	-
Ashhurst	19.8	11.9	12.3	14	5.8	2.7	0.3	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9	2.1	0.7	0.3	0.5	-	-
Waitārere Beach	0.4	15	25	2.5	-	-	-	-
Raetihi	13.2	8.6	3.1	0.8	0.1	0.1	-	-
Manakau	0.3	10	-	6.7	6.7	0	-	-
Sanson	10.2	15.6	1.9	0.6	0.1	-	-	-
Linton	5.2	8.5	2.3	0.4	-	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.7	0.1	-	-	-	-	-
Waiouru	5.6	7.1	3.4	0.5	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	7.2	3.4	4.4	-	-	-	-
Mangatainoka	4.7	11.7	4.9	0	-	-	-	-
Ormondville	5.1	3.5	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	5.2	4.6	9.3	12.8	4.5	2	5.2
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	5.8	3.3	5	2.5	-	-	-
Rural property use type								
Whanganui	9,193.7	8.7	4.9	2.9	0.9	0.6	0.1	0
Palmerston North	14,029.6	6.1	3.6	2.2	1.1	1.1	0.4	0.7
Feilding	7,528	9.4	4.6	2.8	1.4	0.7	0.2	0
Marton	27,105.7	8.4	3.5	1.5	0.6	0.4	0.1	0.1
Ohakune	44,184.2	1.6	0.7	0.3	0.1	0.1	0	0
Longburn	1,302.6	14.3	10.6	4.7	2	2.4	1.3	1.4
Kairanga	6,733.2	18.7	12.8	6.3	3.1	2.2	0.1	0
Levin	7,837.6	12.1	2.4	1.7	0.8	0.5	0.1	0
Woodville	10,615.9	5.4	2.6	1.8	1.2	2.3	2.5	12.5
Foxton	11,957.6	16.5	7.8	4.6	1.3	1.9	1.4	0.5
Foxton Beach	861.7	10.2	10.8	21.8	4.5	2.1	0.1	0.5
Taumarunui	12,241.3	2.3	1.3	0.7	0.3	0.4	0.2	0.2
Dannevirke	34,395.2	7	2.3	1.2	0.6	0.5	0.2	0.2
Bulls	9,085.6	13.4	7.1	3.4	1.1	0.5	0.1	0.1
Tangimoana	9,602.2	11.7	4.6	2.2	0.9	0.6	0.1	0.1
Hunterville	55,534.7	2.9	1.4	0.6	0.2	0.2	0.1	0.2
Shannon	7,725	6.1	5.9	4.7	1.7	0.5	0.1	0.1
Koitiata	908.1	11.2	7.9	4.5	0.6	0.3	0.1	0.2
Ōhau	2,857.8	8.9	5.5	2.7	0.8	0.7	0.1	0.1
Hokio Beach	2,923.4	10.6	9.4	6.6	1.8	0.7	0	0.1
Bunnythorpe	8,837.9	7.9	4	2.7	1.1	0.6	0.1	0
Eketāhuna	37,977.3	5.4	2.4	1	0.4	0.3	0.1	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	2.6	1.1	0.4	0.1	0.1	0.1	0.2
Ōwhango	21,112.2	1.7	0.7	0.3	0.1	0.1	0	0.1
Ōhura	24,006.2	2.9	1.5	0.7	0.3	0.2	0.2	0.1
Pohangina	26,177.4	3.5	1.9	0.9	0.3	0.3	0.1	0.1
Pongaroa	57,773.7	2.1	0.9	0.4	0.2	0.2	0.1	0.1
Mangamutu	1,464.7	6.7	5	3.5	2.2	2.1	0.7	0.2
Pahiatua	56,300.9	3.3	1.8	0.8	0.3	0.3	0.1	0.1
Ashhurst	9,723	6.3	3.8	1.9	0.7	0.6	0.2	0.2
Himatangi Beach	1,181.1	14.2	12.3	4.9	2.4	1.4	0	-
Taihape	66,124.7	2.7	1.4	0.6	0.2	0.2	0.1	0.1
Waitārere Beach	13.3	8.5	9.3	6.7	1	-	-	-
Raetihi	153,110.1	0.5	0.2	0.1	0	0	0	0
Manakau	5,969.4	7.4	3.8	2.3	0.9	0.3	0	0
Sanson	3,977.1	6.2	4.1	2.3	0.8	0.4	0	0
Linton	9,076.6	5.3	3.3	1.7	0.7	0.7	0.1	0.1
Ohakea	1,988.8	16.2	5.3	1.9	0.4	0.1	0	0
Norsewood	5,388.4	8.3	2.5	1	0.4	0.4	0.2	0.2
Tokomaru	5,474	6.6	4.2	4	2.1	0.9	0.1	0
Waiouru	2,552.9	5.2	2.4	1	0.3	0.2	0.1	0.1
National Park	4,186.3	5.3	1.3	0.5	0.3	0.2	0.1	0.1
Waikawa Beach	270	12.1	7.9	3.6	1.1	0.5	0.2	-
Mangatainoka	2,846.3	4.7	3.1	2.1	1.3	2.4	2.4	16.7
Ormondville	15,472.3	3.6	1.3	0.7	0.3	0.3	0.2	0.4
Rongotea	9,950.9	11.2	5.2	3.4	1.7	1.3	0.1	0
Rātana	1,699.3	7.8	4.9	2.4	1.2	0.9	0.2	0.5
Halcombe	20,547.4	6.2	4	2.5	1.1	0.7	0.3	0.1
Kimbolton	9,408.6	4.1	2.2	1.2	0.4	0.3	0.1	0.1
Rangataua	6,946.1	2.3	0.6	0.3	0.1	0.1	0	0
Raurimu	2,159.8	4.9	1.8	0.8	0.4	0.4	0.2	0.3
Kai Iwi	9,060.1	3.4	2.6	1.6	0.6	0.6	0.2	0.2
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	6.5	3.2	2.6	1.6	0.7	0.2	0.4
Palmerston North	5,568.9	4.2	2.6	2	1.1	1.1	0.3	0.2
Feilding	476.3	10	5.6	3.9	0.9	0.3	0.1	0
Marton	1,724.2	3.5	1.6	0.7	0.2	0.1	0.1	0.1
Ohakune	2,300.5	1	0.5	0.3	0.2	0.1	0	0
Longburn	36.4	1.5	1.4	0.6	0.1	-	-	0
Kairanga	29.9	7.9	0.5	0.7	0.9	0.3	0	0
Levin	495.8	19.7	3.1	1.2	1.7	0.9	0.1	0
Woodville	73.1	17.1	0.6	0.4	0.3	0.3	1	23
Foxton	594.5	14.1	8.2	4.8	0.6	0.2	0.1	0
Foxton Beach	309.8	9.4	6.9	4.4	5	0.3	-	-
Taumarunui	503.9	2.1	1.1	1.3	0.6	0.9	0.3	0.5
Dannevirke	855.3	7	1.7	0.7	0.3	0.3	0.1	0
Bulls	223.2	12.1	3.9	1.9	1.4	0.6	0.1	0
Tangimoana	421.8	7.3	4.8	0.9	0.3	0.6	0.3	0.1
Hunterville	2,173.7	1.1	0.6	0.3	0.1	0.2	0.1	0.1
Shannon	2,594	1.1	0.5	0.2	0.1	0.1	0	0
Koitiata	64.1	21.5	14.3	3.7	0.9	0.1	-	-
Ōhau	35.6	6.1	2	0.7	-	-	-	-
Hokio Beach	857.5	14	17.1	3.4	2.5	6.3	0	0
Bunnythorpe	80.9	8.6	2.1	1.1	0.6	1	0.3	0
Eketāhuna	1,475.7	0.5	0.2	0.1	0	0.1	0.1	0
Mangaweka	252	3.5	0.7	0.3	0.2	0.2	0.3	0.7
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.2	0.4	0.1	0.1	0.1	0.1	0
Pohangina	882.3	3.4	1.8	0.8	0.4	0.3	0	0
Pongaroa	3,913	3.2	1.3	0.3	0.1	0.2	0.1	0
Mangamutu	26	2.6	3.6	1.7	-	-	-	-
Pahiatua	2,893.9	0.8	0.3	0.1	0	0.1	0	0
Ashhurst	115.4	6	2.1	1.2	0.8	0.6	0	-
Himatangi Beach	59.4	2.1	0.8	1	0.6	0.7	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4	1.8	0.6	0.3	0.2	0.1	0
Waitārere Beach	24.3	5.6	2.8	0.7	1.7	-	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	3.9	2.4	1.7	0.4	0.3	-	-
Sanson	55.8	4.4	1.7	0.4	0	-	0	-
Linton	426.8	12	2.7	3.2	1.6	2.5	0.9	1.7
Ohakea	56.4	7.6	2.4	1.7	0.1	-	-	-
Norsewood	148.5	1.9	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.5	1	0.3	0	0	0	0
Waiouru	2.1	6.2	9.5	1	0	-	-	-
National Park	1,051.5	1.3	0.4	0.1	0.1	0	0	0
Waikawa Beach	4.2	9.8	11.4	4.8	0.2	15.5	-	-
Mangatainoka	178	3.3	1.8	1	1	1.3	0.1	0
Ormondville	889.7	2.9	1.8	3.3	0.9	0.6	0.3	0.2
Rongotea	137.6	0.5	0.5	1	0.1	0	-	-
Rātana	25.6	5.7	1.3	1	0.1	0.2	0	0.6
Halcombe	913.2	5.5	2.5	2.5	0.8	0.6	0.2	0.7
Kimbolton	334.7	0.1	0.1	-	-	0.2	0	-
Rangataua	766.7	3.2	1.6	0.9	0.3	0.3	0.1	0
Raurimu	190.1	3.3	2.1	1.4	0.1	0.1	0.1	0.1
Kai Iwi	148.2	3.3	3.9	1.8	1.3	0.9	0.1	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.2: Percentage of hectares of property use type flooded for town/settlement for 5% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	7.8	3.5	1.8	0.3	0.1	0	0
Palmerston North	3,060.7	8.5	3.4	1.2	0.4	0.2	0	0
Feilding	1,015.1	16	2.4	0.7	0.4	0.2	0	0
Marton	365.7	12.4	3.8	0.9	0.3	0.3	0.1	-
Ohakune	272.9	7.8	2.7	1.2	0.4	0.3	0	-
Longburn	46.1	6.6	5	2.4	0.5	0	-	-
Kairanga	45.4	26.6	9.7	2.2	0.1	1.3	0	0
Levin	1,280.1	22.7	2.6	0.5	0.1	0.1	0	-
Woodville	119.2	15.6	3.9	3.1	1.6	1.5	0.7	2.4
Foxton	227.8	16.1	11	5.3	0.5	0.1	-	-
Foxton Beach	182.5	15.7	8.2	1.8	0.4	0	-	-
Taumarunui	292.6	7.1	3.9	2	0.8	0.3	0.3	0.4
Dannevirke	346.6	8.7	1.2	0.4	0.2	0.1	0	-
Bulls	172.2	15	4.5	1.2	0.3	0.1	0	-
Tangimoana	38.6	19.7	14.8	3.1	0.1	-	-	-
Hunterville	163.2	6.6	4.6	1.9	0.5	0.3	0.1	0
Shannon	118.1	5.1	1.5	0.5	0.2	0.1	-	-
Koitiata	9.2	6.3	8.8	11.5	5.5	-	-	-
Ōhau	223.5	8.2	1.1	0.6	0.2	0.1	-	-
Hokio Beach	64	9	5.7	1.9	0.6	0	-	-
Bunnythorpe	132.8	6.1	2.4	1.2	0.4	0.1	0.1	-
Eketāhuna	91.5	9	1.8	0.3	0.1	0	0	0
Mangaweka	21.7	13.2	0.9	0.1	0.5	0.1	-	-
Ōwhango	24.1	10.5	1.2	2	1.1	1.7	0.4	-
Ōhura	31.9	10.4	8.5	4.4	0.8	0	-	-
Pohangina	23.7	6.7	1.7	0.5	0	0	-	-
Mangamutu	13.6	10.8	2.9	-	-	-	-	-
Pahiatua	213.1	16.6	6.1	1.3	0.2	0.1	0	0.1
Ashhurst	179.3	13.8	2.3	0.3	0	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	9.5	3.7	0.6	-	-	-	-
Taihape	297.3	3.3	1.2	0.4	0.2	0.1	0.1	0.1
Waitārere Beach	111.8	5.8	6.1	5.2	0.8	0.1	-	-
Raetihi	101.9	8.8	3.7	3	1.2	0.7	0	-
Manakau	115.9	13.7	3.5	1.4	0.2	0.1	-	-
Sanson	58.6	8.7	3.3	2.4	0.2	0	-	-
Linton	44.7	5.8	2.1	2	0.5	0.4	0.1	-
Ohakea	9.9	12.2	0.5	-	-	-	-	-
Norsewood	27.5	9.4	3.8	1.5	-	-	-	-
Tokomaru	58.1	6.9	1	0.9	0	0	0.2	-
Waiouru	8.4	8.6	0.8	-	-	-	-	-
National Park	139.3	2.3	1.4	0.5	0.3	0.8	0.1	-
Waikawa Beach	59.7	9.5	6.2	1.2	0.1	-	-	-
Mangatainoka	20.2	7.9	6.5	3.1	1.4	1.6	0	2.9
Ormondville	40.5	10.9	1.2	0.6	0.1	0	-	-
Rongotea	110	8.5	5.7	2	0.4	0.4	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	7.9	3.8	0.8	0.1	0.1	-	-
Kimbolton	52.5	5.4	4.3	0.3	-	1.4	-	-
Rangataua	28.5	8.7	1.8	0	-	-	-	-
Raurimu	16.9	5.6	1.2	0.5	0.2	0.2	-	-
Kai Iwi	38.6	6	2.8	0.9	2.4	0.3	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	13.1	5.6	1.5	1	1.8	0	-
Palmerston North	686.1	12.3	5.9	3	0.9	1.3	0.3	1.3
Feilding	170.9	27.5	9.2	2.1	0.2	0.2	0	-
Marton	213.9	10.3	14.6	15.6	5.3	1.7	0.3	0.8
Ohakune	22.4	9.4	6.2	2.5	0.8	0.7	0	-
Longburn	60.8	22.8	15.9	3.8	1	0.7	0	0
Kairanga	8	17.9	12.9	1.6	0.4	-	-	-
Levin	180.9	51.2	3.2	0.3	0.5	0.2	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	8.8	3.7	3.8	6.2	12.4	1.2	3.3
Foxton	41.4	17.3	12.6	2.6	1.8	0.3	-	-
Foxton Beach	0.8	8.8	7.5	0	-	-	-	-
Taumarunui	37.9	9.6	3.1	0.6	0.1	0.1	0.1	0
Dannevirke	129.7	9.5	2.5	1.1	0.6	0.7	0.1	0.1
Bulls	53.9	12.8	5.8	0.8	0.4	0.3	0.3	0.4
Tangimoana	4.1	16.1	1	0	-	-	-	-
Hunterville	23.4	11.2	4.8	0.6	0.1	0.2	-	-
Shannon	24.9	10.2	6.7	5.7	0.1	-	-	0.1
Ōhau	7.2	12.8	2.1	1.2	1.9	9.9	2.4	-
Hokio Beach	50	15.3	8	2	-	-	-	-
Bunnythorpe	20.9	12	2.4	0.2	-	-	-	-
Eketāhuna	14	13.4	1.4	0.1	-	-	-	-
Mangaweka	10.3	19.9	2.7	0.5	0.1	0	0	-
Ōwhango	2.4	14.2	2.9	0.4	0.4	-	-	-
Ōhura	1.2	6.7	4.2	3.3	0	-	-	-
Mangamutu	15.3	18.6	8.9	4.6	-	-	-	-
Pahiatua	17.7	18.5	5	0.4	-	-	-	-
Ashhurst	19.8	17.4	12.2	5.8	0.8	2.7	0.3	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9	2.1	0.7	0.3	0.5	-	-
Waitārere Beach	0.4	15	25	2.5	-	-	-	-
Raetihi	13.2	8.6	3.1	0.8	0.1	0.1	-	-
Manakau	0.3	10	-	6.7	6.7	0	-	-
Sanson	10.2	15.6	1.9	0.6	0.1	-	-	-
Linton	5.2	8.5	2.3	0.4	-	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.7	0.1	-	-	-	-	-
Waiouru	5.6	7.1	3.4	0.5	-	-	-	-
National Park	18.3	7.2	3.4	4.4	-	-	-	-
Mangatainoka	4.7	11.7	4.9	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	3.5	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Halcombe	28.3	5.4	8.8	12.8	3	2.7	1.8	4.9
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	5.8	3.3	5	2.5	-	-	-
Rural property use type								
Whanganui	9,193.7	8.7	4.9	2.9	0.9	0.6	0.1	0
Palmerston North	14,029.6	6.1	4	2.5	1.2	1.1	0.4	0.7
Feilding	7,528	10	5.1	2.9	1.3	0.8	0.2	0
Marton	27,105.7	8.4	3.5	1.6	0.6	0.4	0.1	0.1
Ohakune	44,184.2	1.6	0.7	0.3	0.1	0.1	0	0
Longburn	1,302.6	18.7	13.2	5.2	2.9	3.6	1.6	1.3
Kairanga	6,733.2	15.7	14.8	7.4	4	5.2	5.2	1.6
Levin	7,837.6	12.1	2.4	1.7	0.8	0.5	0.1	0
Woodville	10,615.9	5.5	2.7	1.8	1.2	2.2	2.5	12.5
Foxton	11,957.6	16.5	7.7	4.8	2.3	2.3	0.2	0.1
Foxton Beach	861.7	11.6	13.2	18.9	2.7	1.1	0	0.5
Taumarunui	12,241.3	2.3	1.3	0.7	0.3	0.4	0.2	0.2
Dannevirke	34,395.2	7	2.3	1.3	0.6	0.5	0.2	0.2
Bulls	9,085.6	13.3	7.3	4	1.4	0.5	0.1	0.1
Tangimoana	9,602.2	11.8	4.7	2.4	0.9	0.5	0.1	0.1
Hunterville	55,534.7	3	1.4	0.7	0.3	0.2	0.1	0.2
Shannon	7,725	5.5	5.1	5.8	3.1	0.8	0.1	0.1
Koitiata	908.1	11.2	7.9	4.5	0.6	0.3	0.1	0.2
Ōhau	2,857.8	8.7	5.7	2.8	0.8	0.6	0.1	0.1
Hokio Beach	2,923.4	10.6	9.4	6.6	1.8	0.7	0	0.1
Bunnythorpe	8,837.9	7.9	4.1	2.7	1.1	0.6	0.1	0
Eketāhuna	37,977.3	5.4	2.4	1	0.4	0.3	0.1	0
Mangaweka	25,542.3	2.6	1.1	0.4	0.1	0.1	0.1	0.2
Ōwhango	21,112.2	1.7	0.7	0.3	0.1	0.1	0	0.1
Ōhura	24,006.2	2.9	1.5	0.7	0.3	0.2	0.2	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.5	1.9	0.9	0.3	0.3	0.1	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	6.7	5.1	3.6	2.4	2.1	0.7	0.2
Pahiatua	56,300.9	3.3	1.8	0.8	0.3	0.3	0.1	0.1
Ashhurst	9,723	6.4	3.8	1.9	0.7	0.6	0.3	0.2
Himatangi Beach	1,181.1	14.2	12.3	4.9	2.4	1.4	0	-
Taihape	66,124.7	2.7	1.4	0.6	0.2	0.2	0.1	0.1
Waitārere Beach	13.3	8.5	9.3	6.7	1	-	-	-
Raetihi	153,110.1	0.5	0.2	0.1	0	0	0	0
Manakau	5,969.4	7.4	3.7	2.3	0.9	0.3	0	0
Sanson	3,977.1	6.2	4.1	2.3	0.8	0.4	0	0
Linton	9,076.6	5.3	3.3	1.9	0.8	0.7	0.2	0.1
Ohakea	1,988.8	16.4	5.5	1.9	0.4	0.1	0	0
Norsewood	5,388.4	8.3	2.5	1	0.4	0.4	0.2	0.2
Tokomaru	5,474	5.6	4.4	5.5	3.2	1.1	0.1	0
Waiouru	2,552.9	5.2	2.4	1	0.3	0.2	0.1	0.1
National Park	4,186.3	5.3	1.3	0.5	0.3	0.2	0.1	0.1
Waikawa Beach	270	12.1	7.9	3.6	1.1	0.5	0.2	-
Mangatainoka	2,846.3	4.6	3.1	2.1	1.3	2.4	2.4	16.7
Ormondville	15,472.3	3.6	1.3	0.7	0.3	0.3	0.2	0.4
Rongotea	9,950.9	10.8	6.5	4.5	1.9	2.3	1.5	0.2
Rātana	1,699.3	7.8	4.9	2.4	1.2	0.9	0.2	0.5
Halcombe	20,547.4	6.2	3.9	2.5	1.1	0.7	0.3	0.1
Kimbolton	9,408.6	4.1	2.2	1.2	0.4	0.3	0.1	0.1
Rangataua	6,946.1	2.3	0.6	0.3	0.1	0.1	0	0
Raurimu	2,159.8	4.9	1.8	0.8	0.4	0.4	0.2	0.3
Kai Iwi	9,060.1	3.4	2.6	1.6	0.6	0.6	0.2	0.2
Other property use type								
Whanganui	1,392.5	6.6	3.4	2.5	1.3	0.6	0.2	0.4
Palmerston North	5,568.9	4.2	2.6	2	1.2	1	0.4	0.2
Feilding	476.3	12.6	6.6	2.2	0.6	0.3	0.1	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.5	1.7	0.7	0.2	0.1	0.1	0.1
Ohakune	2,300.5	1	0.5	0.3	0.2	0.1	0	0
Longburn	36.4	14.8	1.8	0.7	0.4	-	-	0
Kairanga	29.9	7.8	0.2	0.9	1.1	0.4	0	-
Levin	495.8	19.7	3.1	1.2	1.7	0.9	0.1	0
Woodville	73.1	16.1	0.5	0.5	0.3	0.3	1	23
Foxton	594.5	14.1	8.3	4.8	0.5	0	-	0
Foxton Beach	309.8	9.3	5.8	4	5.1	0.2	-	-
Taumarunui	503.9	2.2	1.2	1	0.5	0.9	0.3	0.5
Dannevirke	855.3	7	1.7	0.7	0.3	0.3	0.1	0
Bulls	223.2	12.1	3.9	1.9	1.4	0.5	0.1	0
Tangimoana	421.8	7.4	4.7	0.9	0.4	0.5	0.3	0
Hunterville	2,173.7	1.1	0.6	0.3	0.1	0.2	0.1	0.1
Shannon	2,594	1.1	0.5	0.2	0.1	0.1	0	0
Koitiata	64.1	21.5	14.3	3.7	0.9	0.1	-	-
Ōhau	35.6	6.1	2	0.7	-	-	-	-
Hokio Beach	857.5	14	17.1	3.4	2.5	6.3	0	0
Bunnythorpe	80.9	8.6	2.2	1.2	0.7	1	0.4	0
Eketāhuna	1,475.7	0.5	0.2	0.1	0	0.1	0.1	0
Mangaweka	252	3.5	0.7	0.3	0.2	0.2	0.3	0.7
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.2	0.4	0.1	0.1	0.1	0.1	0
Pohangina	882.3	3.4	1.8	0.8	0.4	0.3	0	0
Mangamutu	26	2.6	3.6	1.7	-	-	-	-
Pahiatua	2,893.9	0.8	0.3	0.1	0	0.1	0	0
Ashhurst	115.4	6	2	1.3	0.8	0.6	0	-
Himatangi Beach	59.4	2.1	0.8	1	0.6	0.7	0	-
Taihape	2,174.7	4	1.8	0.6	0.3	0.2	0.1	0
Waitārere Beach	24.3	5.6	2.8	0.7	1.7	-	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	3.9	2.4	1.7	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	4.4	1.7	0.4	0	-	0	-
Linton	426.8	12	2.8	3.2	1.6	2.5	0.9	1.7
Ohakea	56.4	7.6	2.4	1.7	0.1	-	-	-
Norsewood	148.5	1.9	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.5	1	0.3	0.1	0	0	0
Waiouru	2.1	6.2	9.5	1	0	-	-	-
National Park	1,051.5	1.3	0.4	0.1	0.1	0	0	0
Waikawa Beach	4.2	9.8	11.4	4.8	0.2	15.5	-	-
Mangatainoka	178	3.3	1.8	1	0.9	1.3	0.1	0
Ormondville	889.7	2.9	1.8	3.3	0.9	0.6	0.3	0.2
Rongotea	137.6	0.3	1.4	1	0	-	-	-
Rātana	25.6	5.7	1.3	1	0.1	0.2	0	0.6
Halcombe	913.2	5.5	2.5	2.5	0.8	0.6	0.2	0.7
Kimbolton	334.7	0.1	0.1	-	-	0.2	0	-
Rangataua	766.7	3.2	1.6	0.9	0.3	0.3	0.1	0
Raurimu	190.1	3.3	2.1	1.4	0.1	0.1	0.1	0.1
Kai Iwi	148.2	3.3	3.9	1.8	1.3	0.9	0.1	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.3: Percentage of hectares of property use type flooded for town/settlement for 2% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.2	3.7	2	0.5	0.2	0.1	0
Palmerston North	3,060.7	8.7	5.2	2.6	0.9	0.5	0.1	0
Feilding	1,015.1	12.8	1.5	1	0.5	0.2	0	0
Marton	365.7	12.5	4.1	1	0.3	0.4	0.1	0
Ohakune	272.9	8.3	2.9	1.5	0.4	0.4	0	-
Longburn	46.1	6.8	2.9	0.3	-	-	-	-
Kairanga	45.4	20.4	8.5	1.9	0.2	0	0	-
Levin	1,280.1	23.4	3.1	0.6	0.1	0.1	0	-
Woodville	119.2	14.4	4.4	4	2.4	5.5	2	3.5
Foxton	227.8	16.4	11.8	5.6	0.5	0.2	0	0
Foxton Beach	182.5	15.8	9.9	2.2	0.5	0.1	-	-
Taumarunui	292.6	7.2	4.4	2.3	1.1	0.6	0.3	0.6
Dannevirke	346.6	9.1	1.3	0.4	0.2	0.1	0	-
Bulls	172.2	15.9	5.4	1.6	0.3	0.1	-	-
Tangimoana	38.6	19.3	18.3	4.8	0.3	-	-	-
Hunterville	163.2	6.8	4.1	1.8	0.5	0.3	0	0
Shannon	118.1	5.2	1.4	0.5	0.2	0.1	-	-
Koitiata	9.2	6.4	8.6	12.8	5	0.5	-	-
Ōhau	223.5	8.9	1.2	0.6	0.2	0.2	-	-
Hokio Beach	64	9.4	5.8	2.2	1	0.1	-	-
Bunnythorpe	132.8	6.5	2.6	1.2	0.2	0.4	0.1	-
Eketāhuna	91.5	9.4	1.9	0.3	0.1	0	0	0
Mangaweka	21.7	14.1	1.2	0.1	0.6	0.1	-	-
Ōwhango	24.1	10.6	1.4	2.1	1.1	1.7	0.4	-
Ōhura	31.9	11.3	8.6	5	0.8	0	-	-
Pohangina	23.7	7.6	1.7	0.5	0	0	-	-
Pongaroa	16.6	9.1	6.2	2.5	1.6	0.7	0.3	-
Mangamutu	13.6	11.9	3.1	-	-	-	-	-
Pahiatua	213.1	17.5	6.6	1.5	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	16.2	3.1	0.4	0.1	0	-	-
Himatangi Beach	50.7	9.7	4.1	0.7	-	-	-	-
Taihape	297.3	3.3	1.2	0.4	0.2	0.2	0.1	0.1
Waitārere Beach	111.8	6.2	6.4	6.3	2	0.4	-	-
Raetihi	101.9	9.1	4	3.2	1.2	0.9	0	-
Manakau	115.9	14.4	4.1	1.6	0.2	0.1	-	-
Sanson	58.6	8.9	3.4	2.4	0.8	0	-	-
Linton	44.7	5.8	2.1	1.7	0.7	0.1	-	-
Ohakea	9.9	12	0.8	0.5	-	-	-	-
Norsewood	27.5	9.6	3.8	1.5	-	-	-	-
Tokomaru	58.1	6.7	1.4	1.2	0	0	0.2	-
Waiouru	8.4	8.6	0.7	0.2	-	-	-	-
National Park	139.3	2.2	1.7	0.4	0.4	0.7	0.3	-
Waikawa Beach	59.7	9	7.3	1.6	0.1	0	-	-
Mangatainoka	20.2	7.4	6.9	2.6	0.4	1	1.7	3.5
Ormondville	40.5	11.6	1.3	0.6	0.1	0	-	-
Rongotea	110	8.8	4.7	2	0	0	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	8.1	4.2	0.9	0.1	0.1	-	-
Kimbolton	52.5	5.2	4.6	0.3	-	1.4	-	-
Rangataua	28.5	9	2.1	0	-	-	-	-
Raurimu	16.9	6	1.2	0.5	0.1	0.2	-	-
Kai Iwi	38.6	6.2	2.8	0.9	2.5	0.3	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	12.2	7.8	2.9	0.8	2	0.4	0
Palmerston North	686.1	12.3	6.7	3.7	1.7	1.6	0.7	1.5
Feilding	170.9	23.2	8.9	2.1	0.7	0.2	0.1	-
Marton	213.9	11.4	10.9	15.5	5.3	1.1	0.4	1
Ohakune	22.4	10.6	6.5	2.6	1	0.8	0	-
Longburn	60.8	17.4	5.8	1.4	0.1	0	0	0
Kairanga	8	15	10.1	1.4	0.1	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	54.3	3.4	0.3	0.4	0.3	-	-
Woodville	12.5	7	1.8	6.5	5.1	5.4	13.4	9.6
Foxton	41.4	20	11.4	1.6	0	0	-	-
Foxton Beach	0.8	17.5	7.5	0	-	-	-	-
Taumarunui	37.9	10.3	3.3	0.7	0.1	0.1	0.1	0.1
Dannevirke	129.7	10.2	2.6	1.2	0.6	0.7	0.4	0.1
Bulls	53.9	12.6	6.6	3.3	1.3	0.7	0.3	0.7
Tangimoana	4.1	18.8	1.5	0	-	-	-	-
Hunterville	23.4	12.9	4	0.6	0.1	0.2	-	-
Shannon	24.9	11.2	3.5	1	-	-	-	0.1
Ōhau	7.2	12.1	3.2	1.4	1.2	6	7.8	0.3
Hokio Beach	50	15.6	8.2	2.6	-	-	-	-
Bunnythorpe	20.9	12.7	2.2	0.4	-	-	-	-
Eketāhuna	14	13.4	1.9	0.1	-	-	-	-
Mangaweka	10.3	21.7	6	1.4	0.6	0.4	0	-
Ōwhango	2.4	12.5	5	0.4	0.4	-	-	-
Ōhura	1.2	5.8	4.2	4.2	-	0	-	-
Pongaroa	2.5	12.4	22	2.4	1.2	-	-	-
Mangamutu	15.3	22.1	13.1	4.4	-	-	-	-
Pahiatua	17.7	18.5	5.8	0.4	-	-	-	-
Ashhurst	19.8	13	13.3	13.9	6.3	2.5	0.8	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.2	2.2	0.7	0.3	0.5	-	-
Waitārere Beach	0.4	17.5	25	2.5	-	-	-	-
Raetihi	13.2	9.2	3.1	0.8	0.1	0.1	-	-
Manakau	0.3	10	3.3	3.3	6.7	0	-	-
Sanson	10.2	19.9	2	0.5	0.3	-	-	-
Linton	5.2	8.3	2.7	1	-	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.7	0.1	-	-	-	-	-
Waiouru	5.6	7.9	3.4	0.5	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	5.5	5.6	-	-	-	-
Mangatainoka	4.7	14.5	4.9	0	-	-	-	-
Ormondville	5.1	3.7	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	5.5	4	5.7	9.9	14.3	2.6	5.9
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	7.5	3.3	5.8	2.5	-	-	-
Rural property use type								
Whanganui	9,193.7	9	5.1	3.1	1.1	0.8	0.2	0
Palmerston North	14,029.6	6.2	3.9	2.5	1.3	1.5	0.6	0.9
Feilding	7,528	9.9	5.1	3.1	1.5	1	0.2	0.1
Marton	27,105.7	8.6	3.8	1.7	0.7	0.6	0.2	0.2
Ohakune	44,184.2	1.6	0.7	0.3	0.1	0.1	0	0
Longburn	1,302.6	14.4	11.1	5.6	1.7	3.3	1.7	1.8
Kairanga	6,733.2	17.6	15.2	7.4	3.4	4.8	0.3	0.1
Levin	7,837.6	12.7	2.6	1.7	0.9	0.6	0.1	0
Woodville	10,615.9	5.4	2.5	1.6	1.1	1.8	1.9	15.8
Foxton	11,957.6	17.2	8.2	4.6	1.3	1.7	1.7	0.9
Foxton Beach	861.7	10.5	10.3	17.1	10.2	2.7	0.2	0.5
Taumarunui	12,241.3	2.3	1.3	0.6	0.4	0.5	0.3	0.4
Dannevirke	34,395.2	7.4	2.4	1.3	0.6	0.6	0.3	0.3
Bulls	9,085.6	13.9	7.4	4.1	1.5	0.7	0.2	0.1
Tangimoana	9,602.2	12.2	5	2.3	1	0.9	0.2	0.1
Hunterville	55,534.7	3.1	1.5	0.7	0.3	0.2	0.1	0.2
Shannon	7,725	5.9	6.2	5.4	2.3	0.7	0.1	0.1
Koitiata	908.1	12	8.2	5.7	0.8	0.4	0.1	0.3
Ōhau	2,857.8	8.8	6.1	3.2	1.1	1	0.2	0.1
Hokio Beach	2,923.4	10.5	9.4	7.3	2.1	1.1	0	0.1
Bunnythorpe	8,837.9	8.3	3.9	2.8	1.3	0.8	0.2	0
Eketāhuna	37,977.3	5.5	2.5	1.1	0.4	0.3	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	2.7	1.1	0.4	0.1	0.1	0.1	0.2
Ōwhango	21,112.2	1.7	0.7	0.4	0.1	0.1	0.1	0.1
Ōhura	24,006.2	3	1.6	0.7	0.3	0.3	0.2	0.2
Pohangina	26,177.4	3.5	2	1.1	0.4	0.4	0.1	0.1
Pongaroa	57,773.7	2.2	0.9	0.4	0.2	0.2	0.1	0.2
Mangamutu	1,464.7	6.7	5.4	4	2.4	2.6	0.8	0.9
Pahiatua	56,300.9	3.5	2	0.9	0.4	0.3	0.2	0.1
Ashhurst	9,723	6.4	3.9	2.2	1	0.7	0.3	0.2
Himatangi Beach	1,181.1	14	13.2	5.7	2.1	2.1	0	-
Taihape	66,124.7	2.7	1.4	0.6	0.2	0.2	0.1	0.1
Waitārere Beach	13.3	6.1	11.1	6.8	1.7	-	-	-
Raetihi	153,110.1	0.5	0.2	0.1	0	0	0	0
Manakau	5,969.4	7.8	3.9	2.7	1.1	0.5	0	0
Sanson	3,977.1	6.3	4.2	2.6	0.9	0.5	0.1	0
Linton	9,076.6	5.4	3.4	1.8	0.6	0.8	0.3	0.1
Ohakea	1,988.8	16.6	5.1	4	1.3	0.4	0.1	0
Norsewood	5,388.4	8.6	2.6	1	0.4	0.4	0.2	0.2
Tokomaru	5,474	6.5	4.2	4.2	2.6	1.4	0.2	0
Waiouru	2,552.9	5.3	2.5	1.1	0.3	0.2	0.1	0.1
National Park	4,186.3	5.5	1.3	0.6	0.3	0.3	0.1	0.1
Waikawa Beach	270	12.2	8.5	4	1.6	0.7	0.2	-
Mangatainoka	2,846.3	4.6	3	2.1	1.2	1.7	2	19.6
Ormondville	15,472.3	3.7	1.3	0.7	0.3	0.4	0.2	0.4
Rongotea	9,950.9	11.6	5.4	3.5	1.8	1.9	0.2	0
Rātana	1,699.3	7.8	5.1	2.4	1.4	1.1	0.3	0.5
Halcombe	20,547.4	6.3	3.9	2.6	1.3	0.9	0.3	0.2
Kimbolton	9,408.6	4.3	2.2	1.3	0.5	0.4	0.1	0.1
Rangataua	6,946.1	2.4	0.6	0.4	0.1	0.1	0	0
Raurimu	2,159.8	5.1	1.8	0.8	0.5	0.4	0.2	0.4
Kai Iwi	9,060.1	3.5	2.5	1.6	0.7	0.6	0.3	0.3
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	6.7	3.4	2.8	1.5	1.1	0.5	0.5
Palmerston North	5,568.9	4.2	2.7	1.8	1.1	1.6	0.5	0.3
Feilding	476.3	10.8	6	4.8	1.3	0.4	0.1	0.1
Marton	1,724.2	3.6	1.7	0.8	0.2	0.2	0.1	0.1
Ohakune	2,300.5	1	0.4	0.3	0.2	0.2	0	0
Longburn	36.4	1.6	1.6	0.6	0.2	-	-	0
Kairanga	29.9	8.1	0.3	0.7	1	0.4	0	0
Levin	495.8	20.7	3.4	1.3	1.3	1.4	0.2	0
Woodville	73.1	18.7	0.7	0.3	0.3	0.4	0.1	23.8
Foxton	594.5	14	8.7	5.1	0.7	0.3	0.1	0
Foxton Beach	309.8	8.4	7.8	4.7	5.6	0.3	-	-
Taumarunui	503.9	2.3	1.1	1.2	0.6	1	0.9	0.8
Dannevirke	855.3	7.5	1.8	0.7	0.4	0.3	0.1	0
Bulls	223.2	12.9	4.4	2.1	1.2	1.6	0.2	0.1
Tangimoana	421.8	8	5.1	0.8	0.3	0.7	0.3	0.1
Hunterville	2,173.7	1.1	0.6	0.3	0.2	0.2	0.1	0.1
Shannon	2,594	1.1	0.5	0.2	0.1	0.1	0	0
Koitiata	64.1	21.6	15.8	3.7	1.3	0.1	-	-
Ōhau	35.6	6.4	2.4	1	0	-	-	-
Hokio Beach	857.5	13.5	18.6	3.6	2	7	0.3	0
Bunnythorpe	80.9	10	2.3	1.2	0.7	1	0.4	0.1
Eketāhuna	1,475.7	0.6	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	3.6	0.7	0.3	0.2	0.1	0.2	0.9
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.2	0.5	0.1	0.1	0.1	0.1	0
Pohangina	882.3	3.5	1.8	0.8	0.4	0.4	0	0
Pongaroa	3,913	3.4	1.4	0.4	0.1	0.2	0.1	0.1
Mangamutu	26	2.5	4	1.7	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.1	0.1	0.1	0	0
Ashhurst	115.4	6.6	2.2	1.7	0.7	0.8	0.2	-
Himatangi Beach	59.4	2.1	1	1	0.7	0.8	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4.1	1.8	0.7	0.3	0.2	0.1	0
Waitārere Beach	24.3	5.6	3	1.1	1.7	-	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	3.9	1.9	2.3	0.6	0.3	0	-
Sanson	55.8	4.5	1.8	0.4	0	-	0	-
Linton	426.8	13.1	2.6	2	1.9	2.3	1.9	2.1
Ohakea	56.4	8	2.5	1.9	0.1	-	-	-
Norsewood	148.5	2	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0	0	0
Waiouru	2.1	6.2	6.2	3.3	1.4	-	-	-
National Park	1,051.5	1.4	0.4	0.1	0.1	0	0	0
Waikawa Beach	4.2	8.3	12.9	5.7	0.5	10	5.5	-
Mangatainoka	178	3.2	2.1	0.8	0.5	1.5	0.8	0
Ormondville	889.7	3	1.6	3	1.5	0.8	0.3	0.4
Rongotea	137.6	0.9	0.5	1	0.1	0	-	-
Rātana	25.6	6	1.4	1.2	0.3	0.3	0.2	0.6
Halcombe	913.2	5.7	2.5	2.3	1	0.7	0.3	0.8
Kimbolton	334.7	0.1	0.1	-	-	-	0.2	0
Rangataua	766.7	3.3	1.6	1	0.4	0.3	0.1	0
Raurimu	190.1	3.5	2.3	1.6	0.1	0	0.1	0.1
Kai Iwi	148.2	3.6	3.2	2.6	1.3	0.9	0.1	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.4: Percentage of hectares of property use type flooded for town/settlement for 2% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.2	3.7	2	0.5	0.1	0.1	0
Palmerston North	3,060.7	9.1	3.9	1.5	0.6	0.5	0.1	0
Feilding	1,015.1	16.9	3	0.8	0.4	0.3	0	0
Marton	365.7	12.7	4.4	1	0.3	0.4	0.1	0
Ohakune	272.9	8.3	2.9	1.5	0.4	0.4	0	-
Longburn	46.1	10	7.5	3.6	1.6	0.3	-	-
Kairanga	45.4	25.6	14.2	5.4	0.2	1.1	0.3	0
Levin	1,280.1	23.4	3.1	0.6	0.1	0.1	0	-
Woodville	119.2	14.9	4.5	4	2.4	5.3	2.2	3.5
Foxton	227.8	16.4	11.7	5.6	0.6	0.1	0	-
Foxton Beach	182.5	16	8.9	2.1	0.4	0	-	-
Taumarunui	292.6	7.2	4.3	2.2	1	0.5	0.3	0.6
Dannevirke	346.6	9.1	1.3	0.4	0.2	0.1	0	-
Bulls	172.2	15.9	5.5	1.7	0.3	0.1	0	-
Tangimoana	38.6	17.8	22.6	12.2	0.7	-	-	-
Hunterville	163.2	6.9	5.3	2.5	0.7	0.5	0.1	0
Shannon	118.1	5.2	1.4	0.9	0.2	0.1	-	-
Koitiata	9.2	6.4	8.6	12.8	5	0.5	-	-
Ōhau	223.5	8.8	1.2	0.6	0.2	0.2	-	-
Hokio Beach	64	9.4	5.8	2.2	1	0.1	-	-
Bunnythorpe	132.8	6.5	2.6	1.2	0.2	0.4	0.1	-
Eketāhuna	91.5	9.4	1.9	0.3	0.1	0	0	0
Mangaweka	21.7	14.1	1.2	0.1	0.6	0.1	-	-
Ōwhango	24.1	10.6	1.4	2.1	1.1	1.7	0.4	-
Ōhura	31.9	11.3	8.6	5	0.8	0	-	-
Pohangina	23.7	7.6	1.7	0.5	0	0	-	-
Mangamutu	13.6	11.9	3.1	-	-	-	-	-
Pahiatua	213.1	17.5	6.6	1.5	0.1	0.1	0	0.1
Ashhurst	179.3	14.5	2.5	0.3	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	9.7	4.1	0.7	-	-	-	-
Taihape	297.3	3.3	1.2	0.4	0.2	0.2	0.1	0.1
Waitārere Beach	111.8	6.2	6.4	6.3	2	0.4	-	-
Raetihi	101.9	9.1	4	3.2	1.2	0.9	0	-
Manakau	115.9	14.4	4.1	1.6	0.2	0.1	-	-
Sanson	58.6	8.9	3.4	2.4	0.8	0	-	-
Linton	44.7	6.3	2.4	1.8	0.8	0.4	0.1	-
Ohakea	9.9	12.1	0.8	0.5	-	-	-	-
Norsewood	27.5	9.6	3.8	1.5	-	-	-	-
Tokomaru	58.1	7.2	1	1.1	0	0	0.2	-
Waiouru	8.4	8.6	0.7	0.2	-	-	-	-
National Park	139.3	2.2	1.7	0.4	0.4	0.7	0.3	-
Waikawa Beach	59.7	9	7.3	1.6	0.1	0	-	-
Mangatainoka	20.2	7.4	6.9	2.6	0.4	1	1.7	3.5
Ormondville	40.5	11.6	1.3	0.6	0.1	0	-	-
Rongotea	110	9.1	5.9	2.2	0.2	0.7	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	8	4.2	0.9	0.1	0.1	-	-
Kimbolton	52.5	5.2	4.6	0.3	-	1.4	-	-
Rangataua	28.5	9	2.1	0	-	-	-	-
Raurimu	16.9	6	1.2	0.5	0.1	0.2	-	-
Kai Iwi	38.6	6.2	2.8	0.9	2.5	0.3	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	13.1	6.4	1.6	0.7	2	0.4	0
Palmerston North	686.1	12.8	6.4	3.3	0.8	1.6	0.6	1.5
Feilding	170.9	28.6	12.8	2.6	0.9	0.2	0	-
Marton	213.9	8.2	8.3	20.1	9.1	4.2	0.6	0.9
Ohakune	22.4	10.6	6.5	2.6	1	0.8	0	-
Longburn	60.8	21.9	28.7	10.3	1.1	1.1	0	0
Kairanga	8	16.8	15.8	1.6	0.5	-	-	-
Levin	180.9	54.3	3.4	0.3	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	7.7	1.7	6.3	5.3	5.1	14.5	8.8
Foxton	41.4	18.5	13.1	3.2	1.6	0.7	-	-
Foxton Beach	0.8	16.2	7.5	0	-	-	-	-
Taumarunui	37.9	10.3	3.3	0.7	0.1	0.1	0.1	0.1
Dannevirke	129.7	10.2	2.6	1.2	0.6	0.7	0.4	0.1
Bulls	53.9	12.6	6.7	3.3	1.4	0.6	0.3	0.7
Tangimoana	4.1	18	1.2	0	-	-	-	-
Hunterville	23.4	13.9	4.9	1.4	0.3	0.3	-	-
Shannon	24.9	7.4	8.9	10.2	4.9	0.1	-	0.1
Ōhau	7.2	12.1	3.2	1.4	1.2	6	7.8	0.3
Hokio Beach	50	15.6	8.2	2.6	-	-	-	-
Bunnythorpe	20.9	12.7	2.2	0.4	-	-	-	-
Eketāhuna	14	13.4	1.9	0.1	-	-	-	-
Mangaweka	10.3	21.7	6	1.4	0.6	0.4	0	-
Ōwhango	2.4	12.5	5	0.4	0.4	-	-	-
Ōhura	1.2	5.8	4.2	4.2	-	0	-	-
Mangamutu	15.3	21.6	8.2	5.4	-	-	-	-
Pahiatua	17.7	18.6	5.8	0.4	-	-	-	-
Ashhurst	19.8	17.7	12.4	7.3	1	2.5	0.7	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.2	2.2	0.7	0.3	0.5	-	-
Waitārere Beach	0.4	17.5	25	2.5	-	-	-	-
Raetihi	13.2	9.2	3.1	0.8	0.1	0.1	-	-
Manakau	0.3	10	3.3	3.3	6.7	0	-	-
Sanson	10.2	19.9	2	0.5	0.3	-	-	-
Linton	5.2	7.9	2.9	0.6	-	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.7	0.1	-	-	-	-	-
Waiouru	5.6	7.9	3.4	0.5	-	-	-	-
National Park	18.3	3.9	5.5	5.6	-	-	-	-
Mangatainoka	4.7	14.5	4.9	0	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	3.7	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Halcombe	28.3	5.7	5.1	11.6	10.2	3.4	1.8	5.5
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	7.5	3.3	5.8	2.5	-	-	-
Rural property use type								
Whanganui	9,193.7	9	5.1	3.1	1.1	0.8	0.2	0
Palmerston North	14,029.6	6.1	4.5	3.1	1.7	1.8	0.6	0.9
Feilding	7,528	10.5	5.6	3.1	1.5	1	0.2	0.1
Marton	27,105.7	8.5	3.8	1.8	0.7	0.5	0.1	0.2
Ohakune	44,184.2	1.6	0.7	0.3	0.1	0.1	0	0
Longburn	1,302.6	18.3	16.2	7.7	2.6	4.7	2	1.6
Kairanga	6,733.2	14.7	15.3	8.8	4	6.2	4.6	4
Levin	7,837.6	12.7	2.5	1.7	0.9	0.6	0.1	0
Woodville	10,615.9	5.5	2.5	1.6	1.1	1.8	1.9	15.8
Foxton	11,957.6	17.1	8	4.9	2.4	2.8	0.6	0.1
Foxton Beach	861.7	12.1	12.6	20.4	2.9	1.3	0	0.5
Taumarunui	12,241.3	2.3	1.3	0.6	0.4	0.5	0.3	0.4
Dannevirke	34,395.2	7.4	2.4	1.3	0.6	0.6	0.3	0.3
Bulls	9,085.6	13.8	7.4	4.6	1.8	0.8	0.2	0.1
Tangimoana	9,602.2	12.3	5	2.5	1	0.7	0.1	0.1
Hunterville	55,534.7	3.1	1.5	0.7	0.3	0.2	0.1	0.2
Shannon	7,725	5.2	4.6	5.2	4	2.6	0.2	0.1
Koitiata	908.1	12	8.2	5.8	0.8	0.3	0.1	0.3
Ōhau	2,857.8	8.8	6.2	3.4	1	0.8	0.1	0.1
Hokio Beach	2,923.4	10.5	9.4	7.3	2.1	1.1	0	0.1
Bunnythorpe	8,837.9	8.3	4.1	2.8	1.3	0.8	0.2	0
Eketāhuna	37,977.3	5.5	2.5	1.1	0.4	0.3	0.1	0.1
Mangaweka	25,542.3	2.7	1.1	0.4	0.1	0.1	0.1	0.2
Ōwhango	21,112.2	1.7	0.7	0.4	0.1	0.1	0.1	0.1
Ōhura	24,006.2	3	1.6	0.7	0.3	0.3	0.2	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.5	2	1.1	0.4	0.4	0.1	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	6.5	5.4	4.2	2.6	2.7	0.8	0.9
Pahiatua	56,300.9	3.5	2	0.9	0.4	0.3	0.2	0.1
Ashhurst	9,723	6.6	4.1	2.5	1.1	0.7	0.3	0.3
Himatangi Beach	1,181.1	14	13.2	5.7	2.1	2.1	0	-
Taihape	66,124.7	2.7	1.4	0.6	0.2	0.2	0.1	0.1
Waitārere Beach	13.3	6.1	11.1	6.8	1.7	-	-	-
Raetihi	153,110.1	0.5	0.2	0.1	0	0	0	0
Manakau	5,969.4	7.8	3.9	2.7	1.1	0.5	0	0
Sanson	3,977.1	6.3	4.2	2.6	0.9	0.5	0.1	0
Linton	9,076.6	5.4	3.3	2	1	0.9	0.2	0.1
Ohakea	1,988.8	16.5	5.3	4.1	1	0.3	0.1	0
Norsewood	5,388.4	8.6	2.6	1	0.4	0.4	0.2	0.2
Tokomaru	5,474	5.5	4	5.6	3.4	2.3	0.2	0
Waiouru	2,552.9	5.3	2.5	1.1	0.3	0.2	0.1	0.1
National Park	4,186.3	5.5	1.3	0.6	0.3	0.3	0.1	0.1
Waikawa Beach	270	12.2	8.5	4	1.6	0.7	0.2	-
Mangatainoka	2,846.3	4.6	3	2.1	1.2	1.7	2	19.6
Ormondville	15,472.3	3.7	1.3	0.7	0.3	0.4	0.2	0.4
Rongotea	9,950.9	11.2	6.6	4.8	2.1	2.4	1.6	0.3
Rātana	1,699.3	7.8	5.1	2.4	1.4	1.1	0.3	0.5
Halcombe	20,547.4	6.4	3.9	2.6	1.3	0.9	0.3	0.2
Kimbolton	9,408.6	4.3	2.2	1.3	0.5	0.4	0.1	0.1
Rangataua	6,946.1	2.4	0.6	0.4	0.1	0.1	0	0
Raurimu	2,159.8	5.1	1.8	0.8	0.5	0.4	0.2	0.4
Kai Iwi	9,060.1	3.5	2.5	1.6	0.7	0.6	0.3	0.3
Other property use type								
Whanganui	1,392.5	6.7	3.4	2.9	1.5	1.1	0.5	0.5
Palmerston North	5,568.9	4.2	2.7	1.8	1.2	1.7	0.7	0.4
Feilding	476.3	13.1	7.8	2.9	0.7	0.4	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.6	1.7	0.8	0.2	0.2	0.1	0.1
Ohakune	2,300.5	1	0.4	0.3	0.2	0.2	0	0
Longburn	36.4	20.2	5.5	0.7	0.5	0	-	0
Kairanga	29.9	7.9	0.1	0.8	1	0.6	0	-
Levin	495.8	20.7	3.4	1.3	1.3	1.4	0.2	0
Woodville	73.1	17.4	0.5	0.3	0.3	0.4	0.1	23.8
Foxton	594.5	14.1	8.7	5.1	0.6	0.1	-	0
Foxton Beach	309.8	8.6	6.4	4.2	5.6	0.2	-	-
Taumarunui	503.9	2.3	1.3	0.8	0.3	1	0.9	0.8
Dannevirke	855.3	7.5	1.8	0.7	0.4	0.3	0.1	0
Bulls	223.2	12.9	4.4	2.1	1.2	1.6	0.2	0.1
Tangimoana	421.8	8.1	5	1.1	0.2	0.7	0.3	0
Hunterville	2,173.7	1.1	0.6	0.3	0.2	0.2	0.1	0.1
Shannon	2,594	1.1	0.5	0.2	0.1	0.1	0	0
Koitiata	64.1	21.6	15.8	3.7	1.3	0.1	-	-
Ōhau	35.6	6.4	2.4	1	0	-	-	-
Hokio Beach	857.5	13.5	18.6	3.6	2	7	0.3	0
Bunnythorpe	80.9	10.1	2.5	1.3	0.9	1	0.4	0.1
Eketāhuna	1,475.7	0.6	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	3.6	0.7	0.3	0.2	0.1	0.2	0.9
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.2	0.5	0.1	0.1	0.1	0.1	0
Pohangina	882.3	3.5	1.8	0.8	0.4	0.4	0	0
Mangamutu	26	2.5	4	1.7	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.1	0.1	0.1	0	0
Ashhurst	115.4	6.6	2.1	1.8	0.7	0.8	0.2	-
Himatangi Beach	59.4	2.1	1	1	0.7	0.8	0	-
Taihape	2,174.7	4.2	1.8	0.7	0.3	0.2	0.1	0
Waitārere Beach	24.3	5.6	3	1.1	1.7	-	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	3.9	1.9	2.3	0.6	0.3	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	4.5	1.8	0.4	0	-	0	-
Linton	426.8	13.1	2.7	2.2	1.9	2.3	1.8	2.1
Ohakea	56.4	8	2.5	1.9	0.1	-	-	-
Norsewood	148.5	2	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0	0	0
Waiouru	2.1	6.2	6.2	3.3	1.4	-	-	-
National Park	1,051.5	1.4	0.4	0.1	0.1	0	0	0
Waikawa Beach	4.2	8.3	12.9	5.7	0.5	10	5.5	-
Mangatainoka	178	3.2	2.1	0.8	0.5	1.5	0.8	0
Ormondville	889.7	3	1.6	3	1.5	0.8	0.3	0.4
Rongotea	137.6	0.2	1.5	1	0	-	-	-
Rātana	25.6	6	1.4	1.2	0.3	0.3	0.2	0.6
Halcombe	913.2	5.7	2.5	2.3	1	0.7	0.3	0.8
Kimbolton	334.7	0.1	0.1	-	-	-	0.2	0
Rangataua	766.7	3.3	1.6	1	0.4	0.3	0.1	0
Raurimu	190.1	3.5	2.3	1.6	0.1	0	0.1	0.1
Kai Iwi	148.2	3.6	3.2	2.6	1.3	0.9	0.1	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.5: Percentage of hectares of property use type flooded for town/settlement for 1% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.4	3.9	2.3	0.6	0.3	0.1	0
Palmerston North	3,060.7	8.9	5.3	2.9	1	0.6	0.1	0
Feilding	1,015.1	13.5	1.7	0.8	0.7	0.2	0	0
Marton	365.7	12.9	4.7	1	0.3	0.4	0.2	0
Ohakune	272.9	8.5	3.2	1.6	0.5	0.4	0.1	-
Longburn	46.1	6.9	2.2	1	1.2	1	-	-
Kairanga	45.4	19.4	11.5	2.7	0.6	0.1	0	-
Woodville	119.2	13	4.9	4.5	3.5	5.7	5.4	5.4
Foxton	227.8	4.2	1.2	0	-	-	-	-
Foxton Beach	182.5	7.3	3.7	1.2	0.2	0	-	-
Taumarunui	292.6	7.4	4.4	2.6	1.1	0.9	0.3	0.7
Dannevirke	346.6	9.4	1.4	0.5	0.2	0.1	0	0
Bulls	172.2	16.3	6.1	2.2	0.3	0.1	0	-
Tangimoana	38.6	19.1	19.9	6.3	0.6	-	-	-
Hunterville	163.2	6.9	5.1	2.2	0.6	0.4	0.1	0
Koitiata	9.2	6.6	8.9	13.2	4.7	0.9	-	-
Bunnythorpe	132.8	6.7	2.6	1.3	0.2	0.4	0.1	-
Mangaweka	21.7	14.9	1.3	0	0.4	0.5	-	-
Ōwhango	24.1	10.7	1.4	2.1	1.1	1.7	0.4	-
Ōhura	31.9	11.1	9	5.4	0.9	0	-	-
Pohangina	23.7	9.5	1.6	0.8	0	0	-	-
Mangamutu	13.6	11	3.2	-	-	-	-	-
Pahiatua	213.1	3.4	1.4	1.1	0.2	0	0	0.1
Ashhurst	179.3	17.2	3.3	0.5	0.1	0	-	-
Himatangi Beach	50.7	10	4.7	0.7	-	-	-	-
Taihape	297.3	3.5	1.2	0.4	0.2	0.1	0.1	0.2
Raetihi	101.9	9.4	4.4	2.9	1.5	0.9	0	-
Sanson	58.6	9.2	3.3	1.8	1.5	0	-	-
Linton	44.7	5.8	2	1.5	0.8	0.1	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ohakea	9.9	13.9	0.8	0.5	-	-	-	-
Norsewood	27.5	9.6	3.9	1.5	-	-	-	-
Tokomaru	58.1	0.3	0.6	0.5	0	0	-	-
Waiouru	8.4	8.6	0.7	0.2	-	-	-	-
National Park	139.3	2.2	1.7	0.4	0.4	0.6	0.5	-
Mangatainoka	20.2	7.2	7	2.9	0.4	-	1	5.2
Ormondville	40.5	11.8	1.2	0.7	0.1	0	-	-
Rongotea	110	8.8	4.1	2.7	0.3	0	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	8.2	4.6	0.9	0.1	0.1	-	-
Kimbolton	52.5	5.2	4.6	0.3	-	1.4	-	-
Rangataua	28.5	9.3	2.3	0	-	-	-	-
Raurimu	16.9	6.2	1.2	0.5	0	0.3	-	-
Kai Iwi	38.6	6.1	2.9	0.9	2.5	0.4	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	12.6	8.4	3.4	0.5	2.2	0.7	0
Palmerston North	686.1	12.7	6.8	3.8	2.1	1.4	1.2	1.6
Feilding	170.9	23.3	10.5	2.8	0.8	0.2	0.1	-
Marton	213.9	9.9	9.7	14.2	11.4	2.5	0.6	1.1
Ohakune	22.4	11.2	6.3	3.1	1	0.8	0.1	-
Longburn	60.8	20.4	7.6	1.9	1	0.2	0	0
Kairanga	8	18.6	11.8	1.4	0.1	-	-	-
Woodville	12.5	8.6	3.7	2.4	2.8	10.9	5.1	22.9
Foxton	41.4	5.7	3.3	-	-	-	-	-
Foxton Beach	0.8	2.5	-	-	-	-	-	-
Taumarunui	37.9	11.1	3.5	0.7	0.1	0.2	0.1	0.1
Dannevirke	129.7	10.5	2.7	1.2	0.8	0.7	0.5	0.2
Bulls	53.9	13.2	8.7	3.2	3	2	0.4	0.9
Tangimoana	4.1	20	1.7	0	-	-	-	-
Hunterville	23.4	16.4	5.2	0.9	0.2	0.3	-	-
Bunnythorpe	20.9	13.2	2.3	0.4	0	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	10.3	23.9	6.7	1.8	0.5	0.9	0.1	0
Ōwhango	2.4	12.5	5	0.4	0.4	-	-	-
Ōhura	1.2	5.8	4.2	5	-	0	-	-
Mangamutu	15.3	24.6	12.4	5.2	-	-	-	-
Pahiatua	17.7	0.2	-	-	-	-	-	-
Ashhurst	19.8	13.4	14.6	14.3	6.6	2.2	1.4	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.3	2.4	0.7	0.4	0.6	0	-
Raetihi	13.2	10.5	3.2	0.8	0.1	0.1	-	-
Sanson	10.2	19.9	1.7	0.9	0.3	-	-	-
Linton	5.2	8.1	3.1	1.2	0.2	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Waiouru	5.6	7.9	2.9	0.9	-	-	-	-
National Park	18.3	3.9	5.5	3.3	2.2	-	-	-
Mangatainoka	4.7	15.1	4.3	0.6	-	-	-	-
Ormondville	5.1	3.7	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.8	5.4	4.7	5.6	20.2	3.6	6.3
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	6.7	5	5	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.3	5.1	3.4	1.2	0.8	0.2	0.1
Palmerston North	14,029.6	6.3	4.1	2.7	1.5	1.7	0.8	1
Feilding	7,528	10.3	5.5	3.5	1.7	1.2	0.3	0.1
Marton	27,105.7	8.6	3.9	1.9	0.8	0.7	0.2	0.2
Ohakune	44,184.2	1.7	0.7	0.4	0.1	0.1	0	0
Longburn	1,302.6	14.1	11.7	7.1	1.8	4.6	2.2	2.2
Kairanga	6,733.2	16.6	15.9	8.9	3.7	5.4	2.4	0.1
Woodville	10,615.9	5.3	2.5	1.4	1	1.5	1.7	17.5
Foxton	11,957.6	13.8	6	3	0.9	0.6	0.4	0.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Foxton Beach	861.7	9.7	9.2	3.2	1.3	0.6	0	0
Taumarunui	12,241.3	2.3	1.3	0.6	0.3	0.5	0.3	0.5
Dannevirke	34,395.2	7.7	2.5	1.4	0.7	0.6	0.3	0.3
Bulls	9,085.6	14.1	7.5	4.7	1.8	0.9	0.2	0.2
Tangimoana	9,602.2	12.5	5.2	2.6	1	1.1	0.3	0.2
Hunterville	55,534.7	3.1	1.6	0.8	0.3	0.3	0.1	0.3
Koitiata	908.1	12.4	9.5	8.1	2.2	0.4	0.2	0.3
Bunnythorpe	8,837.9	8.6	4	2.9	1.3	1	0.2	0
Mangaweka	25,542.3	2.8	1.1	0.4	0.1	0.1	0.1	0.3
Ōwhango	21,112.2	1.7	0.7	0.4	0.2	0.1	0.1	0.1
Ōhura	24,006.2	3	1.7	0.8	0.3	0.3	0.2	0.2
Pohangina	26,177.4	3.6	2.1	1.2	0.5	0.4	0.1	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	6.2	5.2	4.3	2.6	2.9	0.7	1.5
Pahiatua	56,300.9	0.8	0.4	0.2	0.1	0.1	0	0.1
Ashhurst	9,723	6.7	4.1	2.3	1.2	0.9	0.4	0.3
Himatangi Beach	1,181.1	13.8	13.7	6.2	2.1	2.5	0	-
Taihape	66,124.7	2.7	1.5	0.6	0.2	0.2	0.1	0.1
Raetihi	153,110.1	0.6	0.2	0.1	0	0	0	0
Sanson	3,977.1	6.4	4.3	2.5	1	0.6	0.1	0
Linton	9,076.6	3.4	1.8	1.1	0.4	0.7	0.4	0.1
Ohakea	1,988.8	17.1	5.4	4.2	2.3	0.8	0.1	0
Norsewood	5,388.4	8.8	2.7	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	0.7	0.4	0.2	0	0.1	0	-
Waiouru	2,552.9	5.4	2.4	1	0.3	0.3	0.1	0.1
National Park	4,186.3	5.7	1.4	0.6	0.3	0.3	0.1	0.2
Mangatainoka	2,846.3	4.7	3.1	2.2	1.1	1.6	1.4	21.3
Ormondville	15,472.3	3.7	1.3	0.7	0.3	0.4	0.2	0.4
Rongotea	9,950.9	12	5.5	3.5	2	2.1	0.5	0
Rātana	1,699.3	7.9	5.5	3.2	1.4	1.3	0.4	0.7
Halcombe	20,547.4	6.4	3.9	2.7	1.4	1.1	0.4	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Kimbolton	9,408.6	4.3	2.3	1.3	0.5	0.4	0.2	0.2
Rangataua	6,946.1	2.5	0.6	0.4	0.1	0.1	0	0
Raurimu	2,159.8	5.2	1.9	0.9	0.5	0.5	0.2	0.5
Kai Iwi	9,060.1	3.6	2.4	1.6	0.7	0.6	0.3	0.4
Other property use type								
Whanganui	1,392.5	6.9	3.7	2.4	1.4	2	0.7	0.6
Palmerston North	5,568.9	3.3	2.2	1.6	1	1.7	0.6	0.4
Feilding	476.3	11.4	5.8	5.4	1.8	0.5	0.1	0.1
Marton	1,724.2	3.6	1.8	0.8	0.2	0.2	0.1	0.1
Ohakune	2,300.5	1.1	0.4	0.4	0.2	0.2	0	0
Longburn	36.4	1.5	1.3	1.3	0.6	0.2	-	0
Kairanga	29.9	7.9	0.4	0.7	1	0.6	0	0
Woodville	73.1	19.5	0.7	0.4	0.3	0.6	0.1	23.8
Foxton	594.5	12.1	8.3	4.7	0.5	-	-	-
Foxton Beach	309.8	5.3	6.4	4.2	5.6	0.2	-	-
Taumarunui	503.9	2.2	1.2	1.6	0.9	0.7	1	1.2
Dannevirke	855.3	7.7	2	0.7	0.4	0.4	0.1	0
Bulls	223.2	12.3	4.3	2.8	1.2	2.4	0.4	0.1
Tangimoana	421.8	8.3	5.2	0.9	0.4	0.7	0.3	0.2
Hunterville	2,173.7	1.1	0.6	0.3	0.2	0.2	0.1	0.2
Koitiata	64.1	22	17.2	3.8	1.5	0.1	-	-
Bunnythorpe	80.9	10.4	2.7	1.2	0.7	1	0.6	0.1
Mangaweka	252	3.8	0.7	0.3	0.2	0.2	0.1	1.1
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.5	0.1	0.1	0.1	0.1	0
Pohangina	882.3	3.6	2	0.8	0.4	0.5	0	0
Mangamutu	26	0.6	0.5	0.2	-	-	-	-
Pahiatua	2,893.9	0.3	0.2	0.1	0	0	0	0
Ashhurst	115.4	7.1	2.6	2.5	0.8	0.7	0.4	-
Himatangi Beach	59.4	2.4	1.1	1	0.7	0.8	0.1	-
Taihape	2,174.7	4	1.8	0.8	0.3	0.2	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Sanson	55.8	5.1	1.9	0.4	0	-	0	-
Linton	426.8	13.5	2.6	1.9	1.5	2.5	2.4	2.5
Ohakea	56.4	8.3	2.7	2	0.2	-	-	-
Norsewood	148.5	2	0.7	0.6	0.2	0.3	0.2	0.3
Waiouru	2.1	6.7	6.2	3.3	0	1.4	-	-
National Park	1,051.5	1.4	0.5	0.1	0.1	0	0	0
Mangatainoka	178	3.2	2.1	0.8	0.6	0.8	1.3	0.4
Ormondville	889.7	3	1.6	2.7	1.9	0.9	0.4	0.4
Rongotea	137.6	0.9	0.7	0.8	0.3	0	-	-
Rātana	25.6	6.5	1.6	1.2	0.6	0.7	0.2	0.7
Halcombe	913.2	5.8	2.4	2.2	1.1	0.8	0.3	0.9
Kimbolton	334.7	0.1	0.1	-	-	-	0.2	0
Rangataua	766.7	3.4	1.7	1	0.5	0.3	0.1	0
Raurimu	190.1	4	2	1.6	0.3	0.1	0.1	0.1
Kai Iwi	148.2	3.4	3.4	2.5	1.3	1.2	0.1	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.6: Percentage of hectares of property use type flooded for town/settlement for 1% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.4	3.9	2.3	0.6	0.3	0.1	0
Palmerston North	3,060.7	9.5	4.6	2.1	0.8	0.8	0.1	0
Feilding	1,015.1	17.4	3.6	0.9	0.5	0.3	0	0
Marton	365.7	13	4.9	1.1	0.3	0.4	0.2	0
Ohakune	272.9	8.5	3.2	1.6	0.5	0.4	0.1	-
Longburn	46.1	11	10.8	4.9	1.6	1.1	-	-
Kairanga	45.4	22	19.5	6.3	1.7	0.7	0.7	0
Levin	1,280.1	23.9	3.5	0.6	0.1	0.1	0	-
Woodville	119.2	13.4	4.9	4.5	3.4	5.9	5.3	5.5
Foxton	227.8	16.4	12.1	5.9	0.6	0.1	0	-
Foxton Beach	182.5	17	9.4	2.3	0.5	0.1	-	-
Taumarunui	292.6	7.2	4.3	2.5	1	0.9	0.3	0.7
Dannevirke	346.6	9.4	1.4	0.5	0.2	0.1	0	0
Bulls	172.2	16.4	6.1	2.3	0.3	0.1	0	0
Tangimoana	38.6	12	24.4	23.3	2.5	0.1	-	-
Hunterville	163.2	6.8	5.8	2.9	1.1	0.5	0.1	0
Shannon	118.1	5.5	1.5	0.6	0.4	0.3	-	-
Koitiata	9.2	6.6	8.9	13.2	4.7	0.9	-	-
Ōhau	223.5	9.2	1.3	0.7	0.2	0.2	-	-
Hokio Beach	64	9.6	5.7	2.8	1	0.2	-	-
Bunnythorpe	132.8	6.8	2.6	1.3	0.2	0.4	0.1	-
Eketāhuna	91.5	9.8	1.9	0.4	0.1	0	0	0
Mangaweka	21.7	14.9	1.3	0	0.4	0.5	-	-
Ōwhango	24.1	10.7	1.4	2.1	1.1	1.7	0.4	-
Ōhura	31.9	11.1	9	5.4	0.9	0	-	-
Pohangina	23.7	9.5	1.6	0.8	0	0	-	-
Mangamutu	13.6	11.7	3.3	-	-	-	-	-
Pahiatua	213.1	18	6.6	1.7	0.2	0.1	0	0.1
Ashhurst	179.3	15.3	2.7	0.4	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	10	4.7	0.7	-	-	-	-
Taihape	297.3	3.5	1.2	0.4	0.2	0.1	0.1	0.2
Waitārere Beach	111.8	7.2	6.5	6.5	3.4	0.7	-	-
Raetihi	101.9	9.4	4.4	2.9	1.5	0.9	0	-
Manakau	115.9	15	4.5	1.6	0.3	0.1	-	-
Sanson	58.6	9.2	3.3	1.8	1.5	0	-	-
Linton	44.7	6.8	2.6	1.6	0.9	0.3	0.1	-
Ohakea	9.9	12.2	0.5	0.7	-	-	-	-
Norsewood	27.5	9.6	3.9	1.5	-	-	-	-
Tokomaru	58.1	7.3	1	1.2	0.1	0	0.2	-
Waiouru	8.4	8.6	0.7	0.2	-	-	-	-
National Park	139.3	2.2	1.7	0.4	0.4	0.6	0.5	-
Waikawa Beach	59.7	9	7.6	1.8	0.1	0	-	-
Mangatainoka	20.2	7.3	6.9	3	0.4	0	0.9	5.2
Ormondville	40.5	11.8	1.2	0.7	0.1	0	-	-
Rongotea	110	9.3	5.2	3.1	0.2	0.8	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	8.2	4.6	0.9	0.1	0.1	-	-
Kimbolton	52.5	5.2	4.6	0.3	-	1.4	-	-
Rangataua	28.5	9.3	2.3	0	-	-	-	-
Raurimu	16.9	6.2	1.2	0.5	0	0.3	-	-
Kai Iwi	38.6	6.1	2.9	0.9	2.5	0.4	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	13.5	7.1	2	0.4	2.2	0.7	0
Palmerston North	686.1	13.1	6.6	3.9	0.8	1.3	1.1	1.6
Feilding	170.9	28.3	14.5	4	1.3	0.2	0	-
Marton	213.9	8	4.8	15.9	14.9	7.4	0.7	1
Ohakune	22.4	11.2	6.3	3.1	1	0.8	0.1	-
Longburn	60.8	16.1	36.1	18.2	1.4	1.4	0	0
Kairanga	8	19.2	17.8	1.9	0.5	-	-	-
Levin	180.9	55.3	3.8	0.3	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	8.3	3.5	2.4	2.9	10.8	5.1	23
Foxton	41.4	19	13.1	3.7	1.7	0.8	-	-
Foxton Beach	0.8	18.7	7.5	0	-	-	-	-
Taumarunui	37.9	11	3.5	0.7	0.2	0.2	0.1	0.1
Dannevirke	129.7	10.5	2.7	1.2	0.8	0.7	0.5	0.2
Bulls	53.9	13.3	8.7	3.1	3	2	0.4	0.9
Tangimoana	4.1	18.8	1.5	0	-	-	-	-
Hunterville	23.4	13.5	4.7	2.1	0.3	0.3	-	-
Shannon	24.9	5.1	3.9	5	11.9	8.4	-	0.1
Ōhau	7.2	12.9	2.4	2.2	1	4.3	9.6	0.8
Hokio Beach	50	15.8	8.3	3.1	-	-	-	-
Bunnythorpe	20.9	13.2	2.3	0.4	0	-	-	-
Eketāhuna	14	13.9	2.1	0.1	-	-	-	-
Mangaweka	10.3	23.9	6.7	1.8	0.5	0.9	0.1	0
Ōwhango	2.4	12.5	5	0.4	0.4	-	-	-
Ōhura	1.2	5.8	4.2	5	-	0	-	-
Mangamutu	15.3	23.9	9.2	5.4	-	-	-	-
Pahiatua	17.7	19.1	6	0.6	-	-	-	-
Ashhurst	19.8	18.3	13	8.6	0.8	2.2	1.2	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.3	2.4	0.7	0.4	0.6	0	-
Waitārere Beach	0.4	25	25	2.5	-	-	-	-
Raetihi	13.2	10.5	3.2	0.8	0.1	0.1	-	-
Manakau	0.3	10	3.3	3.3	6.7	0	-	-
Sanson	10.2	19.9	1.7	0.9	0.3	-	-	-
Linton	5.2	8.3	2.3	1.2	-	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.7	0.1	-	-	-	-	-
Waiouru	5.6	7.9	2.9	0.9	-	-	-	-
National Park	18.3	3.9	5.5	3.3	2.2	-	-	-
Mangatainoka	4.7	15.1	4.3	0.6	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	3.7	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Halcombe	28.3	5.8	4.2	9.3	13.1	4.8	1.8	6
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	6.7	5	5	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.3	5.1	3.4	1.2	0.8	0.2	0.1
Palmerston North	14,029.6	6	4.7	3.5	2	2.2	0.8	1
Feilding	7,528	10.7	6	3.5	1.7	1.2	0.3	0.1
Marton	27,105.7	8.6	3.9	1.9	0.9	0.7	0.2	0.2
Ohakune	44,184.2	1.7	0.7	0.4	0.1	0.1	0	0
Longburn	1,302.6	17	20.5	12.3	2.5	5.2	2.5	1.9
Kairanga	6,733.2	14.2	15.1	10	4.1	6.8	4.4	5.5
Levin	7,837.6	13.2	2.6	1.8	1	0.7	0.1	0
Woodville	10,615.9	5.5	2.5	1.5	1	1.5	1.7	17.5
Foxton	11,957.6	17.5	8	5.2	2.4	2.9	0.9	0.2
Foxton Beach	861.7	12.2	12.8	21	3.2	1.4	0	0.5
Taumarunui	12,241.3	2.3	1.3	0.6	0.3	0.5	0.3	0.5
Dannevirke	34,395.2	7.7	2.5	1.4	0.7	0.6	0.3	0.3
Bulls	9,085.6	14	7.5	4.9	2.2	1	0.2	0.2
Tangimoana	9,602.2	12.6	5.2	2.7	1.1	0.9	0.1	0.1
Hunterville	55,534.7	3.1	1.6	0.8	0.3	0.3	0.1	0.2
Shannon	7,725	4.8	4.5	4.2	2.5	6.5	0.3	0.1
Koitiata	908.1	12.4	9.5	8.1	2.2	0.4	0.2	0.3
Ōhau	2,857.8	8.8	6.5	3.8	1.2	0.9	0.2	0.1
Hokio Beach	2,923.4	10.5	9.4	7.8	2.3	1.4	0.1	0.1
Bunnythorpe	8,837.9	8.6	4.2	2.8	1.3	1	0.2	0
Eketāhuna	37,977.3	5.6	2.7	1.2	0.4	0.4	0.1	0.1
Mangaweka	25,542.3	2.8	1.1	0.4	0.1	0.1	0.1	0.3
Ōwhango	21,112.2	1.7	0.7	0.4	0.2	0.1	0.1	0.1
Ōhura	24,006.2	3	1.7	0.8	0.3	0.3	0.2	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.6	2.1	1.2	0.5	0.4	0.1	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	6.3	5.3	4.5	2.7	3.1	0.7	1.5
Pahiatua	56,300.9	3.6	2.1	1	0.4	0.4	0.2	0.1
Ashhurst	9,723	6.7	4.2	2.8	1.5	1	0.4	0.3
Himatangi Beach	1,181.1	13.8	13.7	6.2	2.1	2.5	0	-
Taihape	66,124.7	2.7	1.5	0.6	0.2	0.2	0.1	0.1
Waitārere Beach	13.3	7.3	11.7	6	2.6	-	-	-
Raetihi	153,110.1	0.6	0.2	0.1	0	0	0	0
Manakau	5,969.4	8.2	4.1	2.9	1.2	0.7	0.1	0
Sanson	3,977.1	6.4	4.3	2.5	1	0.6	0.1	0
Linton	9,076.6	5.5	3.4	1.9	1	1.1	0.2	0.1
Ohakea	1,988.8	16.4	5.5	4.3	2.1	0.6	0.1	0
Norsewood	5,388.4	8.8	2.7	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	5.3	3.5	5.3	3.5	3.8	0.3	0.1
Waiouru	2,552.9	5.4	2.4	1	0.3	0.3	0.1	0.1
National Park	4,186.3	5.7	1.4	0.6	0.3	0.3	0.1	0.2
Waikawa Beach	270	12.1	9	4.4	1.8	0.8	0.3	-
Mangatainoka	2,846.3	4.7	3.1	2.2	1.1	1.6	1.4	21.3
Ormondville	15,472.3	3.7	1.3	0.7	0.3	0.4	0.2	0.4
Rongotea	9,950.9	11.5	6.8	5	2.3	2.5	1.6	0.4
Rātana	1,699.3	7.9	5.5	3.2	1.4	1.3	0.4	0.7
Halcombe	20,547.4	6.4	3.9	2.7	1.4	1.1	0.4	0.3
Kimbolton	9,408.6	4.3	2.3	1.3	0.5	0.4	0.2	0.2
Rangataua	6,946.1	2.5	0.6	0.4	0.1	0.1	0	0
Raurimu	2,159.8	5.2	1.9	0.9	0.5	0.5	0.2	0.5
Kai Iwi	9,060.1	3.6	2.4	1.6	0.7	0.6	0.3	0.4
Other property use type								
Whanganui	1,392.5	6.8	3.6	2.4	1.4	2	0.7	0.6
Palmerston North	5,568.9	4.1	2.8	2	1.1	2	1	0.6
Feilding	476.3	13.1	8.1	3.7	1.1	0.4	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.6	1.8	0.9	0.2	0.2	0.1	0.1
Ohakune	2,300.5	1.1	0.4	0.4	0.2	0.2	0	0
Longburn	36.4	16	10.4	0.9	0.4	0.2	-	0
Kairanga	29.9	7.9	0.1	0.8	1	0.7	0	-
Levin	495.8	21.3	3.6	1.4	1	1.9	0.3	0
Woodville	73.1	18.5	0.7	0.2	0.4	0.6	0.1	23.8
Foxton	594.5	14	9.4	5.2	0.6	0.1	0	0
Foxton Beach	309.8	8.4	6.6	4.3	5.8	0.3	-	-
Taumarunui	503.9	2.2	1.3	1.5	0.3	0.6	1	1.2
Dannevirke	855.3	7.7	2	0.7	0.4	0.4	0.1	0
Bulls	223.2	12.3	4.3	2.8	1.2	2.3	0.4	0.1
Tangimoana	421.8	8.3	5.1	1.5	0.2	0.8	0.3	0.1
Hunterville	2,173.7	1.1	0.7	0.4	0.2	0.2	0.2	0.2
Shannon	2,594	1.1	0.6	0.2	0.1	0.1	0	0
Koitiata	64.1	22	17.2	3.8	1.5	0.1	-	-
Ōhau	35.6	6.9	2.5	1.5	0.1	-	-	-
Hokio Beach	857.5	13.2	19.1	4.2	1.9	6.8	1	0
Bunnythorpe	80.9	10.4	3	1.4	0.9	1.1	0.5	0.1
Eketāhuna	1,475.7	0.5	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	3.8	0.7	0.3	0.2	0.2	0.1	1.1
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.5	0.1	0.1	0.1	0.1	0
Pohangina	882.3	3.6	2	0.8	0.4	0.5	0	0
Mangamutu	26	2.8	3.5	1.5	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.1	0.1	0.1	0	0
Ashhurst	115.4	7	2.5	2.6	0.8	0.7	0.4	-
Himatangi Beach	59.4	2.4	1.1	1	0.7	0.8	0.1	-
Taihape	2,174.7	4	1.8	0.8	0.3	0.2	0.1	0.1
Waitārere Beach	24.3	5.2	3.2	1.6	1.7	-	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	3.9	2.1	2.3	0.6	0.4	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	5.1	1.9	0.4	0	-	0	-
Linton	426.8	13.5	2.6	2	1.8	2.2	2.3	2.4
Ohakea	56.4	8.3	2.7	2	0.2	-	-	-
Norsewood	148.5	2	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0.1	0	0
Waiouru	2.1	6.7	6.2	3.3	0	1.4	-	-
National Park	1,051.5	1.4	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	6.4	11.2	8.1	1.9	6.7	9	-
Mangatainoka	178	3.2	2.1	0.8	0.6	0.8	1.3	0.4
Ormondville	889.7	3	1.6	2.7	1.9	0.9	0.4	0.4
Rongotea	137.6	0.3	1.5	0.7	0.3	-	-	-
Rātana	25.6	6.5	1.6	1.2	0.6	0.7	0.2	0.7
Halcombe	913.2	5.8	2.3	2.2	1.1	0.8	0.3	0.9
Kimbolton	334.7	0.1	0.1	-	-	-	0.2	0
Rangataua	766.7	3.4	1.7	1	0.5	0.3	0.1	0
Raurimu	190.1	4	2	1.6	0.3	0.1	0.1	0.1
Kai Iwi	148.2	3.4	3.4	2.5	1.3	1.2	0.1	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.7: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.5	4.1	2.4	0.8	0.4	0.2	0.1
Palmerston North	3,060.7	9.1	5.5	3.1	1.1	0.6	0.1	0
Feilding	1,015.1	14.2	1.8	0.8	0.8	0.2	0	0
Marton	365.7	13.1	5.2	1.1	0.4	0.4	0.2	0.1
Ohakune	272.9	8.7	3.4	1.7	0.5	0.4	0.1	-
Longburn	46.1	9.5	4.6	2.5	1.2	1.6	-	-
Kairanga	45.4	18.1	15.9	2.1	0.8	0.7	0	-
Levin	1,280.1	24.4	3.8	0.6	0.1	0.1	0	-
Woodville	119.2	11.9	4.2	4.4	4.1	7.6	5.5	10.6
Foxton	227.8	16.6	12.5	6.2	0.5	0.2	0	0
Foxton Beach	182.5	16.8	11.3	2.8	0.5	0.3	-	-
Taumarunui	292.6	7.6	4.7	2.8	1.2	1.1	0.4	0.8
Dannevirke	346.6	9.7	1.5	0.5	0.2	0.1	0	0
Bulls	172.2	16.6	7	2.8	0.4	0.2	0	-
Tangimoana	38.6	17	26	12.7	1.4	0	-	-
Hunterville	163.2	7	5.5	2.7	0.7	0.5	0.1	0
Shannon	118.1	5.7	1.4	0.6	0.2	0.1	-	-
Koitiata	9.2	6.6	8.3	12.2	6.2	0.9	-	-
Ōhau	223.5	9.6	1.5	0.9	0.2	0.2	0	-
Hokio Beach	64	9.5	6.2	3	1	0.4	-	-
Bunnythorpe	132.8	7	3	1.2	0.3	0.4	0.1	-
Eketāhuna	91.5	10.1	2	0.3	0.1	0.1	0	0
Mangaweka	21.7	16	2.6	0.2	0.3	0.6	-	-
Ōwhango	24.1	11.5	1.2	2.3	1.1	1.7	0.4	-
Ōhura	31.9	10.9	9.7	5.9	1	0.1	-	-
Pohangina	23.7	11.4	1.5	0.9	0	0	-	-
Pongaroa	16.6	10.7	6.4	2.7	1.7	0.8	0.5	0.1
Mangamutu	13.6	11.5	3.4	0	-	-	-	-
Pahiatua	213.1	18.3	7.2	1.8	0.4	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	17.7	3.5	0.5	0.1	0	-	-
Himatangi Beach	50.7	10	5.5	0.9	-	-	-	-
Taihape	297.3	3.6	1.2	0.5	0.2	0.1	0.1	0.2
Waitārere Beach	111.8	7.3	6.2	7.3	3.6	1.4	-	-
Raetihi	101.9	9.6	4.7	2.9	1.9	1	0	-
Manakau	115.9	15.7	4.7	1.8	0.4	0.1	0	-
Sanson	58.6	9.4	3.3	1.3	2	0	-	-
Linton	44.7	6.8	2.1	1.5	0.8	0.1	-	-
Ohakea	9.9	14.6	8.1	2	0	-	-	-
Norsewood	27.5	9.6	3.9	1.5	-	-	-	-
Tokomaru	58.1	7.1	1.3	1.2	0.3	0	0.2	-
Waiouru	8.4	8.2	1.1	0.2	-	-	-	-
National Park	139.3	2.2	1.6	0.6	0.3	0.6	0.6	0
Waikawa Beach	59.7	9.1	7.6	2.1	0.2	0	-	-
Mangatainoka	20.2	7.2	6.5	3.4	0.6	-	0	6.1
Ormondville	40.5	11.9	1.4	0.7	0.1	0	-	-
Rongotea	110	9.4	4	2.8	0.4	0	-	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	8.7	4.8	1	0.3	0.1	-	-
Kimbolton	52.5	5.2	4.6	0.3	-	1.4	-	-
Rangataua	28.5	9.5	2.4	0	-	-	-	-
Raurimu	16.9	6.9	1.2	0.5	0	0.3	-	-
Kai Iwi	38.6	6.2	2.8	0.9	2.6	0.4	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	12.7	8.3	4.4	1	1.5	1.7	0
Palmerston North	686.1	12.9	7.1	3.8	2.1	1.3	1.5	1.8
Feilding	170.9	23.7	11.3	3.9	0.9	0.2	0.1	-
Marton	213.9	9.4	6.7	14.5	14.8	5.7	0.7	1.2
Ohakune	22.4	11.4	6.6	3.3	1.1	0.8	0.1	-
Longburn	60.8	20.6	25	9.8	1	1.1	0	0
Kairanga	8	18.8	12.1	1.4	0.1	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	57.4	4.4	0.5	0.4	0.3	-	-
Woodville	12.5	6.7	2.7	4.4	5.5	5.8	10	27.9
Foxton	41.4	21.3	12.1	1.9	0	0	-	-
Foxton Beach	0.8	20	8.8	0	-	-	-	-
Taumarunui	37.9	11.4	4	1.1	0.1	0.2	0.1	0.2
Dannevirke	129.7	10.8	2.9	1.4	0.8	0.8	0.5	0.4
Bulls	53.9	12.9	7.5	5.5	3.2	3.8	0.3	1.1
Tangimoana	4.1	19.5	2.4	0	-	-	-	-
Hunterville	23.4	12.6	5.2	1.1	0.2	0.3	-	-
Shannon	24.9	9.9	7.6	1.4	0	-	-	0.1
Ōhau	7.2	13.1	2.9	1.7	1.4	3.5	9.9	2.1
Hokio Beach	50	16.4	8.5	3.2	-	-	-	-
Bunnythorpe	20.9	13.4	2.3	0.5	0	-	-	-
Eketāhuna	14	14.4	2.1	0.2	-	-	-	-
Mangaweka	10.3	26	8	2.2	1.1	1	0.3	0
Ōwhango	2.4	14.6	5	0.4	0.4	-	-	-
Ōhura	1.2	5.8	4.2	5	0.8	0	-	-
Pongaroa	2.5	10.8	25.2	2.4	1.6	-	-	-
Mangamutu	15.3	25.1	12.6	5.2	-	-	-	-
Pahiatua	17.7	20.2	6.8	0.6	-	-	-	-
Ashhurst	19.8	12.6	15.3	16.2	7	2	1.8	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.7	2.5	0.9	0.3	0.6	0.1	-
Waitārere Beach	0.4	32.5	30	2.5	-	-	-	-
Raetihi	13.2	11.1	3.2	0.8	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	0	-	-
Sanson	10.2	19.8	1.7	0.9	0.4	-	-	-
Linton	5.2	7.9	3.1	1	0.6	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.9	0.1	-	-	-	-	-
Waiouru	5.6	7.9	2.9	0.9	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	3.3	5.6	2.2	-	-	-
Mangatainoka	4.7	15.1	3.2	1.7	-	-	-	-
Ormondville	5.1	3.9	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.8	4.2	5.7	4.7	20.8	4.9	6.7
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	6.7	5	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.5	5	3.3	1.6	1	0.2	0.1
Palmerston North	14,029.6	6.3	4.3	3.1	1.7	2	1.1	1.2
Feilding	7,528	10.6	5.9	3.7	1.8	1.3	0.3	0.1
Marton	27,105.7	8.7	4	2	0.9	0.8	0.2	0.2
Ohakune	44,184.2	1.7	0.8	0.4	0.1	0.1	0	0
Longburn	1,302.6	17.3	15.1	9.1	1.9	4.8	3	2.7
Kairanga	6,733.2	15.7	15.8	9.6	4.6	4.9	5.1	0.8
Levin	7,837.6	13.5	2.8	1.8	1	0.8	0.1	0
Woodville	10,615.9	5.3	2.5	1.3	0.8	1.2	1.3	19
Foxton	11,957.6	17.9	8.3	4.6	2.1	1.9	1.9	1.6
Foxton Beach	861.7	11.1	10.4	8	20	3.8	0.2	0.6
Taumarunui	12,241.3	2.3	1.3	0.7	0.3	0.5	0.3	0.7
Dannevirke	34,395.2	7.9	2.5	1.4	0.7	0.7	0.3	0.4
Bulls	9,085.6	14.4	7.6	5	2.1	1.2	0.2	0.2
Tangimoana	9,602.2	12.7	5.3	2.9	1.1	1.2	0.4	0.2
Hunterville	55,534.7	3.1	1.6	0.8	0.4	0.3	0.2	0.3
Shannon	7,725	5.4	6.3	6.7	2.9	1.2	0.2	0.1
Koitiata	908.1	11.9	9.9	9.5	4.2	1.2	0.2	0.3
Ōhau	2,857.8	8.6	6.4	4.2	1.7	1.3	0.4	0.2
Hokio Beach	2,923.4	10.5	9.3	8.3	2.5	1.6	0.1	0.1
Bunnythorpe	8,837.9	8.7	4.1	2.9	1.4	1.1	0.3	0
Eketāhuna	37,977.3	5.7	2.8	1.2	0.5	0.4	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	2.8	1.1	0.4	0.1	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.1	0.1	0.2
Ōhura	24,006.2	3	1.8	0.9	0.4	0.4	0.2	0.3
Pohangina	26,177.4	3.7	2.1	1.3	0.5	0.4	0.2	0.1
Pongaroa	57,773.7	2.3	1	0.4	0.2	0.2	0.1	0.2
Mangamutu	1,464.7	6.5	5.2	4.5	2.7	3.3	0.6	1.9
Pahiatua	56,300.9	3.6	2.2	1.1	0.5	0.4	0.2	0.2
Ashhurst	9,723	6.6	4.2	2.5	1.3	1.1	0.4	0.3
Himatangi Beach	1,181.1	13.7	14.1	6.8	2.1	2.8	0	-
Taihape	66,124.7	2.7	1.5	0.7	0.3	0.2	0.1	0.1
Waitārere Beach	13.3	5.6	11.7	7.9	2.6	-	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0	0	0	0
Manakau	5,969.4	8.3	4.2	3.1	1.4	0.9	0.1	0
Sanson	3,977.1	6.5	4.3	2.6	1.1	0.6	0.2	0
Linton	9,076.6	5.5	3.5	1.9	0.6	0.7	0.6	0.1
Ohakea	1,988.8	17.4	6.7	4.2	3.2	1.5	0.2	0
Norsewood	5,388.4	9	2.8	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	6.4	3.8	4.1	3.3	2.1	0.2	0.1
Waiouru	2,552.9	5.4	2.4	1	0.3	0.3	0.1	0.1
National Park	4,186.3	5.9	1.5	0.5	0.3	0.3	0.1	0.2
Waikawa Beach	270	12.3	9.1	5	1.9	1	0.4	-
Mangatainoka	2,846.3	4.7	3.1	2.3	1.2	1.5	1.3	22.5
Ormondville	15,472.3	3.8	1.4	0.7	0.3	0.4	0.3	0.5
Rongotea	9,950.9	12.3	5.9	3.6	2.1	2.2	0.9	0.1
Rātana	1,699.3	7.7	5.1	4.3	2	1.5	0.5	0.8
Halcombe	20,547.4	6.5	3.8	2.7	1.5	1.3	0.4	0.3
Kimbolton	9,408.6	4.3	2.3	1.3	0.5	0.4	0.2	0.2
Rangataua	6,946.1	2.6	0.6	0.4	0.1	0.1	0	0
Raurimu	2,159.8	5.3	2	0.9	0.5	0.5	0.2	0.4
Kai Iwi	9,060.1	3.7	2.4	1.6	0.8	0.6	0.3	0.5
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.1	3.5	2.6	1.4	1.8	1	1.1
Palmerston North	5,568.9	4.2	2.8	1.8	1.1	1.6	0.9	0.6
Feilding	476.3	11.9	5.7	5.9	2.1	0.6	0.1	0.1
Marton	1,724.2	3.5	1.9	0.9	0.2	0.2	0.1	0.1
Ohakune	2,300.5	1.1	0.4	0.4	0.2	0.2	0.1	0
Longburn	36.4	18.8	3.5	1.4	2.4	0.5	-	0
Kairanga	29.9	8	0.4	0.6	0.9	0.7	0	0
Levin	495.8	21.8	3.6	1.6	0.8	2.1	0.4	0.1
Woodville	73.1	19.5	1	0.6	0.7	0.9	0.1	23.8
Foxton	594.5	14.1	9.7	5.4	0.7	0.3	0.1	0
Foxton Beach	309.8	8.7	8.4	5.3	4.4	2.1	0	-
Taumarunui	503.9	2.2	1.3	1.3	1.4	0.5	0.9	1.7
Dannevirke	855.3	8	1.4	1.5	0.4	0.4	0.2	0
Bulls	223.2	12.8	4.6	2.1	1.5	2.6	0.9	0.2
Tangimoana	421.8	8.5	5.1	1.3	0.3	0.9	0.2	0.3
Hunterville	2,173.7	1.2	0.6	0.4	0.2	0.2	0.1	0.2
Shannon	2,594	1.1	0.6	0.2	0.1	0.1	0	0
Koitiata	64.1	21.2	19.3	3.7	1.6	0.1	-	-
Ōhau	35.6	7.4	3	1.7	0.2	-	-	-
Hokio Beach	857.5	12.3	20.8	4.7	1.8	6.6	1.4	0
Bunnythorpe	80.9	11.4	2.7	1.2	0.8	1	0.7	0.1
Eketāhuna	1,475.7	0.5	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	4	0.7	0.3	0.2	0.2	0.1	1.1
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.5	0.2	0	0.1	0.1	0.1
Pohangina	882.3	3.6	1.9	0.9	0.5	0.5	0.1	0
Pongaroa	3,913	3.5	1.4	0.4	0.2	0.2	0.1	0.3
Mangamutu	26	2.8	3.5	1.5	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0
Ashhurst	115.4	7.4	2.6	2.6	1.6	0.9	0.5	-
Himatangi Beach	59.4	2.6	1.2	1	0.8	0.8	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	3.9	1.8	0.9	0.3	0.2	0.1	0.1
Waitārere Beach	24.3	5	3.5	1.7	1.7	-	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	4.1	1.9	2.4	0.9	0.4	0	-
Sanson	55.8	5.4	1.9	0.4	0	-	0	-
Linton	426.8	13.9	2.7	1.8	1.3	2.5	2.4	3.1
Ohakea	56.4	8.7	2.8	2.1	0.3	0	-	-
Norsewood	148.5	2	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0.1	0	0
Waiouru	2.1	5.2	8.1	4.3	-	0	1.4	-
National Park	1,051.5	1.5	0.4	0.1	0.1	0	0	0
Waikawa Beach	4.2	8.1	10.5	8.1	3.1	5.2	10.5	-
Mangatainoka	178	3.1	2.2	0.9	0.5	0.6	1.5	0.7
Ormondville	889.7	3.2	1.5	2.5	2.2	1	0.3	0.5
Rongotea	137.6	0.8	0.9	0.8	0.3	0	-	-
Rātana	25.6	7	2.2	1.2	0.8	0.9	0.4	0.9
Halcombe	913.2	5.9	2.4	2.3	1.2	0.8	0.2	1
Kimbolton	334.7	0.2	0.1	-	-	-	0.2	0
Rangataua	766.7	3.4	1.7	1	0.5	0.4	0.2	0
Raurimu	190.1	4.4	2.2	2	0.3	0.1	0.1	0.1
Kai Iwi	148.2	3.3	3	2.9	1.1	1.6	0.2	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.8: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Current Climate, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.5	4.1	2.4	0.8	0.4	0.2	0.1
Palmerston North	3,060.7	9.9	5.4	2.7	1.2	1.2	0.3	0.1
Feilding	1,015.1	17.8	4	0.9	0.6	0.3	0	0
Marton	365.7	13.1	5.3	1.3	0.4	0.4	0.2	0.1
Ohakune	272.9	8.7	3.4	1.7	0.5	0.4	0.1	-
Longburn	46.1	9.7	13.9	6.6	1.7	1.7	-	-
Kairanga	45.4	18.9	21.2	7.3	3.8	0.2	1.3	0
Levin	1,280.1	24.4	3.8	0.6	0.1	0.1	0	-
Woodville	119.2	12.1	4.1	4.5	4.2	7.4	5.6	10.5
Foxton	227.8	16.6	12.5	6.2	0.6	0.1	0	-
Foxton Beach	182.5	16.9	10.3	2.4	0.5	0.1	-	-
Taumarunui	292.6	7.5	4.5	2.7	1.2	1	0.4	0.8
Dannevirke	346.6	9.7	1.5	0.5	0.2	0.1	0	0
Bulls	172.2	16.7	7	2.8	0.4	0.2	0	0
Tangimoana	38.6	7.5	18.7	33.8	7.1	0.5	-	-
Hunterville	163.2	7.1	6.2	3.5	1.3	0.6	0.2	0
Shannon	118.1	5.7	1.4	0.7	0.3	0.5	0	-
Koitiata	9.2	6.6	8.3	12.2	6.2	0.9	-	-
Ōhau	223.5	9.6	1.4	0.7	0.2	0.2	0	-
Hokio Beach	64	9.5	6.2	3	1	0.4	-	-
Bunnythorpe	132.8	7	3	1.2	0.3	0.4	0.1	-
Eketāhuna	91.5	10.1	2	0.3	0.1	0.1	0	0
Mangaweka	21.7	16	2.6	0.2	0.3	0.6	-	-
Ōwhango	24.1	11.5	1.2	2.3	1.1	1.7	0.4	-
Ōhura	31.9	10.9	9.7	5.9	1	0.1	-	-
Pohangina	23.7	11.4	1.5	0.9	0	0	-	-
Mangamutu	13.6	12.9	3.5	0	-	-	-	-
Pahiatua	213.1	18.3	7.1	1.9	0.3	0.1	0	0.1
Ashhurst	179.3	15.9	3	0.4	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	10	5.5	0.9	-	-	-	-
Taihape	297.3	3.6	1.2	0.5	0.2	0.1	0.1	0.2
Waitārere Beach	111.8	7.3	6.2	7.3	3.6	1.4	-	-
Raetihi	101.9	9.6	4.7	2.9	1.9	1	0	-
Manakau	115.9	15.7	4.7	1.8	0.4	0.1	0	-
Sanson	58.6	9.4	3.3	1.3	2	0	-	-
Linton	44.7	7.1	2.7	1.6	0.9	0.3	0.2	-
Ohakea	9.9	16	6.2	1.2	0	-	-	-
Norsewood	27.5	9.6	3.9	1.5	-	-	-	-
Tokomaru	58.1	7	1.3	1.1	0.5	0	0.2	-
Waiouru	8.4	8.2	1.1	0.2	-	-	-	-
National Park	139.3	2.2	1.6	0.6	0.3	0.6	0.6	0
Waikawa Beach	59.7	9.1	7.6	2.1	0.2	0	-	-
Mangatainoka	20.2	7.3	6.4	3.4	0.7	-	0	6.1
Ormondville	40.5	11.9	1.4	0.7	0.1	0	-	-
Rongotea	110	9.6	5.2	3.2	0.2	0.8	0	-
Rātana	17.4	9.9	3.7	6.1	-	-	-	-
Halcombe	132.9	8.7	4.8	1	0.3	0.1	-	-
Kimbolton	52.5	5.2	4.6	0.3	-	1.4	-	-
Rangataua	28.5	9.5	2.4	0	-	-	-	-
Raurimu	16.9	6.9	1.2	0.5	0	0.3	-	-
Kai Iwi	38.6	6.2	2.8	0.9	2.6	0.4	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	13.1	8.2	3.8	0.9	1.5	1.7	0
Palmerston North	686.1	13.5	6.7	4.6	0.9	1.2	1.3	1.7
Feilding	170.9	27.7	15.2	5.5	0.9	0.8	0	-
Marton	213.9	8.1	4.1	10.2	18.6	10.9	0.9	1.1
Ohakune	22.4	11.4	6.6	3.3	1.1	0.8	0.1	-
Longburn	60.8	15	30	28.9	2.9	1.5	0.1	0
Kairanga	8	19.5	17.9	2.6	0.6	-	-	-
Levin	180.9	57.4	4.4	0.5	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	7.1	2.6	4.3	5.4	5.9	10	28.1
Foxton	41.4	19.5	13.2	4.1	1.7	0.8	-	-
Foxton Beach	0.8	17.5	8.8	0	-	-	-	-
Taumarunui	37.9	11.3	4.1	1.1	0.1	0.2	0.1	0.2
Dannevirke	129.7	10.8	2.9	1.4	0.8	0.8	0.5	0.4
Bulls	53.9	12.9	7.6	5.4	3.2	3.8	0.3	1.1
Tangimoana	4.1	19	1.5	0	-	-	-	-
Hunterville	23.4	20.6	5.4	2.4	0.5	0.3	-	-
Shannon	24.9	5.5	2.8	4	5.7	18.3	0.2	0.1
Ōhau	7.2	13.1	2.9	1.7	1.4	3.5	9.9	2.1
Hokio Beach	50	16.4	8.5	3.2	-	-	-	-
Bunnythorpe	20.9	13.4	2.3	0.5	0	-	-	-
Eketāhuna	14	14.4	2.1	0.2	-	-	-	-
Mangaweka	10.3	26	8	2.2	1.1	1	0.3	0
Ōwhango	2.4	14.6	5	0.4	0.4	-	-	-
Ōhura	1.2	5.8	4.2	5	0.8	0	-	-
Mangamutu	15.3	22.7	12	3.6	0.2	-	-	-
Pahiatua	17.7	20.3	6.7	0.6	-	-	-	-
Ashhurst	19.8	18	13.9	10.2	0.7	2	1.7	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.7	2.4	0.9	0.3	0.6	0.1	-
Waitārere Beach	0.4	32.5	30	2.5	-	-	-	-
Raetihi	13.2	11.1	3.2	0.8	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	0	-	-
Sanson	10.2	19.8	1.7	0.9	0.4	-	-	-
Linton	5.2	8.3	2.7	1.2	-	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.9	0.1	-	-	-	-	-
Waiouru	5.6	7.9	2.9	0.9	-	-	-	-
National Park	18.3	3.9	3.3	5.6	2.2	-	-	-
Mangatainoka	4.7	15.1	3.2	1.7	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	3.9	0.8	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Halcombe	28.3	5.4	4.4	7.4	12.6	8.3	1.9	6.4
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	6.7	5	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.5	5	3.3	1.6	1	0.2	0.1
Palmerston North	14,029.6	6	4.8	3.8	2.2	2.4	1	1.1
Feilding	7,528	10.9	6.4	3.8	1.8	1.3	0.3	0.1
Marton	27,105.7	8.7	4	2	1	0.9	0.2	0.2
Ohakune	44,184.2	1.7	0.8	0.4	0.1	0.1	0	0
Longburn	1,302.6	15.1	22.2	17.9	3.2	5.6	3	2.1
Kairanga	6,733.2	13.9	15.2	10.9	4.3	6.8	4.9	6.6
Levin	7,837.6	13.6	2.7	1.8	1	0.8	0.1	0
Woodville	10,615.9	5.4	2.6	1.4	0.8	1.2	1.3	19
Foxton	11,957.6	17.8	8.1	5.3	2.5	3.1	1	0.2
Foxton Beach	861.7	12.5	12.8	21.7	3.4	1.6	0	0.5
Taumarunui	12,241.3	2.3	1.3	0.7	0.3	0.5	0.3	0.7
Dannevirke	34,395.2	7.9	2.6	1.4	0.7	0.7	0.3	0.4
Bulls	9,085.6	14.3	7.6	5.2	2.5	1.4	0.2	0.2
Tangimoana	9,602.2	12.8	5.4	3	1.2	1	0.2	0.1
Hunterville	55,534.7	3.1	1.6	0.9	0.4	0.3	0.1	0.3
Shannon	7,725	4.5	4.4	4.7	2	7.2	1.1	0.2
Koitiata	908.1	11.8	9.9	9.5	4.2	1.2	0.2	0.3
Ōhau	2,857.8	8.7	6.5	4.3	1.4	1	0.3	0.1
Hokio Beach	2,923.4	10.5	9.3	8.3	2.5	1.6	0.1	0.1
Bunnythorpe	8,837.9	8.7	4.3	2.9	1.3	1	0.3	0
Eketāhuna	37,977.3	5.7	2.8	1.2	0.5	0.4	0.1	0.1
Mangaweka	25,542.3	2.9	1.1	0.4	0.1	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.1	0.1	0.2
Ōhura	24,006.2	3	1.8	0.9	0.4	0.4	0.2	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.7	2.1	1.3	0.5	0.4	0.2	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	6.2	5.2	4.6	2.9	3.5	0.7	1.9
Pahiatua	56,300.9	3.6	2.2	1.1	0.5	0.4	0.2	0.2
Ashhurst	9,723	6.6	4.2	3	1.8	1.3	0.4	0.4
Himatangi Beach	1,181.1	13.7	14.1	6.8	2.1	2.8	0	-
Taihape	66,124.7	2.7	1.5	0.7	0.3	0.2	0.1	0.1
Waitārere Beach	13.3	5.6	11.7	7.9	2.6	-	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0	0	0	0
Manakau	5,969.4	8.3	4.2	3.1	1.4	0.9	0.1	0
Sanson	3,977.1	6.5	4.3	2.6	1.1	0.6	0.2	0
Linton	9,076.6	5.6	3.5	2	1	1.3	0.3	0.1
Ohakea	1,988.8	17.5	6.6	4.4	3.1	1.2	0.1	0
Norsewood	5,388.4	9	2.8	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	5.4	3.3	4.9	3.5	4.4	1	0.1
Waiouru	2,552.9	5.4	2.4	1	0.3	0.3	0.1	0.1
National Park	4,186.3	5.9	1.5	0.5	0.3	0.3	0.1	0.2
Waikawa Beach	270	12.3	9.1	5	1.9	1	0.4	-
Mangatainoka	2,846.3	4.7	3.1	2.3	1.2	1.5	1.3	22.5
Ormondville	15,472.3	3.8	1.4	0.7	0.3	0.4	0.3	0.5
Rongotea	9,950.9	11.7	6.9	5.2	2.5	2.6	1.7	0.4
Rātana	1,699.3	7.7	5.1	4.3	2	1.5	0.5	0.8
Halcombe	20,547.4	6.5	3.8	2.7	1.5	1.3	0.4	0.3
Kimbolton	9,408.6	4.4	2.4	1.3	0.5	0.4	0.2	0.2
Rangataua	6,946.1	2.6	0.6	0.4	0.1	0.1	0	0
Raurimu	2,159.8	5.3	2	0.9	0.5	0.5	0.2	0.4
Kai Iwi	9,060.1	3.7	2.4	1.6	0.8	0.6	0.3	0.5
Other property use type								
Whanganui	1,392.5	7.1	3.5	2.6	1.3	1.8	1.1	1.1
Palmerston North	5,568.9	4	2.7	2.1	1.3	1.9	1.3	0.9
Feilding	476.3	13.3	8.3	4.5	1.3	0.5	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.5	1.9	0.9	0.2	0.2	0.1	0.1
Ohakune	2,300.5	1.1	0.4	0.4	0.2	0.2	0.1	0
Longburn	36.4	10.8	15.5	1.3	0.5	0.3	-	0
Kairanga	29.9	8.5	0.3	0.7	0.9	0.8	0	0
Levin	495.8	21.8	3.6	1.6	0.8	2.1	0.4	0.1
Woodville	73.1	18.9	1	0.5	0.7	0.8	0.1	24
Foxton	594.5	14.2	9.8	5.3	0.6	0.1	0	0
Foxton Beach	309.8	8.9	6.9	4.5	4.4	2	-	-
Taumarunui	503.9	2.1	1.2	1.5	0.9	0.4	0.9	1.7
Dannevirke	855.3	8	1.4	1.5	0.4	0.4	0.2	0
Bulls	223.2	12.8	4.6	2.1	1.5	2.6	0.9	0.2
Tangimoana	421.8	8.5	4.9	1.7	0.4	0.8	0.3	0.1
Hunterville	2,173.7	1.2	0.7	0.4	0.2	0.2	0.2	0.2
Shannon	2,594	1.1	0.7	0.2	0.1	0.1	0	0
Koitiata	64.1	21.2	19.3	3.7	1.6	0.1	-	-
Ōhau	35.6	7.4	3	1.7	0.2	-	-	-
Hokio Beach	857.5	12.3	20.8	4.7	1.8	6.6	1.4	0
Bunnythorpe	80.9	11.4	2.9	1.6	0.9	1.1	0.7	0.1
Eketāhuna	1,475.7	0.5	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	4	0.7	0.3	0.2	0.2	0.1	1.1
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.5	0.2	0	0.1	0.1	0.1
Pohangina	882.3	3.6	1.9	0.9	0.5	0.5	0.1	0
Mangamutu	26	2.8	3.5	1.5	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.1	0.1	0.1	0	0
Ashhurst	115.4	7.3	2.5	2.7	1.6	0.9	0.5	-
Himatangi Beach	59.4	2.6	1.2	1	0.8	0.8	0.1	-
Taihape	2,174.7	3.9	1.8	0.9	0.3	0.2	0.1	0.1
Waitārere Beach	24.3	5	3.5	1.7	1.7	-	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	4.1	1.9	2.4	0.9	0.4	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	5.4	1.9	0.4	0	-	0	-
Linton	426.8	13.9	2.6	1.9	1.5	2.4	2.4	2.7
Ohakea	56.4	8.7	2.8	2.1	0.3	0	-	-
Norsewood	148.5	2	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0.1	0	0
Waiouru	2.1	5.2	8.1	4.3	-	0	1.4	-
National Park	1,051.5	1.5	0.4	0.1	0.1	0	0	0
Waikawa Beach	4.2	8.1	10.5	8.1	3.1	5.2	10.5	-
Mangatainoka	178	3.1	2.2	0.9	0.5	0.6	1.5	0.7
Ormondville	889.7	3.2	1.5	2.5	2.2	1	0.3	0.5
Rongotea	137.6	0.3	1.5	0.7	0.3	-	-	-
Rātana	25.6	7	2.2	1.2	0.8	0.9	0.4	0.9
Halcombe	913.2	5.9	2.4	2.3	1.2	0.8	0.2	1
Kimbolton	334.7	0.2	0.1	-	-	-	0.2	0
Rangataua	766.7	3.4	1.7	1	0.5	0.4	0.2	0
Raurimu	190.1	4.4	2.2	2	0.3	0.1	0.1	0.1
Kai Iwi	148.2	3.3	3	2.9	1.1	1.6	0.2	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.9: Percentage of hectares of property use type flooded for town/settlement for 0.2% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.1	4.8	4	2	1.2	0.4	0.3
Palmerston North	3,060.7	9.5	5.6	3.3	1.2	0.7	0.1	0
Feilding	1,015.1	15	2	0.8	0.9	0.3	0	0
Marton	365.7	13.4	7.4	2.1	0.5	0.5	0.2	0.1
Ohakune	272.9	9.2	3.6	1.8	0.7	0.4	0.2	-
Longburn	46.1	12	6.7	3.6	1.1	1.7	0	-
Kairanga	45.4	16	20	4.5	0.4	1.3	0.2	0
Levin	1,280.1	25.1	4	0.6	0.1	0.1	0	-
Woodville	119.2	10.9	3.8	2.9	3.2	8.3	7.4	17.1
Foxton	227.8	17.4	13.5	6.4	0.6	0.2	0	0
Foxton Beach	182.5	16.5	12.7	3	0.6	0.3	-	-
Taumarunui	292.6	7.8	5.4	3.8	1.5	1.2	0.7	0.9
Dannevirke	346.6	10.1	1.6	0.5	0.2	0.1	0	0
Bulls	172.2	16.4	11.3	5.4	1.4	0.4	0	-
Tangimoana	38.6	7.9	9.4	37.3	17.9	2.2	-	-
Hunterville	163.2	6.9	5.3	3.3	1.3	0.9	0.1	0
Shannon	118.1	6	1.6	0.7	0.2	0.1	-	-
Koitiata	9.2	7.2	9.2	12.2	5.9	1.4	-	-
Ōhau	223.5	10.2	1.5	1	0.3	0.2	0	-
Hokio Beach	64	9.6	6.4	3.5	1.1	0.5	-	-
Bunnythorpe	132.8	7.1	2.8	1.6	0.2	0.4	0.1	0
Eketāhuna	91.5	10.4	2.1	0.4	0.1	0	0	0
Mangaweka	21.7	14.4	5.3	0.5	0.3	0.6	-	-
Ōwhango	24.1	11.7	1.2	2.3	1.1	1.7	0.4	-
Ōhura	31.9	11.1	9.3	6.5	2	0.2	-	-
Pohangina	23.7	13	1.6	1.1	0	0	-	-
Pongaroa	16.6	10.2	7.8	3.3	2.5	1	0.7	1.7
Mangamutu	13.6	12.7	3	0.1	-	-	-	-
Pahiatua	213.1	18.5	7.6	2	0.5	0.2	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	18.4	3.7	0.5	0.2	0	-	-
Himatangi Beach	50.7	10.7	7.2	1.2	0	-	-	-
Taihape	297.3	3	0.7	0.4	0.3	0.2	0.1	0.2
Waitārere Beach	111.8	7.1	7.1	7.5	4.1	1.8	0	-
Raetihi	101.9	9.8	4.8	2.8	2	1	0.1	-
Manakau	115.9	16.1	5.5	1.9	0.5	0.1	0	-
Sanson	58.6	9.6	3	2.1	0.8	1.3	0	-
Linton	44.7	7.3	2.1	1.5	0.9	0.1	-	-
Ohakea	9.9	10.7	9.3	16.1	0.9	0.3	-	-
Norsewood	27.5	10	3.9	1.5	-	-	-	-
Tokomaru	58.1	7.3	1.2	1.2	0.3	0	0.2	-
Waiouru	8.4	7.3	4	1.1	-	-	-	-
National Park	139.3	2.4	1.7	0.6	0.3	0.6	0.7	0.1
Waikawa Beach	59.7	9.3	8.1	2.6	0.3	0	-	-
Mangatainoka	20.2	8.4	6.7	3.4	1.5	-	-	6.2
Ormondville	40.5	12.1	1.6	0.7	0.1	0	-	-
Rongotea	110	10.5	5.5	2.6	0.5	0.3	-	-
Rātana	17.4	10	3.7	6.1	-	-	-	-
Halcombe	132.9	8.7	4.6	2.2	0.8	0.4	-	-
Kimbolton	52.5	5.2	4.3	0.6	-	1.4	-	-
Rangataua	28.5	10.2	2.5	0	-	-	-	-
Raurimu	16.9	7.3	1.4	0.5	0	0.3	-	-
Kai Iwi	38.6	6.6	2.8	1.6	1.6	0.5	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	13.1	8.6	5.5	1.9	1.7	2.4	0
Palmerston North	686.1	13	7.3	4.7	2.1	1.5	1.5	1.9
Feilding	170.9	23.9	11.2	5.4	1.2	0.2	0.1	0
Marton	213.9	9.7	5.6	5.8	15.9	18.4	1.7	1.5
Ohakune	22.4	12	6.7	3.6	1.1	0.9	0.2	-
Longburn	60.8	19.1	30.6	14.3	1.2	1.3	0	0
Kairanga	8	18.8	12.6	1.4	0.1	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	58.7	5	0.5	0.4	0.3	-	-
Woodville	12.5	6	4.5	5.8	4	10.5	4.7	40
Foxton	41.4	21.7	12.4	2	0	0	-	-
Foxton Beach	0.8	15	12.5	1.2	-	-	-	-
Taumarunui	37.9	11.9	4.4	1.6	0.8	0.3	0.2	0.2
Dannevirke	129.7	11	3.3	1.7	0.9	1	0.6	0.5
Bulls	53.9	14.7	11.8	6	4.4	7.6	2	1.3
Tangimoana	4.1	17.1	11.7	1.7	-	-	-	-
Hunterville	23.4	18.7	6.9	1.5	0.3	0.3	-	-
Shannon	24.9	10.3	7.6	1.5	0	-	-	0.1
Ōhau	7.2	13.3	3.1	1.1	2.2	2.9	7.2	5.7
Hokio Beach	50	16.8	8.7	3.4	-	-	-	-
Bunnythorpe	20.9	14.1	2.3	0.4	0	-	-	-
Eketāhuna	14	14.4	2.5	0.2	-	-	-	-
Mangaweka	10.3	22	13.1	2.9	1.3	1.8	0.8	0.2
Ōwhango	2.4	14.6	5	0.4	0.4	-	-	-
Ōhura	1.2	6.7	5	4.2	0.8	0	-	-
Pongaroa	2.5	10	23.6	4.4	2	-	-	-
Mangamutu	15.3	27.2	17.3	3.5	0.2	-	-	-
Pahiatua	17.7	20.8	7.3	0.7	0	-	-	-
Ashhurst	19.8	12.6	14.4	17.7	7.9	1.9	2.2	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	7.7	3.3	1.2	0.3	0.7	0.3	-
Waitārere Beach	0.4	5	60	10	-	-	-	-
Raetihi	13.2	11.4	3.5	0.8	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	24.2	7.2	1.9	0.5	0.6	-	-
Linton	5.2	8.5	2.7	1.2	0.8	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.8	0.1	-	-	-	-	-
Waiouru	5.6	10.5	3.6	1.8	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	1	5.6	4.4	-	-	-
Mangatainoka	4.7	13	4.9	2.1	-	-	-	-
Ormondville	5.1	3.9	1	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	10.7	12.8	0.2	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.9	3.1	4.8	6.1	18	10.2	7.8
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	6.7	4.2	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.7	5.1	3.3	1.6	1.4	0.3	0.2
Palmerston North	14,029.6	6.4	4.6	3.4	1.9	2.1	1.2	1.3
Feilding	7,528	10.7	6.4	4.2	2	1.5	0.4	0.1
Marton	27,105.7	8.3	4.1	2	1.2	1.2	0.4	0.4
Ohakune	44,184.2	1.8	0.8	0.4	0.1	0.1	0	0
Longburn	1,302.6	17	17.4	11.4	2	4.8	3.3	2.9
Kairanga	6,733.2	15	15.9	10.6	4.5	6.1	4.9	3.1
Levin	7,837.6	14.1	2.9	1.8	1.1	0.9	0.2	0
Woodville	10,615.9	5.3	2.7	1.4	0.9	1	0.9	20.3
Foxton	11,957.6	19	9.4	5.1	1.8	2.4	1.9	1.7
Foxton Beach	861.7	11.5	11.1	13	16.1	3.4	0.2	0.6
Taumarunui	12,241.3	2.3	1.4	0.7	0.3	0.5	0.4	0.9
Dannevirke	34,395.2	8.2	2.6	1.5	0.8	0.8	0.4	0.5
Bulls	9,085.6	14.3	8	5.7	2.7	2.1	0.4	0.3
Tangimoana	9,602.2	14.8	7.1	3.6	1.6	1.7	0.8	0.4
Hunterville	55,534.7	3.3	1.5	0.8	0.4	0.3	0.2	0.4
Shannon	7,725	5	5.8	7.4	3.3	1.6	0.2	0.1
Koitiata	908.1	12.7	9.5	10.4	5.5	2.6	0.2	0.3
Ōhau	2,857.8	8.6	6.3	4.8	2	1.6	0.5	0.2
Hokio Beach	2,923.4	10.4	9.4	8.7	2.8	1.9	0.1	0.1
Bunnythorpe	8,837.9	9.1	4.2	2.9	1.4	1.2	0.4	0.1
Eketāhuna	37,977.3	5.8	2.9	1.3	0.5	0.4	0.2	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	2.7	0.6	0.3	0.1	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.1	0.1	0.2
Ōhura	24,006.2	3	1.9	1.1	0.5	0.4	0.2	0.3
Pohangina	26,177.4	3.7	2.1	1.5	0.6	0.5	0.2	0.1
Pongaroa	57,773.7	2.4	1	0.4	0.2	0.2	0.2	0.3
Mangamutu	1,464.7	6.1	5	4.7	2.9	4	0.8	2.4
Pahiatua	56,300.9	3.7	2.3	1.2	0.5	0.5	0.2	0.2
Ashhurst	9,723	6.7	4.3	2.6	1.4	1.2	0.5	0.4
Himatangi Beach	1,181.1	15.3	17.2	8	2.3	3.1	0	-
Taihape	66,124.7	2.4	0.8	0.4	0.2	0.2	0.1	0.2
Waitārere Beach	13.3	4.7	11.1	8.8	3.3	0.1	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0	0	0	0
Manakau	5,969.4	8.5	4.4	3.3	1.6	1.1	0.1	0
Sanson	3,977.1	6.9	3.6	2	0.7	0.4	0.1	0
Linton	9,076.6	5.8	3.5	2	0.6	0.7	0.6	0.2
Ohakea	1,988.8	18.3	11.4	7.3	4	4.7	0.4	0.1
Norsewood	5,388.4	9.2	2.9	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	6.5	3.8	3.7	3.3	3	0.2	0.1
Waiouru	2,552.9	5.3	1.5	0.6	0.3	0.3	0.1	0.1
National Park	4,186.3	6.1	1.5	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	12.3	10.5	5.4	2	1.4	0.4	0.1
Mangatainoka	2,846.3	4.6	2.9	2.4	1.5	1.9	1.2	23.7
Ormondville	15,472.3	3.9	1.4	0.7	0.3	0.4	0.3	0.5
Rongotea	9,950.9	12.7	6.6	3.9	1.9	2.4	1.2	0.1
Rātana	1,699.3	7.4	4.4	4.1	2.7	2.3	0.6	1
Halcombe	20,547.4	6.8	3.2	2.2	1.2	1.4	0.5	0.5
Kimbolton	9,408.6	4.5	2.2	1.3	0.5	0.5	0.2	0.2
Rangataua	6,946.1	2.8	0.6	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.4	2	1	0.5	0.5	0.3	0.5
Kai Iwi	9,060.1	4	2.3	1.5	0.7	0.6	0.3	0.6
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.3	3.6	2.8	1.8	1.5	1.3	2
Palmerston North	5,568.9	4.3	2.9	1.8	1.1	1.6	1	0.7
Feilding	476.3	12.6	5.6	6.2	2.6	0.8	0.1	0.1
Marton	1,724.2	3.3	1.9	0.9	0.4	0.7	0.1	0.2
Ohakune	2,300.5	1.2	0.4	0.4	0.2	0.3	0.1	0
Longburn	36.4	16.7	7	0.9	1.4	2.5	-	0
Kairanga	29.9	8.3	0.2	0.7	0.8	0.8	0	0
Levin	495.8	22.3	3.8	1.7	0.7	2.2	0.5	0.1
Woodville	73.1	18.5	0.5	1	1.2	1.8	0.4	24
Foxton	594.5	14.4	10.7	6.1	1.7	0.3	0.1	0
Foxton Beach	309.8	8.7	8.9	5.5	2.8	4.1	-	-
Taumarunui	503.9	1.9	1.2	1.3	0.9	2	0.6	2.2
Dannevirke	855.3	8.3	1.5	1.6	0.4	0.5	0.2	0.1
Bulls	223.2	13.1	5.9	2.9	1.5	2.4	2.3	0.6
Tangimoana	421.8	10.6	6.7	2.7	0.7	0.7	0.7	0.4
Hunterville	2,173.7	1.2	0.6	0.4	0.1	0.2	0.1	0.3
Shannon	2,594	1.1	0.6	0.2	0.1	0.1	0	0
Koitiata	64.1	19.7	21.8	4.5	1.6	0.3	-	-
Ōhau	35.6	8	3.4	2.3	0.4	0	-	-
Hokio Beach	857.5	8.9	18.1	13.2	1.9	6.5	1.8	0
Bunnythorpe	80.9	12.2	2.8	1.3	0.8	1	0.8	0.3
Eketāhuna	1,475.7	0.6	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	3.3	0.7	0.3	0.2	0.2	0.1	1.2
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.7	0.2	0.1	0.1	0.1	0.1
Pohangina	882.3	3.7	1.9	1	0.5	0.6	0.1	0
Pongaroa	3,913	3.6	1.6	0.5	0.2	0.3	0.1	0.3
Mangamutu	26	2.9	3.7	1.5	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0
Ashhurst	115.4	6.9	2.8	2.6	1.9	1.2	0.6	-
Himatangi Beach	59.4	2.7	1.6	1	0.8	0.9	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4.2	0.8	0.3	0.1	0.1	0.1	0.1
Waitārere Beach	24.3	4.9	4	1.4	1.7	0.4	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	3.9	2.8	2.5	1	0.5	0	-
Sanson	55.8	6.5	2.3	0.7	0.1	0	-	0
Linton	426.8	14.4	2.7	1.8	1.3	2.4	2.3	3.5
Ohakea	56.4	11.6	5.2	3.5	1	0.2	-	-
Norsewood	148.5	2.1	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.7	1	0.3	0.1	0.1	0	0
Waiouru	2.1	5.2	9	6.7	3.3	3.3	2.4	3.8
National Park	1,051.5	1.5	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	8.6	11.4	6.7	5	4	12.9	-
Mangatainoka	178	3.2	2.3	1.3	0.5	0.6	1.1	1.3
Ormondville	889.7	3.2	1.6	2.3	2.4	1.1	0.4	0.5
Rongotea	137.6	0.7	1.2	0.8	0.3	0	-	-
Rātana	25.6	7.6	1.8	2	0.8	1.1	0.7	1.1
Halcombe	913.2	4.8	2.6	1.8	0.6	0.4	0.2	0.4
Kimbolton	334.7	0.3	0.1	-	-	-	0.2	0
Rangataua	766.7	3.5	1.8	1	0.5	0.4	0.2	0.1
Raurimu	190.1	4.4	2.5	2.1	0.1	0.1	0.3	0.1
Kai Iwi	148.2	3.7	3.6	2.8	1.1	1.3	0.7	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.10: Percentage of hectares of property use type flooded for town/settlement for 0.1% AEP, Current Climate, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	7.9	4.5	4	2.8	2.3	0.8	0.5
Palmerston North	3,060.7	9.7	5.7	3.5	1.2	0.9	0.1	0
Feilding	1,015.1	15.5	2.1	0.9	0.8	0.4	0.1	0
Marton	365.7	13.8	8.1	2.3	0.6	0.6	0.3	0.2
Ohakune	272.9	9.5	3.8	1.9	0.7	0.5	0.2	-
Longburn	46.1	11.9	12.7	4.4	1.3	2	0	-
Kairanga	45.4	15.4	20.6	7	2.9	0.5	0.9	0
Levin	1,280.1	25.5	4.2	0.6	0.1	0.1	0	-
Woodville	119.2	10	3.4	4.3	2.7	6.3	8.3	22.2
Foxton	227.8	17.7	13.7	6.5	0.6	0.2	0	0
Foxton Beach	182.5	16.3	14	3.3	0.7	0.4	0	-
Taumarunui	292.6	6.5	6.7	7.3	2.9	1.8	0.8	1
Dannevirke	346.6	10.4	1.6	0.5	0.2	0.1	0	0
Bulls	172.2	16.4	11.5	5.9	1.9	0.6	0	-
Tangimoana	38.6	7.3	4.9	26.6	31.3	6.4	-	-
Hunterville	163.2	7	5.5	4.2	2	0.9	0.3	0
Shannon	118.1	6.3	1.6	0.7	0.2	0.1	-	-
Koitiata	9.2	7.3	8.8	12.4	6.1	1.4	-	-
Ōhau	223.5	10.4	1.6	1	0.3	0.2	0	-
Hokio Beach	64	9.5	6.7	3.7	1.2	0.5	-	-
Bunnythorpe	132.8	7.3	2.6	1.8	0.2	0.4	0.1	0
Eketāhuna	91.5	10.7	2.2	0.4	0	0.1	0	0
Mangaweka	21.7	14.9	6.1	0.5	0.4	0.6	0	-
Ōwhango	24.1	11.9	1.2	2.3	0.7	2.2	0.4	-
Ōhura	31.9	10.9	9.1	6.9	2.3	0.3	-	-
Pohangina	23.7	13.1	1.9	1.2	0	0	-	-
Pongaroa	16.6	10.2	6.7	5	2.3	1.3	0.7	1.9
Mangamutu	13.6	19.1	3	0.1	-	-	-	-
Pahiatua	213.1	18.7	7.8	2	0.6	0.3	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	19	3.9	0.5	0.2	0	-	-
Himatangi Beach	50.7	10.7	8.1	1.3	0	-	-	-
Taihape	297.3	3.1	0.7	0.5	0.3	0.2	0.1	0.3
Waitārere Beach	111.8	7.3	7.1	7.9	4.3	1.9	0	-
Raetihi	101.9	10	5	2.6	2.3	1.2	0.1	-
Manakau	115.9	16.1	5.9	2	0.7	0.1	0	-
Sanson	58.6	9.7	3.1	2.2	0.7	1.4	0	-
Linton	44.7	7.5	2.1	1.6	0.9	0.2	-	-
Ohakea	9.9	11	5.7	16	5.1	0.5	-	-
Norsewood	27.5	10	3.9	1.5	-	-	-	-
Tokomaru	58.1	7.4	1.3	1.2	0.3	0	0.2	-
Waiouru	8.4	7.1	4.2	1.1	-	-	-	-
National Park	139.3	2.5	1.7	0.6	0.4	0.7	0.7	0.1
Waikawa Beach	59.7	9.4	8.3	2.8	0.4	0	-	-
Mangatainoka	20.2	8.9	7.5	4.3	1.9	0.1	-	6.2
Ormondville	40.5	12.1	1.8	0.7	0.1	0	-	-
Rongotea	110	10.6	5.8	2.8	0.5	0.4	-	-
Rātana	17.4	10	3.7	6.1	-	-	-	-
Halcombe	132.9	9.3	4.1	2.8	0.9	0.4	-	-
Kimbolton	52.5	4.9	4.6	0.6	-	1.4	-	-
Rangataua	28.5	10.7	2.5	0.1	-	-	-	-
Raurimu	16.9	7.9	1.4	0.6	0	0.3	-	-
Kai Iwi	38.6	6.7	2.8	1.6	1.6	0.6	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	11.4	6.9	8.3	4.1	2.7	2.5	0.7
Palmerston North	686.1	13.3	7.5	4.7	2.3	1.7	1.5	2.1
Feilding	170.9	24.8	11.1	6.8	1.6	0.3	0.1	0
Marton	213.9	10.1	5.5	3.4	12.1	24.4	2.2	1.9
Ohakune	22.4	12.8	6.7	3.8	1.3	0.9	0.2	-
Longburn	60.8	17.3	28.4	24.3	2.4	1.5	0.1	0
Kairanga	8	19.6	13.4	1.2	0.4	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	60	5.5	0.5	0.4	0.3	-	-
Woodville	12.5	7.1	3	6.1	5.5	8.3	9.3	43.1
Foxton	41.4	21.4	13.1	2.1	0.1	0	-	-
Foxton Beach	0.8	16.2	11.2	2.5	-	-	-	-
Taumarunui	37.9	12.3	4.9	2.2	1.2	0.6	0.2	0.3
Dannevirke	129.7	11.3	3.3	1.9	1	1.1	0.6	0.7
Bulls	53.9	14.3	9.5	8.2	3.5	8.5	3.5	1.4
Tangimoana	4.1	19.8	18	9.3	-	-	-	-
Hunterville	23.4	21.3	11.7	2.6	0.4	0.3	-	-
Shannon	24.9	10.6	8.5	1.8	0	-	-	0.1
Ōhau	7.2	14.2	2.6	1.7	1.9	2.5	6.4	7.4
Hokio Beach	50	17.1	8.8	3.5	-	-	-	-
Bunnythorpe	20.9	14.4	2.3	0.4	0	-	-	-
Eketāhuna	14	15.3	2.5	0.2	-	-	-	-
Mangaweka	10.3	22.4	15.2	2.8	1	2.4	1.1	0.6
Ōwhango	2.4	15	5	0.4	0.4	-	-	-
Ōhura	1.2	7.5	3.3	5.8	1.7	0	-	-
Pongaroa	2.5	10.4	23.2	4.4	2.4	-	-	-
Mangamutu	15.3	28.4	21	6.4	0.2	-	-	-
Pahiatua	17.7	20.7	8	0.8	0	-	-	-
Ashhurst	19.8	12	13.9	18.5	8.9	1.7	2.6	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	8	3.2	1.3	0.4	0.7	0.4	0
Waitārere Beach	0.4	2.5	45	30	-	-	-	-
Raetihi	13.2	11.4	3.6	1	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	24.4	7.6	2	0.4	0.7	-	-
Linton	5.2	8.3	2.7	1.5	0.8	0.2	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.8	0.1	-	-	-	-	-
Waiouru	5.6	10.7	3.6	1.8	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	0.1	6.7	4.4	-	-	-
Mangatainoka	4.7	13	4.5	2.6	-	-	-	-
Ormondville	5.1	3.9	1	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	10.4	12.8	0.2	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.6	2.9	4.7	5.9	15.5	13.9	8.1
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	8.3	4.2	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.8	5.3	3.4	1.6	1.4	0.7	0.2
Palmerston North	14,029.6	6.3	4.7	3.7	2.2	2.4	1.3	1.5
Feilding	7,528	10.7	6.7	4.5	2.1	1.5	0.4	0.2
Marton	27,105.7	8.5	4.3	2	1.1	1.4	0.5	0.4
Ohakune	44,184.2	1.8	0.8	0.5	0.2	0.1	0	0
Longburn	1,302.6	16	20.4	14.9	2.5	4.5	3.7	3.2
Kairanga	6,733.2	14.2	15.1	11.3	4.6	7.1	4.6	6
Levin	7,837.6	14.4	3	1.9	1.2	0.9	0.2	0
Woodville	10,615.9	5.4	2.7	1.5	0.9	1.1	0.7	20.9
Foxton	11,957.6	19.1	9.6	5.3	1.8	2.4	2	1.9
Foxton Beach	861.7	11.7	11.6	11.5	17.9	3.8	0.2	0.6
Taumarunui	12,241.3	2.4	1.4	0.8	0.3	0.5	0.4	1
Dannevirke	34,395.2	8.4	2.7	1.6	0.8	0.9	0.4	0.5
Bulls	9,085.6	14.5	7.9	5.9	2.8	2.6	0.5	0.3
Tangimoana	9,602.2	15	7.2	3.7	1.7	1.8	0.9	0.4
Hunterville	55,534.7	3.3	1.6	0.8	0.4	0.4	0.2	0.4
Shannon	7,725	4.8	5.5	7.8	3.6	1.8	0.2	0.1
Koitiata	908.1	12	9.5	10.5	5.9	4	0.3	0.3
Ōhau	2,857.8	8.7	6.3	5.3	2	1.8	0.6	0.2
Hokio Beach	2,923.4	10.4	9.4	9	3	2.1	0.1	0.1
Bunnythorpe	8,837.9	9.3	4.4	2.9	1.5	1.3	0.4	0.1
Eketāhuna	37,977.3	5.9	3	1.4	0.5	0.4	0.2	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	2.7	0.6	0.3	0.1	0.2	0.1	0.4
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.1	0.1	0.2
Ōhura	24,006.2	3	1.9	1.1	0.6	0.5	0.2	0.4
Pohangina	26,177.4	3.7	2.1	1.5	0.7	0.5	0.2	0.1
Pongaroa	57,773.7	2.4	1	0.5	0.2	0.3	0.2	0.3
Mangamutu	1,464.7	6	4.5	4.2	3.1	4.2	2.3	2.6
Pahiatua	56,300.9	3.7	2.4	1.3	0.6	0.5	0.2	0.2
Ashhurst	9,723	6.7	4.5	2.8	1.4	1.4	0.5	0.4
Himatangi Beach	1,181.1	15.1	17.3	8.5	2.5	3.4	0	-
Taihape	66,124.7	2.5	0.8	0.4	0.2	0.2	0.1	0.2
Waitārere Beach	13.3	4	11.1	8.6	4.1	0.1	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0	0	0	0
Manakau	5,969.4	8.6	4.5	3.4	1.7	1.2	0.1	0
Sanson	3,977.1	7.2	3.7	2.1	0.7	0.5	0.1	0
Linton	9,076.6	5.8	3.6	2	0.7	0.7	0.7	0.2
Ohakea	1,988.8	18.3	11.1	7.2	4.5	5.7	0.6	0.1
Norsewood	5,388.4	9.4	3	1.1	0.5	0.4	0.2	0.2
Tokomaru	5,474	6.6	3.8	3.6	3.1	3.4	0.3	0.1
Waiouru	2,552.9	5.5	1.5	0.6	0.3	0.3	0.1	0.1
National Park	4,186.3	6.2	1.6	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	11.7	10.9	6.7	2.2	1.6	0.4	0.2
Mangatainoka	2,846.3	4.6	2.9	2.2	1.5	2.2	1.3	24.3
Ormondville	15,472.3	3.9	1.4	0.7	0.3	0.4	0.3	0.5
Rongotea	9,950.9	13	6.7	4.4	2	2.6	1.4	0.1
Rātana	1,699.3	7.5	3.9	3.7	2.7	3.2	0.7	1.1
Halcombe	20,547.4	7	3.3	2.2	1.2	1.5	0.6	0.5
Kimbolton	9,408.6	4.6	2.3	1.4	0.6	0.5	0.2	0.2
Rangataua	6,946.1	2.8	0.7	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.3	2.1	1	0.5	0.5	0.3	0.5
Kai Iwi	9,060.1	4.1	2.3	1.6	0.7	0.7	0.4	0.6
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.4	3.6	2.8	1.5	2.3	1.2	2.5
Palmerston North	5,568.9	4.3	2.9	1.9	1.2	1.5	1.1	0.8
Feilding	476.3	12.9	5.7	6.3	2.9	0.9	0.1	0.1
Marton	1,724.2	3.4	1.9	0.9	0.4	0.8	0.1	0.3
Ohakune	2,300.5	1.2	0.5	0.4	0.2	0.3	0.1	0
Longburn	36.4	11.7	12.8	0.7	1.5	2.9	-	0
Kairanga	29.9	8.5	0.1	0.8	0.8	0.9	0	0
Levin	495.8	22.9	3.9	1.8	0.7	2.3	0.5	0.2
Woodville	73.1	19	0.6	0.3	0.6	2.6	1.2	24.1
Foxton	594.5	14.5	10.7	6.3	1.9	0.3	0.1	0
Foxton Beach	309.8	8.5	9	5.8	2.7	4.4	-	-
Taumarunui	503.9	1.8	0.9	1	1.2	2.2	0.8	2.5
Dannevirke	855.3	8.4	1.6	1.7	0.4	0.5	0.2	0.1
Bulls	223.2	13.4	5.9	2.9	1.4	2.4	2.7	0.7
Tangimoana	421.8	10.5	6.7	3.4	0.9	0.8	0.7	0.4
Hunterville	2,173.7	1.3	0.7	0.4	0.2	0.2	0.1	0.3
Shannon	2,594	1.1	0.6	0.2	0.1	0.1	0	0
Koitiata	64.1	19	22.3	5.6	1.7	0.4	-	-
Ōhau	35.6	8.1	3.9	2.4	0.9	0	-	-
Hokio Beach	857.5	7.1	17.6	16.8	2	6.4	2.1	0
Bunnythorpe	80.9	12.9	2.9	1.3	0.8	1.2	0.8	0.4
Eketāhuna	1,475.7	0.6	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	3.3	0.7	0.3	0.2	0.2	0.1	1.3
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.7	0.2	0.1	0.1	0.1	0.1
Pohangina	882.3	3.6	2.1	0.9	0.5	0.6	0.1	0
Pongaroa	3,913	3.6	1.6	0.5	0.2	0.3	0.1	0.4
Mangamutu	26	2.8	3.9	1.8	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0.1
Ashhurst	115.4	7.7	2.9	2.9	2.3	1.8	0.7	-
Himatangi Beach	59.4	2.6	2	1	0.8	0.9	0.2	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4.4	0.8	0.3	0.1	0.1	0.1	0.2
Waitārere Beach	24.3	4.6	4.1	1.6	1.9	0.4	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	4.1	3.4	2.6	0.9	0.5	0	-
Sanson	55.8	6.9	2.3	0.7	0.1	0	-	0
Linton	426.8	14.2	3.3	1.8	1.3	2.3	2	4.1
Ohakea	56.4	11.8	5.5	3.5	1.1	0.2	-	-
Norsewood	148.5	2.1	0.6	0.7	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.7	1	0.4	0	0.1	0	0
Waiouru	2.1	5.7	7.6	6.2	4.3	2.4	4.8	4.3
National Park	1,051.5	1.5	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	10.5	12.6	6	6	3.1	14	-
Mangatainoka	178	3.3	2.5	1.6	0.5	0.7	0.8	1.7
Ormondville	889.7	3.3	1.6	2.1	2.6	1.1	0.4	0.6
Rongotea	137.6	0.7	1.3	0.7	0.1	0.3	-	-
Rātana	25.6	7.5	1.8	1.8	1.1	1	0.9	1.3
Halcombe	913.2	5	2.3	2	0.8	0.5	0.2	0.4
Kimbolton	334.7	0.3	0.2	-	-	-	0.2	0
Rangataua	766.7	3.6	1.8	1	0.5	0.4	0.2	0.1
Raurimu	190.1	4.5	2.4	2	0.6	0.2	0.2	0.3
Kai Iwi	148.2	3.5	3.7	2.7	1.3	1.4	0.6	0.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.11: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +1°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.3	4.8	3.6	1.4	0.9	0.3	0.2
Palmerston North	3,060.7	9.4	5.6	3.3	1.2	0.8	0.1	0
Feilding	1,015.1	14.8	1.9	0.9	0.8	0.3	0	0
Marton	365.7	13.4	5.6	1.3	0.4	0.5	0.2	0.1
Ohakune	272.9	9.2	3.6	1.8	0.7	0.4	0.2	-
Longburn	46.1	11.5	11.1	4.2	1.1	1.9	0	-
Kairanga	45.4	16.8	18.4	5.7	0.4	1.1	0.4	0
Levin	1,280.1	25.2	4.1	0.6	0.1	0.1	0	-
Woodville	119.2	12.5	5	4.9	3.9	6.7	5.2	7.4
Foxton	227.8	17	13	6.4	0.6	0.2	0	0
Foxton Beach	182.5	16.5	12.4	3.2	0.6	0.3	-	-
Taumarunui	292.6	7.7	6.2	4.2	1.6	1.2	0.8	0.9
Dannevirke	346.6	10.1	1.6	0.5	0.2	0.1	0	0
Bulls	172.2	17.6	7.5	3.6	0.8	0.2	0	-
Tangimoana	38.6	14.7	27.2	19.2	2	0.2	-	-
Hunterville	163.2	7	6.2	2.8	1	0.6	0.1	0
Shannon	118.1	6.1	1.5	0.7	0.2	0.1	-	-
Koitiata	9.2	7.1	8.7	12.2	6.1	1.1	-	-
Ōhau	223.5	10.2	1.5	1	0.3	0.2	0	-
Hokio Beach	64	9.5	6.4	3.5	1.1	0.5	-	-
Bunnythorpe	132.8	7	2.7	1.6	0.2	0.4	0.1	0
Eketāhuna	91.5	10.4	2.1	0.4	0.1	0.1	0	0
Mangaweka	21.7	16.1	3	0.2	0.1	0.7	-	-
Ōwhango	24.1	11.9	1.2	2.3	1.1	1.7	0.4	-
Ōhura	31.9	11.1	9.2	6.6	2	0.2	-	-
Pohangina	23.7	12.7	1.5	1.1	0	0	-	-
Pongaroa	16.6	10.4	8.1	3	2.5	0.9	0.8	1.7
Mangamutu	13.6	12	3	0.1	-	-	-	-
Pahiatua	213.1	18.5	7.7	1.9	0.6	0.3	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	18.5	3.7	0.5	0.2	0	-	-
Himatangi Beach	50.7	9.8	6.5	1.1	-	-	-	-
Taihape	297.3	3.6	1.2	0.5	0.2	0.2	0.1	0.2
Waitārere Beach	111.8	7.3	6.9	7.5	4	1.5	0	-
Raetihi	101.9	9.9	4.8	2.8	2	1	0.1	-
Manakau	115.9	16.1	5.6	1.9	0.5	0.1	0	-
Sanson	58.6	9.9	3.4	1.3	1.4	0.7	-	-
Linton	44.7	7.2	2.1	1.6	0.9	0.1	-	-
Ohakea	9.9	10.1	8.5	11.3	0.2	-	-	-
Norsewood	27.5	10	3.9	1.5	-	-	-	-
Tokomaru	58.1	7.3	1.2	1.2	0.3	0	0.2	-
Waiouru	8.4	8.2	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.6	0.3	0.7	0.7	0.1
Waikawa Beach	59.7	9.2	8.1	2.6	0.3	0	-	-
Mangatainoka	20.2	8.1	7	3.2	1.7	0	0.6	5.5
Ormondville	40.5	12.1	1.6	0.7	0.1	0	-	-
Rongotea	110	9.9	4.7	2.6	0.5	0.2	-	-
Rātana	17.4	10	3.7	6.1	-	-	-	-
Halcombe	132.9	8.5	5.2	1.1	0.3	0.1	-	-
Kimbolton	52.5	5.2	4.3	0.6	-	1.4	-	-
Rangataua	28.5	10.1	2.4	0	-	-	-	-
Raurimu	16.9	7.5	1.4	0.5	0	0.3	-	-
Kai Iwi	38.6	6.3	2.9	0.8	1.6	1.4	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	12.8	8.4	5.6	1.9	1.3	2.7	0
Palmerston North	686.1	13	7.5	4.4	2	1.4	1.5	2
Feilding	170.9	23.8	11.3	5	1.1	0.2	0.1	0
Marton	213.9	9	5.2	10.9	17	10.3	1.2	1.3
Ohakune	22.4	12	6.7	3.6	1.1	0.9	0.2	-
Longburn	60.8	17.5	31.2	19.8	1.8	1.4	0.1	0
Kairanga	8	19.8	12.6	1.4	0.1	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	58.9	5	0.5	0.4	0.3	-	-
Woodville	12.5	8.5	2.6	5.4	2.3	11.2	4.4	25.5
Foxton	41.4	21.6	12.4	2	0.1	0	-	-
Foxton Beach	0.8	15	12.5	1.2	-	-	-	-
Taumarunui	37.9	12.1	4.2	1.7	0.9	0.3	0.2	0.2
Dannevirke	129.7	11	3.2	1.6	0.8	1	0.6	0.5
Bulls	53.9	14.5	9.4	3.9	4.8	5.5	0.7	1.2
Tangimoana	4.1	19.3	3.2	0	-	-	-	-
Hunterville	23.4	15.6	5.4	1.8	0.3	0.3	-	-
Shannon	24.9	10.5	7.4	1.6	0	-	-	0.1
Ōhau	7.2	13.3	2.9	1.1	2.4	2.8	7.1	6.1
Hokio Beach	50	16.9	8.7	3.4	-	-	-	-
Bunnythorpe	20.9	14.1	2.3	0.4	0	-	-	-
Eketāhuna	14	14.9	2.5	0.2	-	-	-	-
Mangaweka	10.3	25.1	9.5	2.7	1.1	1.4	0.8	0.1
Ōwhango	2.4	15	5	0.4	0.4	-	-	-
Ōhura	1.2	6.7	4.2	4.2	0.8	0	-	-
Pongaroa	2.5	10	23.6	4.4	2	-	-	-
Mangamutu	15.3	27.2	17.3	3.5	0.2	-	-	-
Pahiatua	17.7	20.8	7.4	0.7	0	-	-	-
Ashhurst	19.8	12.1	14.1	18.3	8.3	1.9	2.2	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.8	2.6	0.9	0.3	0.7	0.2	-
Waitārere Beach	0.4	7.5	62.5	5	-	-	-	-
Raetihi	13.2	11.4	3.5	0.8	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	19.9	1.7	0.9	0.4	-	-	-
Linton	5.2	8.3	2.7	1.5	0.8	0.2	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.9	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.5	1.4	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	3.3	3.4	4.4	-	-	-
Mangatainoka	4.7	13	4.9	2.1	-	-	-	-
Ormondville	5.1	3.9	1	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	5.1	3.4	5.7	4.9	19.9	6.7	7.2
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	8.3	4.2	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.6	5.1	3.4	1.6	1.3	0.3	0.1
Palmerston North	14,029.6	6.2	4.6	3.6	2	2.3	1.2	1.4
Feilding	7,528	10.8	6.3	4.1	1.9	1.5	0.4	0.1
Marton	27,105.7	8.9	4	2	1	1	0.3	0.3
Ohakune	44,184.2	1.8	0.8	0.4	0.1	0.1	0	0
Longburn	1,302.6	16.9	19.1	12.7	2.1	4.6	3.6	3.1
Kairanga	6,733.2	14.9	15.6	10.2	4.3	6.5	4.7	4.1
Levin	7,837.6	14.1	2.9	1.9	1.1	0.9	0.2	0
Woodville	10,615.9	5.5	2.7	1.4	1	1.4	1.6	18.2
Foxton	11,957.6	18.2	8.5	4.9	1.7	2.4	2	1.8
Foxton Beach	861.7	11.3	10.9	7.1	21	4.3	0.3	0.6
Taumarunui	12,241.3	2.3	1.4	0.7	0.3	0.5	0.4	0.9
Dannevirke	34,395.2	8.2	2.6	1.5	0.8	0.8	0.3	0.4
Bulls	9,085.6	14.5	7.7	5.2	2.3	1.5	0.3	0.2
Tangimoana	9,602.2	13.1	5.4	3.2	1.2	1.4	0.5	0.2
Hunterville	55,534.7	3.2	1.6	0.9	0.4	0.4	0.2	0.3
Shannon	7,725	5	5.9	7.4	3.2	1.6	0.2	0.1
Koitiata	908.1	12	9.9	10.1	5	1.9	0.2	0.3
Ōhau	2,857.8	8.7	6.3	4.8	2	1.6	0.6	0.2
Hokio Beach	2,923.4	10.5	9.4	8.7	2.8	1.8	0.1	0.1
Bunnythorpe	8,837.9	9.1	4.2	2.9	1.4	1.1	0.3	0.1
Eketāhuna	37,977.3	5.8	3	1.4	0.5	0.4	0.2	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	2.9	1.2	0.5	0.2	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.1	0.1	0.2
Ōhura	24,006.2	3	1.9	1.1	0.5	0.4	0.2	0.4
Pohangina	26,177.4	3.7	2.1	1.4	0.6	0.5	0.2	0.1
Pongaroa	57,773.7	2.4	1	0.4	0.2	0.2	0.2	0.2
Mangamutu	1,464.7	6.2	5.1	4.8	3	3.9	0.8	1.7
Pahiatua	56,300.9	3.7	2.4	1.2	0.5	0.5	0.2	0.2
Ashhurst	9,723	6.6	4.4	2.6	1.3	1.3	0.5	0.4
Himatangi Beach	1,181.1	13.5	14.3	7.4	2.2	3.1	0	-
Taihape	66,124.7	2.8	1.5	0.7	0.3	0.2	0.1	0.2
Waitārere Beach	13.3	5.3	11.1	8.8	2.6	-	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0	0	0	0
Manakau	5,969.4	8.5	4.4	3.3	1.6	1.1	0.1	0
Sanson	3,977.1	6.7	4.4	2.8	1.1	0.7	0.2	0
Linton	9,076.6	5.8	3.5	2	0.6	0.7	0.7	0.2
Ohakea	1,988.8	17.1	7.6	5.2	3.9	2.4	0.2	0
Norsewood	5,388.4	9.3	2.9	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	6.5	3.8	3.7	3.2	3.1	0.2	0.1
Waiouru	2,552.9	5.5	2.5	1	0.3	0.3	0.1	0.1
National Park	4,186.3	6	1.6	0.5	0.4	0.3	0.1	0.2
Waikawa Beach	270	12.4	10.6	5.4	2	1.4	0.4	0.1
Mangatainoka	2,846.3	4.9	3.1	2.4	1.4	1.8	1.4	22
Ormondville	15,472.3	3.9	1.4	0.7	0.3	0.4	0.3	0.5
Rongotea	9,950.9	12.6	6.2	3.9	2.1	2.4	1.2	0.1
Rātana	1,699.3	7.4	4.7	4.1	2.5	1.9	0.6	0.9
Halcombe	20,547.4	6.7	3.8	2.7	1.5	1.5	0.5	0.4
Kimbolton	9,408.6	4.5	2.4	1.3	0.6	0.5	0.2	0.2
Rangataua	6,946.1	2.8	0.6	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.4	2	1	0.5	0.5	0.3	0.5
Kai Iwi	9,060.1	3.8	2.4	1.7	0.8	0.6	0.3	0.5
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.1	3.7	2.9	1.6	1.4	1.4	1.7
Palmerston North	5,568.9	4.2	2.9	1.8	1.1	1.6	1.1	0.8
Feilding	476.3	12.4	5.6	6.2	2.5	0.7	0.1	0.1
Marton	1,724.2	3.5	2	0.9	0.2	0.2	0.1	0.2
Ohakune	2,300.5	1.2	0.4	0.4	0.2	0.3	0.1	0
Longburn	36.4	12.4	12	0.9	1.3	2.8	-	0
Kairanga	29.9	8.3	0.3	0.7	0.8	0.8	0	0
Levin	495.8	22.4	3.8	1.7	0.7	2.2	0.5	0.1
Woodville	73.1	20.6	0.7	0.4	0.4	0.6	0.1	24
Foxton	594.5	14.1	10	5.5	0.8	0.3	0.1	0
Foxton Beach	309.8	8.4	8.6	5.4	2.9	4	0	-
Taumarunui	503.9	1.9	1.2	1.2	0.9	2.1	0.5	2.3
Dannevirke	855.3	8.3	1.5	1.6	0.4	0.5	0.2	0.1
Bulls	223.2	12.9	5	1.9	2	2	1.8	0.4
Tangimoana	421.8	8.8	5.2	1.5	0.2	0.9	0.2	0.4
Hunterville	2,173.7	1.2	0.6	0.4	0.2	0.2	0.1	0.2
Shannon	2,594	1.1	0.6	0.2	0.1	0.1	0	0
Koitiata	64.1	20.1	21.2	4.1	1.6	0.1	-	-
Ōhau	35.6	7.9	3.6	2.3	0.5	0	-	-
Hokio Beach	857.5	9.7	18.8	11.4	1.9	6.5	1.8	0
Bunnythorpe	80.9	12.2	2.8	1.3	0.8	1	0.8	0.2
Eketāhuna	1,475.7	0.6	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	4.3	0.8	0.3	0.2	0.2	0.1	1.2
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.7	0.2	0.1	0.1	0.1	0.1
Pohangina	882.3	3.7	2	1	0.5	0.6	0.1	0
Pongaroa	3,913	3.6	1.6	0.5	0.2	0.3	0.1	0.3
Mangamutu	26	3	3.7	1.5	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0.1
Ashhurst	115.4	7.3	2.6	2.8	1.8	1.3	0.6	-
Himatangi Beach	59.4	2.7	1.5	1	0.7	0.9	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4	1.9	0.8	0.3	0.2	0.2	0.1
Waitārere Beach	24.3	5	3.9	1.6	1.9	-	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	3.9	2.8	2.5	1	0.5	0	-
Sanson	55.8	5.7	2	0.4	0	-	0	-
Linton	426.8	14.4	2.8	1.8	1.3	2.3	2.1	3.9
Ohakea	56.4	8.9	3.2	2.1	0.4	0.1	-	-
Norsewood	148.5	2.1	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0.1	0	0
Waiouru	2.1	5.2	6.7	5.7	-	0	1.4	-
National Park	1,051.5	1.5	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	9.5	11.4	6.7	5	3.1	13.8	-
Mangatainoka	178	3.3	2.3	1.2	0.5	0.6	0.7	1.9
Ormondville	889.7	3.2	1.5	2.3	2.4	1.1	0.4	0.5
Rongotea	137.6	0.6	1.2	0.8	0.3	0	-	-
Rātana	25.6	7.8	2	1.7	0.8	1	0.6	1
Halcombe	913.2	6	2.7	2.3	1.3	0.9	0.3	1
Kimbolton	334.7	0.3	0.1	-	-	-	0.2	0
Rangataua	766.7	3.5	1.7	1	0.5	0.4	0.2	0.1
Raurimu	190.1	4.5	2.5	2.1	0.1	0.3	0.1	0.1
Kai Iwi	148.2	3.3	2.7	3.2	1	1.6	0.3	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.12: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +1°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8.3	4.9	3.6	1.4	0.9	0.3	0.2
Palmerston North	3,060.7	10.6	6.2	3.6	1.5	1.6	0.6	0.2
Feilding	1,015.1	18.3	4.5	1.1	0.6	0.4	0	0
Marton	365.7	13.5	5.7	1.4	0.4	0.5	0.2	0.1
Ohakune	272.9	9.2	3.6	1.8	0.7	0.4	0.2	-
Longburn	46.1	7.5	14.8	9.3	2.2	1.9	0	-
Kairanga	45.4	18	21.7	8	4.3	1.2	1.3	0.1
Levin	1,280.1	25.2	4.1	0.6	0.1	0.1	0	-
Woodville	119.2	11.1	3.6	3.4	3.6	8.3	7.2	15.4
Foxton	227.8	17	12.9	6.4	0.6	0.2	0	-
Foxton Beach	182.5	16.6	11.1	2.7	0.6	0.2	-	-
Taumarunui	292.6	7.4	7	5.3	1.7	1.3	0.8	0.9
Dannevirke	346.6	10.1	1.6	0.5	0.2	0.1	0	0
Bulls	172.2	17.6	7.5	3.6	0.7	0.2	0	0
Tangimoana	38.6	6.6	10.2	36.6	15.8	1.1	-	-
Hunterville	163.2	6.8	7.1	3.8	1.5	0.7	0.2	0
Shannon	118.1	6.1	1.5	0.7	0.4	0.6	0	-
Koitiata	9.2	7.1	8.7	12.2	6.1	1.1	-	-
Ōhau	223.5	10.2	1.5	0.8	0.2	0.2	0	-
Hokio Beach	64	9.5	6.4	3.5	1.1	0.5	-	-
Bunnythorpe	132.8	7	2.7	1.6	0.2	0.4	0.1	0
Eketāhuna	91.5	10.4	2.1	0.4	0.1	0	0	0
Mangaweka	21.7	16.1	3	0.2	0.1	0.7	-	-
Ōwhango	24.1	11.9	1.2	2.3	1.1	1.7	0.4	-
Ōhura	31.9	11.1	9.2	6.6	2	0.2	-	-
Pohangina	23.7	12.7	1.5	1.1	0	0	-	-
Mangamutu	13.6	12.4	3.1	0.1	-	-	-	-
Pahiatua	213.1	18.6	7.6	2	0.5	0.1	0	0.1
Ashhurst	179.3	16.7	3.3	0.5	0.1	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	9.8	6.5	1.1	-	-	-	-
Taihape	297.3	3.6	1.2	0.5	0.2	0.2	0.1	0.2
Waitārere Beach	111.8	7.3	6.9	7.5	4	1.5	0	-
Raetihi	101.9	9.9	4.8	2.8	2	1	0.1	-
Manakau	115.9	16.1	5.6	1.9	0.5	0.1	0	-
Sanson	58.6	9.9	3.4	1.3	1.4	0.7	-	-
Linton	44.7	7.6	2.8	1.6	1	0.3	0.2	-
Ohakea	9.9	11.1	8.8	9.7	0.8	0.1	-	-
Norsewood	27.5	10	3.9	1.5	-	-	-	-
Tokomaru	58.1	7.3	0.9	1.5	0.5	0.1	0.2	-
Waiouru	8.4	8.2	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.6	0.3	0.7	0.7	0.1
Waikawa Beach	59.7	9.2	8.1	2.6	0.3	0	-	-
Mangatainoka	20.2	8.1	6.8	3.3	1.7	0	-	6.2
Ormondville	40.5	12.1	1.6	0.7	0.1	0	-	-
Rongotea	110	10	5.6	3.2	0.2	0.8	0	-
Rātana	17.4	10	3.7	6.1	-	-	-	-
Halcombe	132.9	8.5	5.2	1.1	0.3	0.1	-	-
Kimbolton	52.5	5.2	4.3	0.6	-	1.4	-	-
Rangataua	28.5	10.1	2.4	0	-	-	-	-
Raurimu	16.9	7.5	1.4	0.5	0	0.3	-	-
Kai Iwi	38.6	6.3	2.9	0.8	1.6	1.4	0.1	0.1
Commerical/Industrial property use type								
Whanganui	401.8	12.3	8	6.8	2.5	1.3	2.7	0
Palmerston North	686.1	13.9	6.7	5.4	1	1.2	1.5	1.8
Feilding	170.9	27.6	15.4	6.6	1.1	1.2	0	-
Marton	213.9	8.3	4	5.2	17.4	16.9	1.8	1.2
Ohakune	22.4	12	6.7	3.6	1.1	0.9	0.2	-
Longburn	60.8	10.7	27.9	37.9	4.5	1.7	0.1	0
Kairanga	8	21.4	18.2	2.9	0.6	-	-	-
Levin	180.9	58.9	5	0.5	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	7.2	3.9	4.2	4.1	9.4	6.5	37
Foxton	41.4	19.8	13.3	4.3	1.6	0.9	-	-
Foxton Beach	0.8	17.5	8.8	0	-	-	-	-
Taumarunui	37.9	11.9	4.9	1.8	0.9	0.3	0.2	0.2
Dannevirke	129.7	11	3.2	1.6	0.8	1	0.6	0.5
Bulls	53.9	14.5	9.4	4	4.8	5.4	0.7	1.2
Tangimoana	4.1	19.8	1.7	0	-	-	-	-
Hunterville	23.4	22.8	8	3.3	0.4	0.3	-	-
Shannon	24.9	5.5	2.5	4	3.4	18.4	4.8	0.1
Ōhau	7.2	13.3	2.9	1.1	2.4	2.8	7.1	6.1
Hokio Beach	50	16.9	8.7	3.4	-	-	-	-
Bunnythorpe	20.9	14.1	2.3	0.4	0	-	-	-
Eketāhuna	14	14.9	2.5	0.2	-	-	-	-
Mangaweka	10.3	25.1	9.5	2.7	1.1	1.4	0.8	0.1
Ōwhango	2.4	15	5	0.4	0.4	-	-	-
Ōhura	1.2	6.7	4.2	4.2	0.8	0	-	-
Mangamutu	15.3	20.8	15	4.9	0.2	-	-	-
Pahiatua	17.7	20.8	7.2	0.6	-	-	-	-
Ashhurst	19.8	17.6	14.4	12.1	0.6	2.1	1.7	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	9.8	2.6	0.9	0.3	0.7	0.2	-
Waitārere Beach	0.4	7.5	62.5	5	-	-	-	-
Raetihi	13.2	11.4	3.5	0.8	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	19.9	1.7	0.9	0.4	-	-	-
Linton	5.2	8.5	3.1	1.2	0.2	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	0.9	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.5	1.4	-	-	-	-
National Park	18.3	3.9	3.3	3.4	4.4	-	-	-
Mangatainoka	4.7	13	4.9	2.1	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	3.9	1	0.8	0.8	1.2	0.4	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Halcombe	28.3	6	5	5.9	12.5	10.7	2	6.7
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	8.3	4.2	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.7	5.1	3.4	1.6	1.3	0.3	0.1
Palmerston North	14,029.6	6.1	4.9	4.2	2.4	2.7	1.2	1.2
Feilding	7,528	11	6.8	4.1	1.8	1.5	0.4	0.1
Marton	27,105.7	8.8	4	2	1.1	1	0.3	0.3
Ohakune	44,184.2	1.8	0.8	0.4	0.1	0.1	0	0
Longburn	1,302.6	13.7	23.3	23	4.7	5.6	3.4	2.4
Kairanga	6,733.2	13.5	15.1	11.9	4.5	6.9	5.3	7.5
Levin	7,837.6	14.1	2.9	1.8	1.1	0.9	0.2	0
Woodville	10,615.9	5.4	2.7	1.5	0.9	1	1	20
Foxton	11,957.6	18.3	8.4	5.1	2.9	3.2	1.1	0.2
Foxton Beach	861.7	12.7	13.3	22	3.8	1.7	0	0.5
Taumarunui	12,241.3	2.3	1.4	0.7	0.3	0.5	0.4	0.9
Dannevirke	34,395.2	8.2	2.6	1.5	0.8	0.8	0.3	0.4
Bulls	9,085.6	14.4	7.8	5.3	2.7	1.7	0.3	0.2
Tangimoana	9,602.2	13.2	5.5	3.3	1.3	1.2	0.2	0.1
Hunterville	55,534.7	3.2	1.7	0.9	0.4	0.3	0.2	0.3
Shannon	7,725	3.8	3.1	5	3.5	5.3	4.3	0.3
Koitiata	908.1	11.9	9.9	10.1	4.9	1.9	0.2	0.3
Ōhau	2,857.8	8.9	6.6	5	1.7	1.2	0.4	0.2
Hokio Beach	2,923.4	10.5	9.4	8.7	2.8	1.8	0.1	0.1
Bunnythorpe	8,837.9	9.1	4.5	2.9	1.4	1.1	0.3	0.1
Eketāhuna	37,977.3	5.8	3	1.3	0.5	0.4	0.2	0.1
Mangaweka	25,542.3	2.9	1.2	0.5	0.2	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.1	0.1	0.2
Ōhura	24,006.2	3	1.9	1.1	0.5	0.4	0.2	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.7	2.1	1.4	0.6	0.5	0.2	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	6.1	5	4.8	3	3.9	0.7	2.3
Pahiatua	56,300.9	3.7	2.3	1.2	0.5	0.5	0.2	0.2
Ashhurst	9,723	6.6	4.3	3	1.9	1.7	0.5	0.4
Himatangi Beach	1,181.1	13.5	14.3	7.4	2.2	3.1	0	-
Taihape	66,124.7	2.8	1.5	0.7	0.3	0.2	0.1	0.2
Waitārere Beach	13.3	5.3	11.1	8.8	2.6	-	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0	0	0	0
Manakau	5,969.4	8.5	4.4	3.3	1.6	1.1	0.1	0
Sanson	3,977.1	6.7	4.3	2.8	1.1	0.7	0.2	0
Linton	9,076.6	5.8	3.6	2	1	1.4	0.3	0.1
Ohakea	1,988.8	17.3	7.7	5.3	3.8	2	0.2	0
Norsewood	5,388.4	9.3	2.9	1.1	0.4	0.4	0.2	0.2
Tokomaru	5,474	5.3	3.2	4	3.8	4.6	2.3	0.1
Waiouru	2,552.9	5.5	2.5	1	0.3	0.3	0.1	0.1
National Park	4,186.3	6	1.6	0.5	0.4	0.3	0.1	0.2
Waikawa Beach	270	12.4	10.6	5.4	2	1.4	0.4	0.1
Mangatainoka	2,846.3	4.7	3	2.4	1.5	1.7	1.1	23.4
Ormondville	15,472.3	3.9	1.4	0.7	0.3	0.4	0.3	0.5
Rongotea	9,950.9	12	7	5.3	2.7	2.7	1.7	0.5
Rātana	1,699.3	7.4	4.7	4.1	2.5	1.9	0.6	0.9
Halcombe	20,547.4	6.7	3.8	2.7	1.5	1.5	0.4	0.4
Kimbolton	9,408.6	4.5	2.4	1.3	0.6	0.5	0.2	0.2
Rangataua	6,946.1	2.8	0.6	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.4	2	1	0.5	0.5	0.3	0.5
Kai Iwi	9,060.1	3.8	2.4	1.7	0.8	0.6	0.3	0.5
Other property use type								
Whanganui	1,392.5	7.1	3.7	2.9	1.6	1.3	1.4	1.8
Palmerston North	5,568.9	4.1	2.8	2	1.4	1.9	1.5	1.2
Feilding	476.3	13.7	8.3	5.1	1.7	0.6	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.5	2	1	0.2	0.2	0.1	0.2
Ohakune	2,300.5	1.2	0.4	0.4	0.2	0.3	0.1	0
Longburn	36.4	7.5	17.9	2.3	0.7	0.4	-	0
Kairanga	29.9	8.6	0.5	0.6	1	0.9	0	0
Levin	495.8	22.4	3.8	1.7	0.7	2.2	0.5	0.1
Woodville	73.1	18.2	0.8	1.3	1.2	1.3	0.4	24
Foxton	594.5	14.2	10.1	5.5	0.7	0.1	0	0
Foxton Beach	309.8	8.7	7	4.6	2.8	3.9	-	-
Taumarunui	503.9	1.9	1.1	1.3	1	2.2	0.5	2.3
Dannevirke	855.3	8.3	1.5	1.7	0.4	0.5	0.2	0.1
Bulls	223.2	12.9	5	1.9	1.9	2	1.8	0.4
Tangimoana	421.8	8.7	5.1	1.7	0.6	0.7	0.4	0.1
Hunterville	2,173.7	1.2	0.6	0.4	0.2	0.2	0.1	0.2
Shannon	2,594	1.1	0.6	0.4	0.1	0.1	0	0
Koitiata	64.1	20	21.2	4.1	1.6	0.1	-	-
Ōhau	35.6	7.9	3.6	2.3	0.5	0	-	-
Hokio Beach	857.5	9.7	18.8	11.4	1.9	6.5	1.8	0
Bunnythorpe	80.9	12.1	3	1.8	0.9	1.2	0.8	0.1
Eketāhuna	1,475.7	0.6	0.2	0.1	0	0.1	0.1	0.1
Mangaweka	252	4.3	0.8	0.3	0.2	0.2	0.1	1.2
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.7	0.2	0.1	0.1	0.1	0.1
Pohangina	882.3	3.7	2	1	0.5	0.6	0.1	0
Mangamutu	26	3	3.7	1.5	-	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0
Ashhurst	115.4	7.3	2.5	2.9	1.8	1.3	0.6	-
Himatangi Beach	59.4	2.7	1.5	1	0.7	0.9	0.1	-
Taihape	2,174.7	4	1.9	0.8	0.3	0.2	0.2	0.1
Waitārere Beach	24.3	5	3.9	1.6	1.9	-	-	-
Raetihi	8,257	0.1	0.1	0.1	0	0	0	0
Manakau	138	3.9	2.8	2.5	1	0.5	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	5.7	2	0.4	0	-	0	-
Linton	426.8	14.5	2.7	1.8	1.4	2.5	2.2	3.2
Ohakea	56.4	8.9	3.2	2.1	0.4	0.1	-	-
Norsewood	148.5	2.1	0.7	0.6	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.3	0.1	0.1	0	0
Waiouru	2.1	5.2	6.7	5.7	-	0	1.4	-
National Park	1,051.5	1.5	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	9.5	11.4	6.7	5	3.1	13.8	-
Mangatainoka	178	3.3	2.4	1.2	0.5	0.6	1.2	1.2
Ormondville	889.7	3.2	1.5	2.3	2.4	1.1	0.4	0.5
Rongotea	137.6	0.3	1.6	0.7	0.3	-	-	-
Rātana	25.6	7.8	2	1.7	0.8	1	0.6	1
Halcombe	913.2	6	2.6	2.2	1.3	0.9	0.3	1
Kimbolton	334.7	0.3	0.1	-	-	-	0.2	0
Rangataua	766.7	3.5	1.7	1	0.5	0.4	0.2	0.1
Raurimu	190.1	4.5	2.5	2.1	0.1	0.3	0.1	0.1
Kai Iwi	148.2	3.3	2.7	3.2	1	1.6	0.3	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.13: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +2°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8	4.6	4.1	2.5	2.1	0.7	0.4
Palmerston North	3,060.7	9.8	6	3.5	1.3	1	0.1	0
Feilding	1,015.1	15.5	2.1	0.9	0.8	0.4	0	0
Marton	365.7	13.6	6	1.4	0.4	0.5	0.2	0.1
Ohakune	272.9	9.7	3.8	2	0.7	0.5	0.2	-
Longburn	46.1	9.1	15.7	6.3	1.8	2.1	0	-
Kairanga	45.4	15.9	19	6.9	4.2	1	1.3	0.1
Levin	1,280.1	25.9	4.5	0.6	0.1	0.1	0	-
Woodville	119.2	10.2	3.9	3.8	2.5	6.6	8.5	21.2
Foxton	227.8	17.3	13.3	6.6	0.6	0.2	0	0
Foxton Beach	182.5	16.3	13.8	3.5	0.6	0.4	0	-
Taumarunui	292.6	6.2	6.1	8.4	4.1	2.6	0.9	1.2
Dannevirke	346.6	10.5	1.7	0.5	0.2	0.1	0	0
Bulls	172.2	17.2	8.4	4.3	1.1	0.3	0	-
Tangimoana	38.6	11.5	24.6	27.7	3.9	0.5	-	-
Hunterville	163.2	7.2	6.6	3.9	1.4	0.7	0.2	0
Shannon	118.1	6.5	1.7	0.7	0.2	0.1	-	-
Koitiata	9.2	6.8	8.9	12.6	5.9	1.4	-	-
Ōhau	223.5	10.7	1.6	1	0.3	0.2	0	-
Hokio Beach	64	9.4	6.7	3.8	1.2	0.5	-	-
Bunnythorpe	132.8	7.3	2.8	1.7	0.2	0.4	0.1	0
Eketāhuna	91.5	11	2.2	0.4	0	0.1	0	0
Mangaweka	21.7	16.1	3.2	0.3	-	0.8	-	-
Ōwhango	24.1	12.5	1.4	2.3	0.7	2.2	0.4	-
Ōhura	31.9	11	9	6.8	2.9	0.3	-	-
Pohangina	23.7	13.2	1.9	1.2	0	0	-	-
Pongaroa	16.6	10.3	6.8	5.1	2.3	1.3	0.7	1.9
Mangamutu	13.6	22.7	4.4	0.1	-	-	-	-
Pahiatua	213.1	18.6	8.2	2	0.7	0.3	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	19.4	4.3	0.5	0.2	0	-	-
Himatangi Beach	50.7	9.6	7.5	1.5	0	-	-	-
Taihape	297.3	3.6	1.3	0.5	0.2	0.2	0.1	0.2
Waitārere Beach	111.8	7.3	7.1	7.8	4.2	1.8	0	-
Raetihi	101.9	9.9	5.1	2.6	2.3	1.2	0.1	-
Manakau	115.9	16.2	6.4	2	0.7	0.1	0	-
Sanson	58.6	10.5	3.3	1.4	1.4	0.7	-	-
Linton	44.7	7.8	2.3	1.6	1	0.3	-	-
Ohakea	9.9	10.6	3.5	16.8	1.2	0.2	-	-
Norsewood	27.5	9.1	4.9	1.5	-	-	-	-
Tokomaru	58.1	7.6	1.3	1.2	0.3	0	0.2	-
Waiouru	8.4	9.2	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.6	0.4	0.7	0.7	0.1
Waikawa Beach	59.7	9.4	8.3	2.9	0.4	0	-	-
Mangatainoka	20.2	8.9	8.7	5	1.8	0.7	-	6.2
Ormondville	40.5	13.7	1.8	0.6	0.1	0	-	-
Rongotea	110	10.4	5.2	2.6	0.5	0.4	-	-
Rātana	17.4	10	3.7	6.1	-	-	-	-
Halcombe	132.9	8.5	5.4	1.4	0.2	0.1	-	-
Kimbolton	52.5	4.9	4.6	0.6	-	1.4	-	-
Rangataua	28.5	10.8	2.5	0	-	-	-	-
Raurimu	16.9	8	1.5	0.6	0	0.2	0.2	-
Kai Iwi	38.6	6.7	2.9	1.5	1.7	0.5	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	11.4	6.5	8.1	4.3	2.6	1.9	1.4
Palmerston North	686.1	13.3	7.6	4.9	2.2	1.6	1.3	2.4
Feilding	170.9	24.6	11.2	6.3	1.6	0.2	0.1	0
Marton	213.9	8.9	4.6	6.7	15.6	16.9	1.7	1.4
Ohakune	22.4	12.7	6.7	4	1.3	1	0.2	-
Longburn	60.8	13.9	27.1	34	3.8	1.6	0.1	0
Kairanga	8	19.8	13.1	1.2	0.2	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	60.1	6	0.5	0.4	0.3	-	-
Woodville	12.5	6.3	3.2	6	5.5	8.4	8.4	42.8
Foxton	41.4	21.5	13.6	2.1	0.1	0	-	-
Foxton Beach	0.8	16.2	11.2	2.5	-	-	-	-
Taumarunui	37.9	13	5.2	2.5	1.5	1.2	0.2	0.3
Dannevirke	129.7	11.3	3.3	1.9	1	1.1	0.6	0.7
Bulls	53.9	13.1	10.6	4.5	4.9	6.6	1.6	1.3
Tangimoana	4.1	19.5	3.4	0	-	-	-	-
Hunterville	23.4	22.6	6.3	2.4	0.3	0.3	-	-
Shannon	24.9	10.7	8.7	2.2	0	-	-	0.1
Ōhau	7.2	14.4	2.2	1.8	1.8	2.6	5.6	8.6
Hokio Beach	50	17.5	8.8	3.6	-	-	-	-
Bunnythorpe	20.9	14.4	2.3	0.4	0	-	-	-
Eketāhuna	14	16.4	2.6	0.2	-	-	-	-
Mangaweka	10.3	26.5	10.5	2	1.5	1.8	0.9	0.4
Ōwhango	2.4	15	7.1	0.4	0.4	-	-	-
Ōhura	1.2	7.5	3.3	5.8	1.7	0	-	-
Pongaroa	2.5	9.6	24.4	4.4	2.4	-	-	-
Mangamutu	15.3	24.8	24.6	9.7	0.2	-	-	-
Pahiatua	17.7	21.2	8.5	0.8	0	-	-	-
Ashhurst	19.8	11.9	13.1	18.3	10.5	2.1	2.5	0.1
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	10	2.8	1.1	0.4	0.6	0.2	-
Waitārere Beach	0.4	2.5	52.5	22.5	-	-	-	-
Raetihi	13.2	11.5	3.7	1	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	21.6	1.7	0.9	0.4	0.1	-	-
Linton	5.2	8.7	2.9	1.5	0.8	0.2	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	1	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.9	1.4	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	0.1	6.7	4.4	-	-	-
Mangatainoka	4.7	12.3	5.1	2.6	-	-	-	-
Ormondville	5.1	3.9	1	0.8	0.8	1	0.6	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.8	3.2	5.5	4.9	17.8	10.1	7.6
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	8.3	4.2	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.8	5.2	3.3	1.5	1.3	0.6	0.2
Palmerston North	14,029.6	6.2	4.5	3.9	2.5	2.7	1.4	1.7
Feilding	7,528	10.8	6.6	4.5	2	1.6	0.4	0.2
Marton	27,105.7	9.1	4.1	2	1.1	1.1	0.4	0.3
Ohakune	44,184.2	1.8	0.8	0.4	0.2	0.1	0	0
Longburn	1,302.6	14.7	22.4	17.1	2.9	4.1	4.3	3.6
Kairanga	6,733.2	14.1	14.9	10.7	4.4	7.1	5.3	7.3
Levin	7,837.6	14.7	3	1.9	1.2	0.9	0.2	0.1
Woodville	10,615.9	5.4	2.7	1.4	1	1.1	0.8	20.8
Foxton	11,957.6	18.6	8.7	5.2	2	2.2	2.2	2
Foxton Beach	861.7	11.6	11.4	7.2	21.2	4.7	0.3	0.6
Taumarunui	12,241.3	2.4	1.4	0.8	0.3	0.5	0.5	1.1
Dannevirke	34,395.2	8.5	2.7	1.6	0.8	0.9	0.4	0.5
Bulls	9,085.6	14.7	7.9	5.3	2.6	1.9	0.3	0.3
Tangimoana	9,602.2	13.4	5.6	3.4	1.3	1.5	0.6	0.3
Hunterville	55,534.7	3.3	1.7	0.9	0.4	0.4	0.2	0.4
Shannon	7,725	4.7	5.3	7.9	3.8	1.9	0.2	0.1
Koitiata	908.1	12.1	9.9	10.2	5.5	2.7	0.2	0.3
Ōhau	2,857.8	8.8	6.3	5.4	2.1	1.9	0.7	0.3
Hokio Beach	2,923.4	10.5	9.4	9	3	2.1	0.1	0.1
Bunnythorpe	8,837.9	9.4	4.4	2.9	1.5	1.2	0.4	0.1
Eketāhuna	37,977.3	5.9	3.1	1.4	0.5	0.4	0.2	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	3	1.2	0.5	0.2	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.2	0.1	0.2
Ōhura	24,006.2	3	2	1.2	0.6	0.5	0.2	0.4
Pohangina	26,177.4	3.7	2.1	1.5	0.6	0.5	0.2	0.1
Pongaroa	57,773.7	2.5	1.1	0.5	0.2	0.3	0.2	0.3
Mangamutu	1,464.7	6	4.7	4.4	3.2	4.3	2.1	2.6
Pahiatua	56,300.9	3.8	2.5	1.3	0.6	0.6	0.2	0.2
Ashhurst	9,723	6.7	4.5	2.8	1.4	1.4	0.5	0.4
Himatangi Beach	1,181.1	13.5	14.5	7.9	2.3	3.4	0	-
Taihape	66,124.7	2.8	1.5	0.7	0.3	0.2	0.1	0.2
Waitārere Beach	13.3	4.7	10.3	8.7	4.1	0.1	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0.1	0	0	0
Manakau	5,969.4	8.7	4.6	3.5	1.8	1.3	0.1	0
Sanson	3,977.1	6.9	4.4	2.8	1.1	0.8	0.2	0.1
Linton	9,076.6	5.8	3.6	2.1	0.7	0.7	0.7	0.2
Ohakea	1,988.8	17.2	7.2	6	4.2	3.7	0.3	0.1
Norsewood	5,388.4	9.5	3	1.1	0.5	0.4	0.2	0.2
Tokomaru	5,474	6.6	3.8	3.6	3.1	3.5	0.3	0.1
Waiouru	2,552.9	5.6	2.5	1	0.3	0.4	0.1	0.1
National Park	4,186.3	6.3	1.6	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	11.6	10.6	7.5	2.3	1.7	0.4	0.2
Mangatainoka	2,846.3	4.7	2.9	2.3	1.5	2.2	1.3	24.2
Ormondville	15,472.3	4	1.4	0.7	0.3	0.4	0.3	0.6
Rongotea	9,950.9	12.8	6.6	4.3	2.2	2.6	1.4	0.1
Rātana	1,699.3	7.6	4.3	4	2.8	2.5	0.6	1
Halcombe	20,547.4	6.8	3.8	2.7	1.5	1.7	0.5	0.5
Kimbolton	9,408.6	4.6	2.4	1.4	0.6	0.5	0.2	0.2
Rangataua	6,946.1	2.9	0.7	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.4	2.1	1	0.5	0.5	0.3	0.6
Kai Iwi	9,060.1	4	2.3	1.6	0.7	0.6	0.3	0.6
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.2	3.8	2.7	1.6	2	1.1	2.5
Palmerston North	5,568.9	4.3	2.9	2	1.2	1.5	1.2	0.9
Feilding	476.3	12.8	5.7	6.3	2.8	0.9	0.1	0.1
Marton	1,724.2	3.6	2	1.1	0.3	0.2	0.1	0.2
Ohakune	2,300.5	1.2	0.5	0.4	0.2	0.3	0.1	0
Longburn	36.4	8	16.6	1	1.2	3.2	0	0
Kairanga	29.9	8.5	0.1	0.8	0.8	0.9	0	0
Levin	495.8	23.3	3.9	1.8	0.8	2.2	0.5	0.2
Woodville	73.1	19.3	0.5	0.2	0.9	2.5	1	24
Foxton	594.5	14.3	9.9	6.1	0.8	0.3	0.1	0
Foxton Beach	309.8	8.1	8.8	5.7	2.7	4.4	0	-
Taumarunui	503.9	1.8	0.8	0.7	1	1.9	1.8	2.6
Dannevirke	855.3	8.5	1.6	1.7	0.4	0.5	0.2	0.1
Bulls	223.2	12.9	4.4	2.5	1.5	2.3	2.3	0.6
Tangimoana	421.8	9.2	5.2	1.8	0.3	0.8	0.3	0.4
Hunterville	2,173.7	1.2	0.7	0.4	0.2	0.2	0.1	0.3
Shannon	2,594	1.1	0.6	0.2	0.1	0.1	0	0
Koitiata	64.1	20.1	21.6	5.1	1.6	0.1	-	-
Ōhau	35.6	8.3	4.1	2.7	1.1	0.1	-	-
Hokio Beach	857.5	7.3	18	16.1	1.9	6.4	2.1	0
Bunnythorpe	80.9	12.9	2.9	1.3	0.8	1.1	0.8	0.4
Eketāhuna	1,475.7	0.6	0.2	0.1	0.1	0.1	0.1	0.1
Mangaweka	252	4.4	0.8	0.3	0.2	0.1	0.1	1.3
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.7	0.3	0.1	0.1	0.1	0.1
Pohangina	882.3	3.6	2	1	0.5	0.6	0.1	0
Pongaroa	3,913	3.6	1.6	0.5	0.2	0.3	0.1	0.4
Mangamutu	26	2.5	3.8	2.6	0.1	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0.1
Ashhurst	115.4	7.6	2.8	3	2.3	2.1	0.7	-
Himatangi Beach	59.4	2.4	2.1	1	0.8	0.9	0.2	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4.2	1.9	0.9	0.3	0.3	0.1	0.2
Waitārere Beach	24.3	4.8	3.9	1.7	1.8	0.4	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	4	3.8	2.3	1.3	0.5	0	-
Sanson	55.8	5.9	2.3	0.5	0	-	0	-
Linton	426.8	14.6	2.8	2.4	1.3	2.2	1.9	4.5
Ohakea	56.4	9.2	3.4	2.1	0.6	0.1	-	-
Norsewood	148.5	2.1	0.7	0.7	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.7	1	0.4	0	0.1	0	0
Waiouru	2.1	5.2	6.7	3.3	2.9	0	1.4	-
National Park	1,051.5	1.5	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	10	13.8	6	6.7	2.4	15	-
Mangatainoka	178	3.3	2.7	1.7	0.6	0.7	0.8	1.7
Ormondville	889.7	3.3	1.6	2.2	2.6	1.1	0.4	0.6
Rongotea	137.6	0.5	1.4	0.8	0.3	0	-	-
Rātana	25.6	7.6	1.7	1.8	1.1	1.1	0.6	1.2
Halcombe	913.2	6.1	2.9	2.4	1.2	1	0.3	1
Kimbolton	334.7	0.2	0.2	-	-	-	0.2	0
Rangataua	766.7	3.6	1.8	1	0.5	0.4	0.2	0.1
Raurimu	190.1	4.2	2.5	2.4	0.5	0.2	0.1	0.3
Kai Iwi	148.2	3.8	3.6	2.8	1.1	1.3	0.7	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.14: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +2°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	8	4.6	4.1	2.5	2.1	0.7	0.4
Palmerston North	3,060.7	11.5	8.7	5.1	1.9	2	0.8	0.3
Feilding	1,015.1	18.8	5.1	1.1	0.6	0.4	0	0
Marton	365.7	13.6	6.2	1.5	0.4	0.5	0.2	0.1
Ohakune	272.9	9.7	3.8	2	0.7	0.5	0.2	-
Longburn	46.1	5.6	14.4	12.1	2.6	2.2	0	-
Kairanga	45.4	17	22.9	8.5	4.4	2.6	1.1	0.3
Levin	1,280.1	25.9	4.5	0.6	0.1	0.1	0	-
Woodville	119.2	10.4	3.9	3.6	2.9	6.7	8.5	21.2
Foxton	227.8	17.4	13.3	6.6	0.7	0.2	0	-
Foxton Beach	182.5	16.4	11.8	2.9	0.6	0.2	-	-
Taumarunui	292.6	6.4	6.7	8.8	4	2.5	0.9	1.2
Dannevirke	346.6	10.5	1.7	0.5	0.2	0.1	0	0
Bulls	172.2	17.1	8.5	4.3	1.1	0.3	0	0
Tangimoana	38.6	6.4	5.6	30	26.3	3.9	-	-
Hunterville	163.2	6.4	7.4	4.8	1.9	1	0.2	0
Shannon	118.1	6.4	1.6	0.9	0.3	0.5	0.2	0
Koitiata	9.2	6.8	8.9	12.6	5.9	1.4	-	-
Ōhau	223.5	10.7	1.6	0.8	0.2	0.2	0	-
Hokio Beach	64	9.4	6.7	3.8	1.2	0.5	-	-
Bunnythorpe	132.8	7.4	2.8	1.7	0.2	0.4	0.1	0
Eketāhuna	91.5	11	2.2	0.4	0	0.1	0	0
Mangaweka	21.7	16.1	3.2	0.3	-	0.8	-	-
Ōwhango	24.1	12.5	1.4	2.3	0.7	2.2	0.4	-
Ōhura	31.9	11	9	6.8	2.9	0.3	-	-
Pohangina	23.7	13.2	1.9	1.2	0	0	-	-
Mangamutu	13.6	26.8	5.4	0.3	-	-	-	-
Pahiatua	213.1	18.7	8.1	2	0.7	0.2	0	0.1
Ashhurst	179.3	17.5	3.7	0.5	0.2	0	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	9.6	7.5	1.5	0	-	-	-
Taihape	297.3	3.6	1.3	0.5	0.2	0.2	0.1	0.2
Waitārere Beach	111.8	7.3	7.1	7.8	4.2	1.8	0	-
Raetihi	101.9	9.9	5.1	2.6	2.3	1.2	0.1	-
Manakau	115.9	16.2	6.4	2	0.7	0.1	0	-
Sanson	58.6	10.5	3.3	1.4	1.4	0.7	-	-
Linton	44.7	8	2.9	1.7	1	0.3	0.2	-
Ohakea	9.9	10.6	5.7	14.8	1	0.2	-	-
Norsewood	27.5	9.1	4.9	1.5	-	-	-	-
Tokomaru	58.1	7.5	0.8	1.6	0.6	0.1	0.2	-
Waiouru	8.4	9.2	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.6	0.4	0.7	0.7	0.1
Waikawa Beach	59.7	9.4	8.3	2.9	0.4	0	-	-
Mangatainoka	20.2	8.9	8.8	5.1	1.7	0.8	-	6.2
Ormondville	40.5	13.7	1.8	0.6	0.1	0	-	-
Rongotea	110	10.5	5.6	3.3	0.2	0.8	0	-
Rātana	17.4	10	3.7	6.1	-	-	-	-
Halcombe	132.9	8.5	5.4	1.4	0.2	0.1	-	-
Kimbolton	52.5	4.9	4.6	0.6	-	1.4	-	-
Rangataua	28.5	10.8	2.5	0	-	-	-	-
Raurimu	16.9	8	1.5	0.6	0	0.2	0.2	-
Kai Iwi	38.6	6.7	2.9	1.5	1.7	0.5	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	11.3	5.7	7.6	5.7	3.2	1.8	1.4
Palmerston North	686.1	13.8	7.6	6.1	1.3	1.2	1.5	2
Feilding	170.9	27.1	16.5	7.4	1.8	1.3	0	-
Marton	213.9	8.6	4.1	2.7	13.2	22.9	2.9	1.4
Ohakune	22.4	12.7	6.7	4	1.3	1	0.2	-
Longburn	60.8	8.6	25.2	43.2	6.5	1.8	0.1	0
Kairanga	8	22.2	18.5	3.4	0.6	-	-	-
Levin	180.9	60.1	6	0.5	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	6	3.2	6	5.5	8.5	8.8	42.5
Foxton	41.4	19.6	14	4.5	1.6	1	-	-
Foxton Beach	0.8	16.2	10	0	-	-	-	-
Taumarunui	37.9	12.2	5	2.6	1.5	1.3	0.2	0.3
Dannevirke	129.7	11.3	3.3	1.9	1	1.1	0.6	0.7
Bulls	53.9	13.2	10.6	4.5	5	6.6	1.5	1.3
Tangimoana	4.1	18.5	5.9	0	-	-	-	-
Hunterville	23.4	23.6	10.4	3.9	0.5	0.4	-	-
Shannon	24.9	5.1	2	3.4	3.9	15.8	9.1	0.1
Ōhau	7.2	14.4	2.2	1.8	1.8	2.6	5.6	8.6
Hokio Beach	50	17.5	8.8	3.6	-	-	-	-
Bunnythorpe	20.9	14.4	2.3	0.4	0	-	-	-
Eketāhuna	14	16.4	2.6	0.2	-	-	-	-
Mangaweka	10.3	26.5	10.5	2	1.5	1.8	0.9	0.4
Ōwhango	2.4	15	7.1	0.4	0.4	-	-	-
Ōhura	1.2	7.5	3.3	5.8	1.7	0	-	-
Mangamutu	15.3	24.2	23.3	9.9	0.7	-	-	-
Pahiatua	17.7	21.3	8.1	0.7	0	-	-	-
Ashhurst	19.8	17.6	14.6	13.3	0.9	1.9	2.1	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	10	2.8	1.1	0.4	0.6	0.2	-
Waitārere Beach	0.4	2.5	52.5	22.5	-	-	-	-
Raetihi	13.2	11.5	3.7	1	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	21.6	1.7	0.9	0.4	0.1	-	-
Linton	5.2	8.5	3.1	1.3	0.2	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	1	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.9	1.4	-	-	-	-
National Park	18.3	3.9	0.1	6.7	4.4	-	-	-
Mangatainoka	4.7	12.3	5.1	2.6	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	3.9	1	0.8	0.8	1	0.6	1.2
Rongotea	4.6	13.9	10.2	-	-	-	-	-
Halcombe	28.3	5.9	4.8	5.4	9.9	14.9	2.2	6.9
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	8.3	4.2	5.8	2.5	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.8	5.3	3.3	1.5	1.3	0.6	0.2
Palmerston North	14,029.6	6.1	4.8	4.5	2.7	3	1.4	1.4
Feilding	7,528	11.1	7.1	4.5	1.9	1.6	0.4	0.2
Marton	27,105.7	9	4.1	1.9	1.1	1.2	0.4	0.4
Ohakune	44,184.2	1.8	0.8	0.4	0.2	0.1	0	0
Longburn	1,302.6	11.5	22.5	26.1	7.9	5.7	3.7	2.7
Kairanga	6,733.2	12.9	14.9	13.1	4.7	6.9	5.8	8.3
Levin	7,837.6	14.7	3	1.8	1.2	0.9	0.2	0.1
Woodville	10,615.9	5.4	2.7	1.4	1	1.1	0.7	20.8
Foxton	11,957.6	18.7	8.6	5.2	3	3.4	1.3	0.2
Foxton Beach	861.7	12.8	14	22.4	4.2	1.8	0	0.5
Taumarunui	12,241.3	2.4	1.4	0.8	0.3	0.5	0.5	1.1
Dannevirke	34,395.2	8.5	2.7	1.6	0.8	0.9	0.4	0.5
Bulls	9,085.6	14.6	7.9	5.5	2.9	2.1	0.3	0.3
Tangimoana	9,602.2	13.4	5.7	3.5	1.5	1.3	0.2	0.1
Hunterville	55,534.7	3.3	1.7	0.9	0.4	0.4	0.2	0.4
Shannon	7,725	3.5	2.2	3.2	4.7	5.6	6.6	0.4
Koitiata	908.1	12.1	9.9	10.2	5.6	2.9	0.2	0.3
Ōhau	2,857.8	9	6.6	5.6	1.9	1.4	0.4	0.2
Hokio Beach	2,923.4	10.5	9.4	9	3	2.1	0.1	0.1
Bunnythorpe	8,837.9	9.4	4.6	3	1.4	1.1	0.4	0.1
Eketāhuna	37,977.3	5.9	3.1	1.4	0.5	0.4	0.2	0.1
Mangaweka	25,542.3	3	1.2	0.5	0.2	0.1	0.1	0.3
Ōwhango	21,112.2	1.8	0.8	0.4	0.2	0.2	0.1	0.2
Ōhura	24,006.2	3	2	1.2	0.6	0.5	0.2	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.7	2.1	1.5	0.6	0.5	0.2	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	5.9	4.6	4.6	3.3	4.4	2.2	2.6
Pahiatua	56,300.9	3.8	2.4	1.2	0.6	0.5	0.2	0.2
Ashhurst	9,723	6.6	4.3	3.1	2	2	0.5	0.5
Himatangi Beach	1,181.1	13.5	14.5	7.9	2.3	3.4	0	-
Taihape	66,124.7	2.8	1.5	0.7	0.3	0.2	0.1	0.2
Waitārere Beach	13.3	4.7	10.3	8.7	4.1	0.1	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0.1	0	0	0
Manakau	5,969.4	8.7	4.6	3.5	1.8	1.3	0.1	0
Sanson	3,977.1	6.9	4.4	2.8	1.1	0.8	0.2	0.1
Linton	9,076.6	5.8	3.7	2.1	1	1.4	0.4	0.1
Ohakea	1,988.8	17.3	7.5	6	4.3	3.1	0.2	0
Norsewood	5,388.4	9.5	3	1.1	0.5	0.4	0.2	0.2
Tokomaru	5,474	5.3	3	3.3	3.7	5.3	3.5	0.3
Waiouru	2,552.9	5.5	2.5	1	0.3	0.4	0.1	0.1
National Park	4,186.3	6.3	1.6	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	11.7	10.6	7.4	2.2	1.7	0.4	0.2
Mangatainoka	2,846.3	4.7	2.9	2.3	1.5	2.2	1.3	24.2
Ormondville	15,472.3	4	1.4	0.7	0.3	0.4	0.3	0.6
Rongotea	9,950.9	12.3	7.1	5.4	2.8	2.7	1.7	0.6
Rātana	1,699.3	7.6	4.3	4	2.8	2.5	0.6	1
Halcombe	20,547.4	6.8	3.8	2.7	1.5	1.7	0.5	0.5
Kimbolton	9,408.6	4.6	2.4	1.4	0.6	0.5	0.2	0.2
Rangataua	6,946.1	2.9	0.7	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.4	2.1	1	0.5	0.5	0.3	0.6
Kai Iwi	9,060.1	4	2.3	1.6	0.7	0.6	0.3	0.6
Other property use type								
Whanganui	1,392.5	7.2	3.8	2.7	1.6	2	1.1	2.5
Palmerston North	5,568.9	4.3	3.1	2.3	1.4	2	1.7	1.5
Feilding	476.3	13.9	8.6	5.4	2	0.7	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.6	2	1.1	0.3	0.2	0.1	0.2
Ohakune	2,300.5	1.2	0.5	0.4	0.2	0.3	0.1	0
Longburn	36.4	5	19.9	2.8	0.7	0.7	-	0
Kairanga	29.9	8.5	0.8	0.6	0.8	1	0.1	0
Levin	495.8	23.3	3.9	1.8	0.8	2.2	0.5	0.2
Woodville	73.1	19.1	0.5	0.2	0.7	2.5	1.1	24
Foxton	594.5	14.3	10	6.1	0.7	0.1	0	0
Foxton Beach	309.8	8.5	7.2	4.7	2.6	4.3	-	-
Taumarunui	503.9	1.8	0.8	0.6	0.9	1.9	1.9	2.6
Dannevirke	855.3	8.5	1.6	1.7	0.4	0.5	0.2	0.1
Bulls	223.2	13	4.5	2.5	1.5	2.3	2.2	0.6
Tangimoana	421.8	9	5.3	1.9	0.8	0.6	0.6	0.1
Hunterville	2,173.7	1.2	0.7	0.4	0.2	0.2	0.1	0.3
Shannon	2,594	1.1	0.6	0.4	0.1	0.1	0	0
Koitiata	64.1	20	21.5	5.2	1.6	0.1	-	-
Ōhau	35.6	8.3	4.1	2.7	1.1	0.1	-	-
Hokio Beach	857.5	7.3	18	16.1	1.9	6.4	2.1	0
Bunnythorpe	80.9	13	3	1.9	0.9	1.2	0.8	0.2
Eketāhuna	1,475.7	0.6	0.2	0.1	0.1	0.1	0.1	0.1
Mangaweka	252	4.4	0.8	0.3	0.2	0.1	0.1	1.3
Ōwhango	1,328.7	0	0	0	0	0	-	0
Ōhura	891.6	1.3	0.7	0.3	0.1	0.1	0.1	0.1
Pohangina	882.3	3.6	2	1	0.5	0.6	0.1	0
Mangamutu	26	2.5	3.8	2.5	0.2	-	-	-
Pahiatua	2,893.9	0.8	0.4	0.2	0.1	0.1	0	0.1
Ashhurst	115.4	7.6	2.8	3.1	2.3	2.1	0.7	-
Himatangi Beach	59.4	2.4	2.1	1	0.8	0.9	0.2	-
Taihape	2,174.7	4.2	1.9	0.9	0.3	0.3	0.1	0.2
Waitārere Beach	24.3	4.8	3.9	1.7	1.8	0.4	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	3.9	3.8	2.3	1.2	0.5	0	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	5.9	2.3	0.5	0	-	0	-
Linton	426.8	15.2	2.8	1.8	1.4	2.5	2	3.7
Ohakea	56.4	9.2	3.4	2.1	0.6	0.1	-	-
Norsewood	148.5	2.1	0.7	0.7	0.2	0.3	0.2	0.3
Tokomaru	1,681.2	1.7	1	0.4	0	0.1	0	0
Waiouru	2.1	5.2	6.7	3.3	2.9	0	1.4	-
National Park	1,051.5	1.5	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	9.8	14	6	6.4	2.4	15	-
Mangatainoka	178	3.3	2.7	1.7	0.6	0.7	0.8	1.7
Ormondville	889.7	3.3	1.6	2.2	2.6	1.1	0.4	0.6
Rongotea	137.6	0.3	1.7	0.7	0.3	-	-	-
Rātana	25.6	7.6	1.7	1.8	1.1	1.1	0.6	1.2
Halcombe	913.2	6.1	2.9	2.3	1.2	1	0.3	1
Kimbolton	334.7	0.2	0.2	-	-	-	0.2	0
Rangataua	766.7	3.6	1.8	1	0.5	0.4	0.2	0.1
Raurimu	190.1	4.2	2.5	2.4	0.5	0.2	0.1	0.3
Kai Iwi	148.2	3.8	3.6	2.8	1.1	1.3	0.7	0.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.15: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +3°C, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	7.7	4.5	3.8	3.2	4.1	0.9	0.8
Palmerston North	3,060.7	10.2	6.8	4	1.4	1.3	0.2	0.1
Feilding	1,015.1	16.2	2.3	0.9	0.8	0.4	0.1	0
Marton	365.7	14.1	6.4	1.6	0.4	0.5	0.2	0.1
Ohakune	272.9	10	4.2	2.1	0.8	0.5	0.3	0
Longburn	46.1	5.6	16.6	10.5	2.6	2.4	0	-
Kairanga	45.4	15.9	18.9	6.7	4	5.3	0.7	0.7
Levin	1,280.1	26.6	4.9	0.7	0.1	0.1	0	-
Woodville	119.2	11.2	4.1	3.1	3.5	7.9	7.5	16.4
Foxton	227.8	17.5	13.6	6.9	0.7	0.2	0	0
Foxton Beach	182.5	15.7	15	3.9	0.7	0.4	0	-
Taumarunui	292.6	5.9	5.6	8.3	6	4.8	1.2	1.6
Dannevirke	346.6	10.8	1.9	0.5	0.2	0.2	0	0
Bulls	172.2	17.4	8.6	4.8	1.7	0.4	0	-
Tangimoana	38.6	7.6	15.9	36.6	10	1.2	-	-
Hunterville	163.2	6.9	6.7	4	2.3	1.3	0.3	0
Shannon	118.1	7	1.7	0.8	0.2	0.1	-	-
Koitiata	9.2	7	8.9	12.4	6.1	1.4	-	-
Ōhau	223.5	11.6	1.9	0.9	0.4	0.2	0	-
Hokio Beach	64	9.8	7	3.9	1.2	0.6	-	-
Bunnythorpe	132.8	7.6	2.8	1.8	0.2	0.5	0.1	0
Eketāhuna	91.5	11.4	2.2	0.4	0	0.1	0.1	0
Mangaweka	21.7	17.6	3.3	0.4	0.1	0.8	-	-
Ōwhango	24.1	12.8	1.4	2.3	0.7	2.2	0.4	-
Ōhura	31.9	11.2	9.2	6.6	3.8	0.4	-	-
Pohangina	23.7	12.8	2.6	1.3	0	0	-	-
Pongaroa	16.6	11.4	5.5	5.5	2.7	1.4	0.7	2
Mangamutu	13.6	29.5	13.5	0.3	0.1	-	-	-
Pahiatua	213.1	19.2	8.5	2.1	0.8	0.4	0.2	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	19.8	4.9	0.6	0.2	0	-	-
Himatangi Beach	50.7	9.7	8	2.1	0	-	-	-
Taihape	297.3	3.6	1.3	0.6	0.3	0.2	0.1	0.2
Waitārere Beach	111.8	7.5	7.4	8.2	4.3	2.1	0	-
Raetihi	101.9	10.6	5	2.9	2.4	1.2	0.1	0
Manakau	115.9	16.9	7	2.2	0.9	0.2	0	-
Sanson	58.6	11.2	3.3	1.5	1.4	0.8	-	-
Linton	44.7	8.2	2.5	1.8	1	0.4	0	-
Ohakea	9.9	10.5	1	14.1	6.6	0.4	-	-
Norsewood	27.5	9.6	4.9	1.5	-	-	-	-
Tokomaru	58.1	7.9	1.3	1.3	0.3	0	0.2	-
Waiouru	8.4	9.3	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.5	0.4	0.6	0.7	0.2
Waikawa Beach	59.7	9.3	9.1	3.3	0.4	0	-	-
Mangatainoka	20.2	10	12.6	7.1	3.4	1.5	-	6.2
Ormondville	40.5	13.9	2	0.7	0.1	0	-	-
Rongotea	110	10.3	5.8	2.8	0.4	0.4	-	-
Rātana	17.4	11.2	3.7	6.1	-	-	-	-
Halcombe	132.9	8.9	5.1	2	0.2	0.1	-	-
Kimbolton	52.5	4.9	4.6	0.6	-	1.4	-	-
Rangataua	28.5	11.2	2.6	0.1	-	-	-	-
Raurimu	16.9	8.4	1.4	0.7	0	0.1	0.2	-
Kai Iwi	38.6	6.9	2.8	1.6	1.6	0.6	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	11	5.8	5.1	6.8	7.1	1.6	2.7
Palmerston North	686.1	13.6	7.8	5.4	2.5	2.1	1.1	2.8
Feilding	170.9	25.6	11.5	8	1.4	0.9	0.1	0
Marton	213.9	9.3	4.5	3.4	12.8	22.8	2.4	1.9
Ohakune	22.4	14.2	6.9	4.2	1.3	1.2	0.2	-
Longburn	60.8	10.9	26.3	42.6	7.5	1.9	0.2	0
Kairanga	8	21.1	13.6	1.2	0.4	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	60.8	7.6	0.5	0.4	0.3	-	-
Woodville	12.5	8.6	3.3	6.5	2.9	10.5	5.4	38.6
Foxton	41.4	22	14.3	2.7	0.1	0	-	-
Foxton Beach	0.8	16.2	8.8	5	-	-	-	-
Taumarunui	37.9	12.2	6.3	4	1.4	2.7	0.6	0.4
Dannevirke	129.7	11.5	3.7	2.3	1.1	1.2	0.6	0.9
Bulls	53.9	12.2	8.1	7.1	3.2	8.7	2.9	1.4
Tangimoana	4.1	19.5	14.6	0	-	-	-	-
Hunterville	23.4	23.5	8.2	3.2	0.4	0.3	-	-
Shannon	24.9	11.6	7.7	4.9	0	-	-	0.1
Ōhau	7.2	15	2.9	1.4	1.1	3.5	4.2	10.6
Hokio Beach	50	18.2	8.8	3.7	-	-	-	-
Bunnythorpe	20.9	14.1	2.5	0.4	0	-	-	-
Eketāhuna	14	17.1	2.9	0.3	-	-	-	-
Mangaweka	10.3	27.9	11.6	2.5	0.8	2.4	1.2	0.9
Ōwhango	2.4	16.2	7.1	0.4	0.4	-	-	-
Ōhura	1.2	8.3	3.3	5.8	1.7	0	-	-
Pongaroa	2.5	8.8	23.2	7.2	2	0.4	-	-
Mangamutu	15.3	18.2	31.4	16.2	1.7	-	-	-
Pahiatua	17.7	22	9.1	1	0	-	-	-
Ashhurst	19.8	12	11.8	18.5	12.5	2.4	2.7	0.1
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	10	2.9	1.3	0.3	0.7	0.3	-
Waitārere Beach	0.4	2.5	45	30	-	-	-	-
Raetihi	13.2	12.3	3.7	1.1	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	21.7	1.8	0.8	0.5	0.1	-	-
Linton	5.2	9.4	3.1	1.2	0.8	0.4	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	1	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.9	1.4	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	0.1	6.7	4.4	-	-	-
Mangatainoka	4.7	14	5.3	1.7	1.3	-	-	-
Ormondville	5.1	4.1	1	0.8	0.8	1	0.6	1.2
Rongotea	4.6	13.7	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.7	3.3	4.1	6	15.5	13.2	8
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	9.2	5	5.8	3.3	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.9	5.3	3.4	1.6	1.3	0.7	0.4
Palmerston North	14,029.6	6.1	4.4	4	2.8	3.1	1.6	1.9
Feilding	7,528	10.9	6.9	4.8	2.1	1.6	0.5	0.2
Marton	27,105.7	9.2	4.2	1.9	1.1	1.2	0.5	0.4
Ohakune	44,184.2	1.8	0.8	0.5	0.2	0.1	0	0
Longburn	1,302.6	11.9	22.3	22.4	6.6	4.1	4.7	4
Kairanga	6,733.2	13	14.2	11.8	4.4	6.8	6.7	10.3
Levin	7,837.6	15.2	3.2	1.9	1.2	1	0.2	0.1
Woodville	10,615.9	5.5	2.9	1.5	0.9	1.1	1	20.2
Foxton	11,957.6	18.9	8.8	5.4	2.4	1.9	2.5	2.2
Foxton Beach	861.7	11.3	12.6	7.5	21.1	5.2	0.3	0.6
Taumarunui	12,241.3	2.4	1.4	0.8	0.4	0.4	0.4	1.3
Dannevirke	34,395.2	8.7	2.7	1.6	0.8	0.9	0.4	0.6
Bulls	9,085.6	14.7	7.9	5.5	2.6	2.3	0.4	0.3
Tangimoana	9,602.2	13.6	5.8	3.6	1.6	1.5	0.7	0.4
Hunterville	55,534.7	3.3	1.7	0.9	0.4	0.4	0.2	0.4
Shannon	7,725	4.6	4.6	8.3	4.3	2.3	0.2	0.1
Koitiata	908.1	11.6	9.9	10.4	5.9	3.9	0.3	0.3
Ōhau	2,857.8	8.8	6.4	5.9	2.2	2.2	0.8	0.3
Hokio Beach	2,923.4	10.6	9.4	9.2	3.2	2.3	0.1	0.1
Bunnythorpe	8,837.9	9.6	4.6	2.8	1.6	1.4	0.4	0.1
Eketāhuna	37,977.3	6	3.3	1.6	0.6	0.5	0.2	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	3.1	1.2	0.5	0.2	0.2	0.1	0.4
Ōwhango	21,112.2	1.9	0.8	0.4	0.2	0.2	0.1	0.2
Ōhura	24,006.2	3	2	1.3	0.7	0.7	0.3	0.5
Pohangina	26,177.4	3.7	2.1	1.6	0.7	0.5	0.2	0.1
Pongaroa	57,773.7	2.5	1.1	0.5	0.2	0.3	0.2	0.3
Mangamutu	1,464.7	6	5	5.2	3.4	4.5	1	2.4
Pahiatua	56,300.9	3.8	2.6	1.4	0.6	0.6	0.2	0.2
Ashhurst	9,723	6.6	4.5	3	1.5	1.6	0.6	0.5
Himatangi Beach	1,181.1	13.6	14.9	8.5	2.5	3.6	0	-
Taihape	66,124.7	2.9	1.5	0.7	0.3	0.3	0.1	0.2
Waitārere Beach	13.3	4	11.1	9.2	4.1	0.1	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0.1	0	0	0
Manakau	5,969.4	8.9	4.7	3.7	1.9	1.5	0.2	0
Sanson	3,977.1	7	4.6	2.8	1.2	0.8	0.2	0.1
Linton	9,076.6	6	3.7	2.1	0.7	0.6	0.8	0.3
Ohakea	1,988.8	17.8	6.7	6	4.6	4.9	0.4	0.1
Norsewood	5,388.4	9.8	3.2	1.1	0.5	0.4	0.2	0.2
Tokomaru	5,474	6.7	4	3.7	3.1	3.8	0.3	0.1
Waiouru	2,552.9	5.6	2.5	1.1	0.3	0.4	0.1	0.1
National Park	4,186.3	6.4	1.6	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	11.5	10.1	9.1	2.4	2	0.5	0.2
Mangatainoka	2,846.3	4.9	3.2	2.7	1.6	2.1	1.3	23.7
Ormondville	15,472.3	4	1.4	0.7	0.3	0.4	0.3	0.6
Rongotea	9,950.9	13.1	6.7	4.7	2.3	2.8	1.5	0.2
Rātana	1,699.3	7.5	4	3.6	2.8	3.2	0.7	1.1
Halcombe	20,547.4	6.9	3.9	2.6	1.5	1.8	0.7	0.5
Kimbolton	9,408.6	4.7	2.4	1.4	0.6	0.5	0.2	0.2
Rangataua	6,946.1	3	0.7	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.5	2.1	1.1	0.5	0.6	0.3	0.7
Kai Iwi	9,060.1	4.1	2.3	1.6	0.7	0.7	0.3	0.6
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.4	3.9	2.7	1.6	2.1	1.7	2.7
Palmerston North	5,568.9	4.3	3	2.1	1.3	1.7	1.2	1.2
Feilding	476.3	13.2	5.9	6.3	3.1	1.1	0.1	0.1
Marton	1,724.2	3.7	1.9	1.2	0.3	0.2	0.1	0.2
Ohakune	2,300.5	1.3	0.5	0.4	0.2	0.3	0.1	0
Longburn	36.4	4.2	20.2	1.8	1	3.3	0.2	0
Kairanga	29.9	8.6	0.3	0.8	0.7	0.8	0.2	0
Levin	495.8	23.8	4.1	1.7	0.9	2.3	0.6	0.3
Woodville	73.1	20	0.8	1.1	1	1.5	0.6	24
Foxton	594.5	14.5	10.1	6.3	0.9	0.3	0.1	0
Foxton Beach	309.8	8.1	8.8	6	2.8	4.7	0	-
Taumarunui	503.9	1.8	0.7	0.5	0.5	1.3	1.9	4
Dannevirke	855.3	8.7	1.6	1.8	0.5	0.5	0.2	0.2
Bulls	223.2	13.2	4.5	2.2	1.5	2.3	2.6	0.8
Tangimoana	421.8	9.1	5.4	2.2	0.5	0.6	0.6	0.5
Hunterville	2,173.7	1.2	0.7	0.4	0.2	0.2	0.1	0.3
Shannon	2,594	1.1	0.7	0.3	0.1	0.1	0	0
Koitiata	64.1	19.6	22.3	5.8	1.8	0.1	-	-
Ōhau	35.6	8.5	4.5	3.3	1.3	0.4	-	-
Hokio Beach	857.5	7	14.9	21.1	2	6.3	2.5	0
Bunnythorpe	80.9	14	3.3	1.3	0.8	1.3	0.7	0.5
Eketāhuna	1,475.7	0.6	0.2	0.1	0.1	0	0.1	0.1
Mangaweka	252	4.5	0.8	0.3	0.2	0.2	0.1	1.3
Ōwhango	1,328.7	0	0	0	0	0	0	0
Ōhura	891.6	1.3	0.7	0.4	0.1	0.1	0.1	0.1
Pohangina	882.3	3.6	2.1	0.9	0.5	0.7	0.1	0
Pongaroa	3,913	3.7	1.6	0.6	0.2	0.3	0.2	0.4
Mangamutu	26	3.7	2.8	2.7	0.5	0	-	-
Pahiatua	2,893.9	0.8	0.5	0.2	0.1	0.1	0	0.1
Ashhurst	115.4	8.1	2.7	3.4	2.5	2.6	1	0
Himatangi Beach	59.4	2.4	2.5	1.1	0.8	0.9	0.2	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4.3	1.9	0.9	0.3	0.3	0.2	0.2
Waitārere Beach	24.3	5.7	3.3	1.8	1.5	0.9	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	3.6	4.5	2.4	1.3	0.6	0.1	-
Sanson	55.8	6	2.4	0.5	0	-	0	-
Linton	426.8	15.3	2.8	1.8	1.9	2	2	4.9
Ohakea	56.4	9.9	3.5	2.4	0.6	0.1	-	-
Norsewood	148.5	2.2	0.6	0.7	0.3	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.4	0.1	0.1	0	0
Waiouru	2.1	5.2	6.7	3.3	1.9	1	1.4	-
National Park	1,051.5	1.6	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	10.2	15.7	7.1	6.4	3.1	15.5	0.2
Mangatainoka	178	3.6	2.7	2.3	0.8	0.8	0.4	2.4
Ormondville	889.7	3.4	1.6	2.1	2.7	1.2	0.5	0.6
Rongotea	137.6	0.6	1.3	0.9	0.1	0.3	-	-
Rātana	25.6	9	1.6	1.9	1.1	1	0.8	1.3
Halcombe	913.2	5.9	3	2.9	1.2	1.1	0.3	1.1
Kimbolton	334.7	0.3	0.2	-	-	-	0.2	0
Rangataua	766.7	3.6	1.8	1	0.6	0.5	0.2	0.1
Raurimu	190.1	4.5	2.5	2.4	0.4	0.4	0.1	0.4
Kai Iwi	148.2	3.5	3.7	2.8	1.2	1.4	0.6	0.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.16: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +3°C, Defences Down

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	7.7	4.5	3.8	3.2	4.1	0.9	0.8
Palmerston North	3,060.7	10.5	10.2	7.1	2.7	2.4	1	0.4
Feilding	1,015.1	19.2	5.6	1.2	0.6	0.5	0.1	0
Marton	365.7	14.2	6.7	1.7	0.5	0.5	0.2	0.1
Ohakune	272.9	10	4.2	2.1	0.8	0.5	0.3	0
Longburn	46.1	4.6	14.1	14.3	2.9	2.3	0	-
Kairanga	45.4	16	22.8	8.9	4.8	4.2	1	0.5
Levin	1,280.1	26.6	4.9	0.7	0.1	0.1	0	-
Woodville	119.2	9.8	2.9	3.6	3.2	5.9	7.6	27.6
Foxton	227.8	17.5	13.5	6.9	0.7	0.2	0	-
Foxton Beach	182.5	16.2	12.2	3.3	0.7	0.3	-	-
Taumarunui	292.6	5.8	5.8	8.8	5.9	4.5	1.3	1.6
Dannevirke	346.6	10.8	1.9	0.5	0.2	0.2	0	0
Bulls	172.2	17.4	8.7	4.8	1.6	0.5	0	0
Tangimoana	38.6	6.3	3.9	18.8	35.1	9.6	-	-
Hunterville	163.2	6.2	7.2	4.8	2.6	1.4	0.3	0
Shannon	118.1	6.8	1.6	0.8	0.4	0.4	0.4	0
Koitiata	9.2	7	8.9	12.4	6.1	1.4	-	-
Ōhau	223.5	11.6	1.9	0.9	0.2	0.2	0	-
Hokio Beach	64	9.8	7	3.9	1.2	0.6	-	-
Bunnythorpe	132.8	7.6	2.8	1.8	0.2	0.5	0.1	0
Eketāhuna	91.5	11.4	2.2	0.4	0.1	0.1	0	0
Mangaweka	21.7	17.6	3.3	0.4	0.1	0.8	-	-
Ōwhango	24.1	12.8	1.4	2.3	0.7	2.2	0.4	-
Ōhura	31.9	11.2	9.2	6.6	3.8	0.4	-	-
Pohangina	23.7	12.8	2.6	1.3	0	0	-	-
Mangamutu	13.6	28.1	18.5	0.4	0.1	-	-	-
Pahiatua	213.1	19.2	8.4	2	0.8	0.4	0.1	0.2
Ashhurst	179.3	17.9	4.3	0.6	0.2	0.1	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Himatangi Beach	50.7	9.7	8	2.1	0	-	-	-
Taihape	297.3	3.6	1.3	0.5	0.3	0.2	0.1	0.2
Waitārere Beach	111.8	7.5	7.4	8.2	4.3	2.1	0	-
Raetihi	101.9	10.6	5	2.9	2.4	1.2	0.1	0
Manakau	115.9	16.9	7	2.2	0.9	0.2	0	-
Sanson	58.6	11.2	3.3	1.5	1.4	0.8	-	-
Linton	44.7	8.2	3.1	1.9	1	0.3	0.2	-
Ohakea	9.9	10.8	1	15.4	5.1	0.4	-	-
Norsewood	27.5	9.6	4.9	1.5	-	-	-	-
Tokomaru	58.1	7.9	0.8	1.6	0.6	0.1	0.2	-
Waiouru	8.4	9.3	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.5	0.4	0.6	0.7	0.2
Waikawa Beach	59.7	9.4	9	3.3	0.4	0	-	-
Mangatainoka	20.2	9.9	12.5	7.4	2.8	1.5	-	6.2
Ormondville	40.5	13.9	2	0.7	0.1	0	-	-
Rongotea	110	10.5	6.3	3.3	0.2	0.8	0	-
Rātana	17.4	11.2	3.7	6.1	-	-	-	-
Halcombe	132.9	8.9	5.1	2	0.2	0.1	-	-
Kimbolton	52.5	4.9	4.6	0.6	-	1.4	-	-
Rangataua	28.5	11.2	2.6	0.1	-	-	-	-
Raurimu	16.9	8.4	1.4	0.7	0	0.1	0.2	-
Kai Iwi	38.6	6.9	2.8	1.6	1.6	0.6	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	10.8	5.8	4.8	6.5	8	1.6	2.7
Palmerston North	686.1	14	7.5	7.2	2	1.2	1.5	2.2
Feilding	170.9	26.7	17	8	2.4	1.5	0	-
Marton	213.9	9.1	4.4	1.8	8.1	27.5	4.2	1.9
Ohakune	22.4	14.2	6.9	4.2	1.3	1.2	0.2	-
Longburn	60.8	8.5	20.5	48.7	10.2	2	0.2	0
Kairanga	8	24	18.6	3.9	0.6	-	-	-
Levin	180.9	60.8	7.6	0.5	0.4	0.3	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Woodville	12.5	5.5	3	5.8	4.2	12.8	8.3	49
Foxton	41.4	20.3	14.3	4.6	1.5	1.1	-	-
Foxton Beach	0.8	17.5	10	0	-	-	-	-
Taumarunui	37.9	12	6.4	3.9	1.8	2.7	0.6	0.4
Dannevirke	129.7	11.5	3.7	2.3	1.1	1.2	0.6	0.9
Bulls	53.9	12.2	8.2	7	3.2	8.7	2.9	1.4
Tangimoana	4.1	20	16.8	1.2	-	-	-	-
Hunterville	23.4	23.7	11.5	4.3	0.5	0.4	0	-
Shannon	24.9	5.3	1.5	3.6	3.2	13.1	13.3	0.1
Ōhau	7.2	15	2.9	1.4	1.1	3.5	4.2	10.6
Hokio Beach	50	18.2	8.8	3.7	-	-	-	-
Bunnythorpe	20.9	14.1	2.5	0.4	0	-	-	-
Eketāhuna	14	17.1	2.9	0.3	-	-	-	-
Mangaweka	10.3	27.9	11.6	2.5	0.8	2.4	1.2	0.9
Ōwhango	2.4	16.2	7.1	0.4	0.4	-	-	-
Ōhura	1.2	8.3	3.3	5.8	1.7	0	-	-
Mangamutu	15.3	19.9	29.7	17.3	2.2	-	-	-
Pahiatua	17.7	22.2	8.8	0.9	0	-	-	-
Ashhurst	19.8	17.8	14.3	15.2	1.2	1.8	2.4	-
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	10	2.9	1.3	0.3	0.7	0.3	-
Waitārere Beach	0.4	2.5	45	30	-	-	-	-
Raetihi	13.2	12.3	3.7	1.1	0.1	0.1	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	21.7	1.8	0.8	0.5	0.1	-	-
Linton	5.2	9.4	3.1	1.2	0.6	-	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	1	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.9	1.4	-	-	-	-
National Park	18.3	3.9	0.1	6.7	4.4	-	-	-
Mangatainoka	4.7	14	5.3	1.7	1.3	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ormondville	5.1	4.1	1	0.8	0.8	1	0.6	1.2
Rongotea	4.6	13.7	10.2	-	-	-	-	-
Halcombe	28.3	6	4.9	5.5	7.5	18.3	2.3	7.1
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	9.2	5	5.8	3.3	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.9	5.3	3.4	1.6	1.3	0.7	0.4
Palmerston North	14,029.6	5.9	4.6	4.7	2.9	3.2	1.6	1.5
Feilding	7,528	11.2	7.2	4.9	2	1.6	0.5	0.2
Marton	27,105.7	9.2	4.2	1.8	1.1	1.3	0.5	0.4
Ohakune	44,184.2	1.8	0.8	0.5	0.2	0.1	0	0
Longburn	1,302.6	9.2	21.4	27.5	12.9	6.2	3.9	2.9
Kairanga	6,733.2	12.6	14.4	14.3	5	6.8	6.2	9.1
Levin	7,837.6	15.2	3.2	1.9	1.2	1	0.2	0.1
Woodville	10,615.9	5.5	2.8	1.5	0.9	1.2	0.7	21.3
Foxton	11,957.6	19.1	8.8	5.3	2.6	3.9	1.5	0.2
Foxton Beach	861.7	12.4	15.1	22.8	4.6	1.9	0	0.5
Taumarunui	12,241.3	2.4	1.4	0.8	0.4	0.4	0.4	1.3
Dannevirke	34,395.2	8.7	2.7	1.6	0.8	0.9	0.4	0.6
Bulls	9,085.6	14.6	7.9	5.6	2.9	2.6	0.4	0.3
Tangimoana	9,602.2	13.7	5.9	3.7	1.7	1.5	0.3	0.1
Hunterville	55,534.7	3.3	1.7	0.9	0.5	0.4	0.2	0.4
Shannon	7,725	3.5	2	1.9	3.3	7.7	7.4	0.9
Koitiata	908.1	11.5	9.9	10.4	5.9	4.1	0.3	0.3
Ōhau	2,857.8	9	6.8	6.1	2.1	1.7	0.5	0.2
Hokio Beach	2,923.4	10.6	9.4	9.2	3.2	2.3	0.1	0.1
Bunnythorpe	8,837.9	9.6	4.8	3	1.5	1.3	0.4	0.1
Eketāhuna	37,977.3	6	3.2	1.5	0.5	0.4	0.2	0.1
Mangaweka	25,542.3	3.1	1.2	0.5	0.2	0.2	0.1	0.4
Ōwhango	21,112.2	1.9	0.8	0.4	0.2	0.2	0.1	0.2
Ōhura	24,006.2	3	2	1.3	0.7	0.7	0.3	0.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Pohangina	26,177.4	3.7	2.1	1.6	0.7	0.5	0.2	0.1
Pongaroa	57,773.7	0	0	-	-	-	-	-
Mangamutu	1,464.7	5.5	4.3	4	3	5	3.3	3.8
Pahiatua	56,300.9	3.8	2.6	1.4	0.6	0.6	0.3	0.2
Ashhurst	9,723	6.6	4.3	3.2	2	2.4	0.6	0.5
Himatangi Beach	1,181.1	13.6	14.9	8.5	2.5	3.6	0	-
Taihape	66,124.7	2.9	1.5	0.7	0.3	0.3	0.1	0.2
Waitārere Beach	13.3	4	11.1	9.2	4.1	0.1	-	-
Raetihi	153,110.1	0.6	0.3	0.1	0.1	0	0	0
Manakau	5,969.4	8.9	4.7	3.6	1.9	1.5	0.2	0
Sanson	3,977.1	7	4.6	2.8	1.2	0.8	0.2	0.1
Linton	9,076.6	5.9	3.9	2.2	1	1.5	0.4	0.2
Ohakea	1,988.8	17.9	7	6	4.9	4.2	0.3	0.1
Norsewood	5,388.4	9.8	3.2	1.1	0.5	0.4	0.2	0.2
Tokomaru	5,474	5.4	3	2.9	3.2	6	3.8	0.9
Waiouru	2,552.9	5.6	2.5	1.1	0.3	0.4	0.1	0.1
National Park	4,186.3	6.4	1.6	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	11.5	10.2	9.1	2.4	2	0.5	0.2
Mangatainoka	2,846.3	4.8	2.8	2.2	1.4	2.3	1.7	25
Ormondville	15,472.3	4	1.4	0.7	0.3	0.4	0.3	0.6
Rongotea	9,950.9	12.5	7.2	5.5	2.9	2.8	1.7	0.6
Rātana	1,699.3	7.5	4	3.6	2.8	3.2	0.7	1.1
Halcombe	20,547.4	6.9	3.9	2.6	1.5	1.8	0.6	0.5
Kimbolton	9,408.6	4.7	2.4	1.4	0.6	0.5	0.2	0.2
Rangataua	6,946.1	3	0.7	0.4	0.2	0.1	0	0
Raurimu	2,159.8	5.5	2.1	1.1	0.5	0.6	0.3	0.7
Kai Iwi	9,060.1	4.1	2.3	1.6	0.7	0.7	0.3	0.6
Other property use type								
Whanganui	1,392.5	7.4	3.9	2.7	1.6	2.1	1.6	2.8
Palmerston North	5,568.9	4.1	3.3	2.6	1.4	2.1	1.8	1.7
Feilding	476.3	14.1	8.9	5.8	2.3	0.8	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Marton	1,724.2	3.7	2	1.3	0.3	0.2	0.1	0.2
Ohakune	2,300.5	1.3	0.5	0.4	0.2	0.3	0.1	0
Longburn	36.4	3.2	20.3	3.9	1.7	0.8	-	0
Kairanga	29.9	8.7	0.9	0.7	0.8	1.1	0.1	0
Levin	495.8	23.8	4.1	1.7	0.9	2.3	0.6	0.3
Woodville	73.1	19.7	1	0.9	0.2	2	2	24.6
Foxton	594.5	14.5	10.1	6.2	0.8	0.1	0	0
Foxton Beach	309.8	8.5	7.2	5.1	2.6	4.6	-	-
Taumarunui	503.9	1.8	0.7	0.5	0.6	1.1	1.9	4.1
Dannevirke	855.3	8.7	1.6	1.9	0.5	0.5	0.2	0.2
Bulls	223.2	13.2	4.5	2.2	1.5	2.2	2.6	0.8
Tangimoana	421.8	9	5.3	2.6	0.8	0.7	0.8	0.1
Hunterville	2,173.7	1.2	0.7	0.4	0.2	0.2	0.1	0.3
Shannon	2,594	1.1	0.6	0.3	0.3	0.1	0.1	0
Koitiata	64.1	19.7	22.2	5.8	1.8	0.1	-	-
Ōhau	35.6	8.5	4.5	3.3	1.3	0.4	-	-
Hokio Beach	857.5	7	14.9	21.1	2	6.3	2.5	0
Bunnythorpe	80.9	14.2	3.3	1.9	0.9	1.3	0.7	0.3
Eketāhuna	1,475.7	0.6	0.2	0.1	0.1	0	0.1	0.1
Mangaweka	252	4.5	0.8	0.3	0.2	0.2	0.1	1.3
Ōwhango	1,328.7	0	0	0	0	0	0	0
Ōhura	891.6	1.3	0.7	0.4	0.1	0.1	0.1	0.1
Pohangina	882.3	3.6	2.1	0.9	0.5	0.7	0.1	0
Mangamutu	26	3.8	3.1	2.3	0.4	0	-	-
Pahiatua	2,893.9	0.8	0.5	0.2	0.1	0.1	0	0.1
Ashhurst	115.4	8.1	2.6	3.5	2.5	2.7	1	0
Himatangi Beach	59.4	2.4	2.5	1.1	0.8	0.9	0.2	-
Taihape	2,174.7	4.3	1.9	0.9	0.3	0.3	0.2	0.2
Waitārere Beach	24.3	5.7	3.3	1.8	1.5	0.9	-	-
Raetihi	8,257	0.2	0.1	0.1	0	0	0	0
Manakau	138	3.8	4.3	2.5	1.3	0.6	0.1	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Sanson	55.8	6	2.4	0.5	0	-	0	-
Linton	426.8	15.4	3.4	1.8	1.5	2.4	1.8	4.1
Ohakea	56.4	9.9	3.5	2.4	0.6	0.1	-	-
Norsewood	148.5	2.2	0.6	0.7	0.3	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.4	0.1	0.1	0	0
Waiouru	2.1	5.2	6.7	3.3	1.9	1	1.4	-
National Park	1,051.5	1.6	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	10.2	15.2	6.9	6.2	2.9	15.5	-
Mangatainoka	178	3.7	2.7	2.3	0.8	0.8	0.5	2.2
Ormondville	889.7	3.4	1.6	2.1	2.7	1.2	0.5	0.6
Rongotea	137.6	0.4	1.6	0.9	0	0.3	-	-
Rātana	25.6	9	1.6	1.9	1.1	1	0.8	1.3
Halcombe	913.2	6	3.1	2.8	1.2	1.1	0.3	1.1
Kimbolton	334.7	0.3	0.2	-	-	-	0.2	0
Rangataua	766.7	3.6	1.8	1	0.6	0.5	0.2	0.1
Raurimu	190.1	4.5	2.5	2.4	0.4	0.4	0.1	0.4
Kai Iwi	148.2	3.5	3.7	2.8	1.2	1.4	0.6	0.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.4.17: Percentage of hectares of property use type flooded for town/settlement for 0.5% AEP, Climate Warming +3°C + SLR, Defences Up

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Whanganui	2,321	7.8	4.5	3.9	3.2	4.2	1	0.8
Palmerston North	3,060.7	10.2	6.8	4	1.4	1.3	0.2	0.1
Feilding	1,015.1	16.2	2.3	0.9	0.8	0.4	0.1	0
Marton	365.7	14.1	6.4	1.6	0.4	0.5	0.2	0.1
Ohakune	272.9	-	-	-	-	-	-	-
Longburn	46.1	5.7	16.6	10.5	2.6	2.4	0	-
Kairanga	45.4	15.9	18.9	6.7	4	5.3	0.7	0.7
Levin	1,280.1	26.6	4.9	0.7	0.1	0.1	0	-
Woodville	119.2	2.6	0.7	0.6	0.4	1.3	1.1	0.5
Foxton	227.8	17.5	13.6	6.9	0.7	0.2	-	0
Foxton Beach	182.5	15.4	15.7	5.5	1.3	0.4	0	-
Taumarunui	292.6	5.9	5.6	8.3	6	4.8	1.2	1.6
Dannevirke	346.6	0.1	-	-	-	-	-	-
Bulls	172.2	17.4	8.6	4.8	1.7	0.4	0	-
Tangimoana	38.6	7.5	15.8	36.7	10.1	1.2	-	-
Hunterville	163.2	6.9	6.7	4	2.3	1.3	0.3	0
Shannon	118.1	7	1.7	0.8	0.2	0.1	-	-
Koitiata	9.2	9.7	7.4	14.3	7.8	2.2	-	-
Ōhau	223.5	11.6	1.9	0.9	0.4	0.2	0	-
Hokio Beach	64	9.8	7	3.9	1.2	0.6	-	-
Bunnythorpe	132.8	7.6	2.8	1.8	0.2	0.5	0.1	0
Eketāhuna	91.5	2.5	0.4	0	-	0	-	-
Mangaweka	21.7	17.6	3.3	0.4	0.1	0.8	-	-
Ōwhango	24.1	12.8	1.4	2.3	0.7	2.2	0.4	-
Ōhura	31.9	11.2	9.2	6.6	3.8	0.4	-	-
Pohangina	23.7	12.8	2.6	1.3	0	0	-	-
Pongaroa	16.6	11.4	5.5	5.5	2.7	1.4	0.7	2
Mangamutu	13.6	-	-	-	-	-	-	-
Pahiatua	213.1	-	-	-	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Ashhurst	179.3	19.8	4.9	0.6	0.2	0	-	-
Himatangi Beach	50.7	9.5	8	1.9	0	-	-	-
Taihape	297.3	3.6	1.3	0.6	0.3	0.2	0.1	0.2
Waitārere Beach	111.8	7.2	7.2	8.1	4.3	2.2	0	-
Raetihi	101.9	-	-	-	-	-	-	-
Manakau	115.9	16.9	7	2.2	0.9	0.2	0	-
Sanson	58.6	11.2	3.3	1.5	1.4	0.8	-	-
Linton	44.7	8.2	2.5	1.8	1	0.4	0	-
Ohakea	9.9	10.8	0.7	14.1	6.6	0.4	-	-
Norsewood	27.5	9.3	4.6	1.4	-	-	-	-
Tokomaru	58.1	7.9	1.3	1.3	0.3	0	0.2	-
Waiouru	8.4	9.3	1.1	0.2	-	-	-	-
National Park	139.3	2.5	1.7	0.5	0.4	0.6	0.7	0.2
Waikawa Beach	59.7	9.6	9.3	3.4	0.4	0	-	-
Mangatainoka	20.2	0.5	0.4	0.8	0.7	-	-	1
Ormondville	40.5	13.9	2	0.7	0.1	0	-	-
Rongotea	110	10.3	5.8	2.8	0.4	0.4	-	-
Rātana	17.4	11.2	3.7	6.1	-	-	-	-
Halcombe	132.9	8.9	5.1	2	0.2	0.1	-	-
Kimbolton	52.5	4.9	4.6	0.6	-	1.4	-	-
Rangataua	28.5	3.4	0.6	0	-	-	-	-
Raurimu	16.9	8.4	1.4	0.7	0	0.1	0.2	-
Kai Iwi	38.6	7	2.9	1.6	1.6	0.6	0.4	0.1
Commerical/Industrial property use type								
Whanganui	401.8	10.7	5.7	4.2	5.1	10.7	1.8	3
Palmerston North	686.1	13.6	7.8	5.4	2.5	2.1	1.1	2.8
Feilding	170.9	25.6	11.5	8	1.4	0.9	0.1	0
Marton	213.9	9.3	4.5	3.4	12.8	22.8	2.4	1.9
Ohakune	22.4	-	-	-	-	-	-	-
Longburn	60.8	10.9	26.3	42.6	7.5	1.9	0.2	0
Kairanga	8	21.1	13.6	1.2	0.4	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Levin	180.9	60.8	7.6	0.5	0.4	0.3	-	-
Woodville	12.5	0.3	0.8	2.1	1.4	1.1	2.1	0.2
Foxton	41.4	22.3	13.7	2.2	0.1	0	-	-
Foxton Beach	0.8	16.2	6.2	7.5	-	-	-	-
Taumarunui	37.9	12.2	6.3	4	1.4	2.7	0.6	0.4
Dannevirke	129.7	-	-	-	-	-	-	-
Bulls	53.9	12.2	8.1	7.1	3.2	8.7	2.9	1.4
Tangimoana	4.1	19.5	14.6	0	-	-	-	-
Hunterville	23.4	23.5	8.2	3.2	0.4	0.3	-	-
Shannon	24.9	11.6	7.8	4.9	0	-	-	0.1
Ōhau	7.2	15	2.9	1.4	1.1	3.5	4.2	10.6
Hokio Beach	50	18.2	8.8	3.7	-	-	-	-
Bunnythorpe	20.9	14.1	2.5	0.4	0	-	-	-
Eketāhuna	14	14.4	2.9	0.3	-	-	-	-
Mangaweka	10.3	27.8	11.6	2.5	0.8	2.4	1.2	0.9
Ōwhango	2.4	16.2	7.1	0.4	0.4	-	-	-
Ōhura	1.2	8.3	3.3	5.8	1.7	0	-	-
Pongaroa	2.5	8.8	23.2	7.2	2	0.4	-	-
Mangamutu	15.3	-	-	-	-	-	-	-
Pahiatua	17.7	-	-	-	-	-	-	-
Ashhurst	19.8	12	11.8	18.5	12.5	2.4	2.7	0.1
Himatangi Beach	0.1	10	-	-	-	-	-	-
Taihape	25.8	10	2.9	1.3	0.3	0.7	0.3	-
Waitārere Beach	0.4	2.5	45	30	-	-	-	-
Raetihi	13.2	-	-	-	-	-	-	-
Manakau	0.3	10	6.7	3.3	6.7	3.3	-	-
Sanson	10.2	21.7	1.8	0.8	0.5	0.1	-	-
Linton	5.2	9.4	3.1	1.2	0.8	0.4	-	-
Norsewood	1.9	26.3	6.3	7.9	-	-	-	-
Tokomaru	10	1	0.1	-	-	-	-	-
Waiouru	5.6	8.8	2.9	1.4	-	-	-	-

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
National Park	18.3	3.9	0.1	6.7	4.4	-	-	-
Mangatainoka	4.7	-	-	-	-	-	-	-
Ormondville	5.1	4.1	1	0.8	0.8	1	0.6	1.2
Rongotea	4.6	13.7	10.2	-	-	-	-	-
Rātana	0.1	-	-	-	-	-	-	-
Halcombe	28.3	4.7	3.3	4.1	6	15.5	13.2	8
Kimbolton	0.9	-	4.4	-	-	-	-	-
Raurimu	1.2	9.2	5	5.8	3.3	0.8	-	-
Rural property use type								
Whanganui	9,193.7	9.9	5.3	3.4	1.6	1.3	0.7	0.5
Palmerston North	14,029.6	6	4.4	4	2.8	3.1	1.6	1.9
Feilding	7,528	10.9	6.9	4.8	2.1	1.6	0.5	0.2
Marton	27,105.7	9.2	4.2	1.9	1.1	1.2	0.5	0.4
Ohakune	44,184.2	0	0	0	0	0	-	-
Longburn	1,302.6	11.9	22.3	22.4	6.6	4.1	4.7	4
Kairanga	6,733.2	13	14.2	11.8	4.4	6.8	6.7	10.3
Levin	7,837.6	15.2	3.2	1.9	1.2	1	0.2	0.1
Woodville	10,615.9	1.7	0.9	0.6	0.6	1.4	1.5	9.4
Foxton	11,957.6	19	9	5.1	1.9	2	2.5	2.2
Foxton Beach	861.7	11.2	12.6	6.2	2.5	24	2	0.6
Taumarunui	12,241.3	2.4	1.4	0.8	0.4	0.4	0.4	1.3
Dannevirke	34,395.2	0.5	0.3	0.2	0.1	0.1	0	0
Bulls	9,085.6	14.7	7.8	5.6	2.7	2.3	0.4	0.3
Tangimoana	9,602.2	13.6	5.8	3.5	1.6	1.5	0.7	0.4
Hunterville	55,534.7	3.3	1.7	0.9	0.4	0.4	0.2	0.4
Shannon	7,725	4.6	4.6	8.3	4.3	2.3	0.2	0.1
Koitiata	908.1	11.5	9.8	10.3	6.1	4	0.3	0.3
Ōhau	2,857.8	8.8	6.4	5.9	2.2	2.2	0.8	0.3
Hokio Beach	2,923.4	10.6	9.4	9.3	3.4	2.3	0.1	0.1
Bunnythorpe	8,837.9	9.6	4.6	2.8	1.6	1.4	0.4	0.1
Eketāhuna	37,977.3	1.5	0.8	0.3	0.1	0.1	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Mangaweka	25,542.3	3.1	1.2	0.5	0.2	0.2	0.1	0.4
Ōwhango	21,112.2	1.9	0.8	0.4	0.2	0.2	0.1	0.2
Ōhura	24,006.2	3	2	1.3	0.7	0.7	0.3	0.5
Pohangina	26,177.4	3.7	2.1	1.6	0.7	0.5	0.2	0.1
Pongaroa	57,773.7	2.5	1.1	0.5	0.2	0.3	0.2	0.3
Mangamutu	1,464.7	0	-	-	-	-	-	-
Pahiatua	56,300.9	0.1	0.1	0	0	0	0	0
Ashhurst	9,723	6.6	4.5	3	1.5	1.6	0.6	0.5
Himatangi Beach	1,181.1	13.5	14.9	8.6	2.5	3.6	0	-
Taihape	66,124.7	2.9	1.5	0.7	0.3	0.3	0.1	0.2
Waitārere Beach	13.3	4	11.1	8.7	4.1	0.1	-	-
Raetihi	153,110.1	0.1	0.1	0	0	0	0	0
Manakau	5,969.4	8.9	4.7	3.7	1.9	1.6	0.2	0
Sanson	3,977.1	7	4.6	2.8	1.2	0.8	0.2	0.1
Linton	9,076.6	6	3.7	2.1	0.7	0.6	0.8	0.3
Ohakea	1,988.8	17.8	6.7	6	4.6	4.9	0.4	0.1
Norsewood	5,388.4	8.8	2.8	1	0.4	0.4	0.2	0.2
Tokomaru	5,474	6.7	4	3.7	3.1	3.8	0.3	0.1
Waiouru	2,552.9	5.6	2.5	1.1	0.3	0.4	0.1	0.1
National Park	4,186.3	6.4	1.6	0.6	0.4	0.3	0.1	0.2
Waikawa Beach	270	11.4	10.1	9.2	2.7	2.1	0.5	0.2
Mangatainoka	2,846.3	0.1	0.2	0.4	0.5	0.9	0.5	9.5
Ormondville	15,472.3	4	1.4	0.7	0.3	0.4	0.3	0.6
Rongotea	9,950.9	13.1	6.7	4.7	2.3	2.8	1.5	0.2
Rātana	1,699.3	7.5	4	3.3	3	3.3	0.8	1.1
Halcombe	20,547.4	6.9	3.9	2.6	1.5	1.8	0.7	0.5
Kimbolton	9,408.6	4.7	2.4	1.4	0.6	0.5	0.2	0.2
Rangataua	6,946.1	0.8	0.3	0.2	0.1	0.1	0	-
Raurimu	2,159.8	5.5	2.1	1.1	0.5	0.6	0.3	0.7
Kai Iwi	9,060.1	4.1	2.3	1.6	0.7	0.7	0.4	0.6
Other property use type								

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Whanganui	1,392.5	7.2	3.9	2.8	1.7	2.2	1.8	2.7
Palmerston North	5,568.9	4.3	3	2.1	1.3	1.7	1.2	1.2
Feilding	476.3	13.2	5.9	6.3	3.1	1.1	0.1	0.1
Marton	1,724.2	3.7	1.9	1.2	0.3	0.2	0.1	0.2
Ohakune	2,300.5	-	-	-	-	-	-	-
Longburn	36.4	4.2	20.2	1.8	1	3.3	0.2	0
Kairanga	29.9	8.6	0.3	0.8	0.7	0.8	0.2	0
Levin	495.8	23.8	4.1	1.8	0.9	2.3	0.6	0.3
Woodville	73.1	0.6	0.1	0.1	0	1.6	3	19.3
Foxton	594.5	14.1	10.2	6.1	0.9	0.4	0.1	0
Foxton Beach	309.8	6.1	8.4	9.2	3.9	4.7	0.3	-
Taumarunui	503.9	1.8	0.7	0.5	0.5	1.3	1.9	4
Dannevirke	855.3	-	-	-	-	-	-	-
Bulls	223.2	13.2	4.5	2.2	1.5	2.3	2.6	0.8
Tangimoana	421.8	9.1	5.4	2.2	0.5	0.6	0.6	0.5
Hunterville	2,173.7	1.2	0.7	0.4	0.2	0.2	0.1	0.3
Shannon	2,594	1.1	0.7	0.3	0.1	0.1	0	0
Koitiata	64.1	14.4	21.5	11.6	8.5	3	-	-
Ōhau	35.6	8.5	4.5	3.3	1.3	0.4	-	-
Hokio Beach	857.5	7	14.9	21.2	1.9	6.3	2.5	0
Bunnythorpe	80.9	14	3.3	1.3	0.8	1.3	0.7	0.5
Eketāhuna	1,475.7	0.1	0	0	0	0	0	-
Mangaweka	252	4.5	0.8	0.3	0.2	0.2	0.1	1.3
Ōwhango	1,328.7	0	0	0	0	0	0	0
Ōhura	891.6	1.3	0.7	0.4	0.1	0.1	0.1	0.1
Pohangina	882.3	3.6	2.1	0.9	0.5	0.7	0.1	0
Pongaroa	3,913	3.8	1.6	0.6	0.2	0.3	0.2	0.5
Mangamutu	26	-	-	-	-	-	-	-
Pahiatua	2,893.9	0	0	0	0	-	-	-
Ashhurst	115.4	8.1	2.7	3.4	2.5	2.6	1	0
Himatangi Beach	59.4	2.2	2.1	1.4	1	1.3	0.7	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/settlement (52)	Area of the settlement in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Taihape	2,174.7	4.3	1.9	0.9	0.3	0.3	0.2	0.2
Waitārere Beach	24.3	4.9	4.4	2.4	2	1.1	0.1	0
Raetihi	8,257	0	0	-	-	0	-	-
Manakau	138	3.6	4.5	2.5	1.4	0.6	0.1	-
Sanson	55.8	6	2.4	0.5	0	-	0	-
Linton	426.8	15.3	2.8	1.8	1.9	2	2	4.9
Ohakea	56.4	9.9	3.5	2.4	0.6	0.1	-	-
Norsewood	148.5	2.2	0.6	0.7	0.3	0.3	0.2	0.3
Tokomaru	1,681.2	1.6	1	0.4	0.1	0.1	0	0
Waiouru	2.1	5.2	6.7	3.3	1.9	1	1.4	-
National Park	1,051.5	1.6	0.5	0.1	0.1	0	0	0
Waikawa Beach	4.2	4.5	17.6	17.9	9.8	5.5	14.3	1.2
Mangatainoka	178	-	-	-	-	-	-	-
Ormondville	889.7	3.4	1.6	2.1	2.7	1.2	0.5	0.6
Rongotea	137.6	0.6	1.3	0.9	0.1	0.3	-	-
Rātana	25.6	9	1.6	1.9	1.1	1	0.8	1.3
Halcombe	913.2	5.9	3	2.9	1.2	1.1	0.3	1.1
Kimbolton	334.7	0.3	0.2	-	-	-	0.2	0
Rangataua	766.7	0	0	0	0	0	-	-
Raurimu	190.1	4.5	2.5	2.4	0.4	0.4	0.1	0.4
Kai Iwi	148.2	3.5	3.7	2.8	1.2	1.4	0.6	0.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.1: Total hectares of property use type for district flooded for town/settlement for 5% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	292.6	156.4	69.1	23.1	12.3	1.5	0.2
Whanganui District	2,537.4	191.7	85.5	44.7	9.8	3	1.4	0.4
Horowhenua District	2,664.3	439.1	107.8	37.7	6.1	2.9	0.1	0
Manawatū District	1,941.5	221.1	53.7	19.3	5.4	3.2	0.8	0.3
Tararua District	965.5	112.1	31.4	11.4	4.2	3.7	1.4	3.6
Rangitīkei District	1,258.4	104.6	35.4	18.1	3.9	2	0.9	0.3
Ruapehu District	1,170.5	82.1	36.1	17	6.3	4.7	1.4	1.4
Commerical/Industrial property use type								
Palmerston North City	796.6	97.2	50.6	26.4	10	9.8	2.4	9.3
Whanganui District	420.8	50.5	28.7	10.9	4.6	7.2	0	0
Horowhenua District	350.4	113.6	16.7	2.8	1.3	1.8	0.2	0
Manawatū District	311.9	52.5	17.2	7.4	5	2.3	1.2	2.2
Tararua District	211.2	23.5	7.6	2.9	1.7	2.9	0.6	2.7
Rangitīkei District	335.1	43	29.4	23	2.3	1.7	0.9	1.5
Ruapehu District	25,319.4	243.3	112.5	63	23.2	15.2	3.2	2.4
Rural property use type								
Palmerston North City	27,505.4	2,042.8	1,218.3	657.3	295.3	277.7	88.9	139.7
Whanganui District	302,890.5	4,902.5	2,798.5	1,501.5	534.2	444.4	182.8	346
Horowhenua District	79,623.5	7,950	5,372.1	3,120.5	1,576.3	1,498.3	555.6	196.3
Manawatū District	225,094.6	16,326.2	8,157.7	4,518.3	2,068.9	1,582.2	350.1	259.7
Tararua District	405,511.5	14,345.6	6,395.5	3,039.4	1,343.4	1,457.7	862.3	2,583.1
Rangitīkei District	395,303.1	13,547.5	6,684.6	3,183.4	1,090.4	717.8	273	401.1
Ruapehu District	810,446.7	9,796	4,409.6	2,000.9	859.4	830.5	399.1	577.6
Other property use type								
Palmerston North City	6,131.2	291.1	158.9	124	67.2	75	20.8	19.5
Whanganui District	51,009.4	220	137.2	79.9	56.2	19.8	7.8	45.6
Horowhenua District	17,576.9	415.3	287.3	124.6	105.5	96.6	11.7	11.9
Manawatū District	36,545.9	283	160.6	82.1	27	27.7	13.4	14.2
Tararua District	38,157.8	385	176	103	36.7	37.3	21.6	39.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	229	130.5	63.9	31.8	22.7	6.4	4.6
Ruapehu District	92,049.8	1,067.1	555.1	295.6	131.1	128.9	59.6	101.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.2: Total hectares of property use type for district flooded for town/settlement for 5% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	294.1	111.8	39.7	12.7	6.3	1.3	0.2
Whanganui District	2,537.4	191.7	85.3	43.7	9	2.8	1.1	0.3
Horowhenua District	2,664.3	436.8	106.2	40.7	13.5	4.1	0.2	0
Manawatū District	1,941.5	268.4	67.3	20.7	7.4	6.1	1.1	0.1
Tararua District	965.5	107.8	29.5	10.1	3.9	3.2	1	3.5
Rangitīkei District	1,258.4	105.1	38.3	17.9	6.2	3.8	1.1	0.3
Ruapehu District	1,170.5	82.2	35.7	16.9	6.1	4.6	1.4	1.4
Commerical/Industrial property use type								
Palmerston North City	796.6	104.1	54.3	24.3	7.1	10.2	2.3	9.2
Whanganui District	420.8	53.7	22.8	6.2	4.2	7.1	0	0
Horowhenua District	350.4	112.9	18.3	5.3	2.5	1.9	0.2	0
Manawatū District	311.9	63.5	23	9.4	1.7	1.6	1	2
Tararua District	211.2	22.8	6.5	2.9	1.7	2.9	0.5	2.7
Rangitīkei District	335.1	36.3	36.4	34.1	11.7	3.9	0.8	1.4
Ruapehu District	25,319.4	243.3	112.4	63	23.2	15.2	3.2	2.4
Rural property use type								
Palmerston North City	27,505.4	2,068.3	1,302.5	721.4	333.9	299.8	110	128.4
Whanganui District	302,890.5	4,904.2	2,798.2	1,500.7	534.7	443.2	182.8	343.9
Horowhenua District	79,623.5	7,124.6	4,404.3	4,125.5	3,260.9	2,565.1	108.8	111.6
Manawatū District	225,094.6	16,032.7	8,409.8	4,663.2	2,165.5	2,228.2	1,596.8	820.4
Tararua District	405,511.5	11,883.2	5,305.6	2,615.5	1,142.7	1,214.8	726.2	2,424.1
Rangitīkei District	395,303.1	13,396.3	6,881.3	3,798	1,463.4	843.7	283.7	392.1
Ruapehu District	810,446.7	9,796.2	4,409.2	2,001.4	859.5	830.6	399.1	577.6
Other property use type								
Palmerston North City	6,131.2	291.5	157.6	125.1	72.1	70.5	28.5	19.9
Whanganui District	51,009.4	221.5	139.5	77.9	52.2	19.2	7.8	45.6
Horowhenua District	17,576.9	421.2	291.4	129.7	82.2	69.6	3	9.9
Manawatū District	36,545.9	297.2	172.9	82.3	30.2	28	11.6	13.7
Tararua District	38,157.8	207.4	93.3	71.9	24.4	23.4	12.3	27.7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	229.7	131.4	64	31.9	23	6.5	4.5
Ruapehu District	92,049.8	1,067.7	555.3	294	130.8	128.9	59.6	101.8

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.3: Total hectares of property use type for district flooded for town/settlement for 2% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	301.5	166.6	83.9	27.7	15.2	2.2	0.3
Whanganui District	2,537.4	199.2	91	49.5	13.9	5	1.6	0.6
Horowhenua District	2,664.3	452.8	122.2	43	8	3.6	0.1	0
Manawatū District	1,941.5	236.3	58.8	23	6.5	4	1	0.3
Tararua District	965.5	116.1	34.3	12.6	4.8	8.6	3.5	5.4
Rangitīkei District	1,258.4	108.9	40.2	18.4	8.4	2.7	0.9	0.5
Ruapehu District	1,170.5	85.7	39.8	19.1	7.3	5.9	1.8	2.1
Commerical/Industrial property use type								
Palmerston North City	796.6	99.7	53.3	29.4	13.2	11.7	4.9	10.4
Whanganui District	420.8	49.9	31.6	11.7	3.3	8.2	1.7	0.1
Horowhenua District	350.4	120.2	17.5	3.4	0.9	1.9	0.6	0
Manawatū District	311.9	56.3	20.8	7.3	4.5	5	1.4	2.6
Tararua District	211.2	24.8	7.9	3.4	1.5	1.7	2.5	3.9
Rangitīkei District	335.1	39.2	29	35.3	12.3	2.9	1.1	2
Ruapehu District	25,319.4	250	117.4	68.4	26.8	18.3	4	2.7
Rural property use type								
Palmerston North City	27,505.4	2,068.7	1,286.9	721.8	327.9	380.9	143.6	168.5
Whanganui District	302,890.5	5,012.9	2,868.1	1,616.7	633	546.5	241.2	487.7
Horowhenua District	79,623.5	7,890.4	5,657.7	3,497	1,694.2	1,649.3	637.2	366.9
Manawatū District	225,094.6	16,735.6	8,495.7	4,843.9	2,281	2,377.9	652.9	345.6
Tararua District	405,511.5	14,852.9	6,702.7	3,221.8	1,462	1,535.1	882.9	3,198.8
Rangitīkei District	395,303.1	13,903.2	7,062.5	3,589.1	1,338.8	914.9	349.1	528.7
Ruapehu District	810,446.7	9,990.8	4,612.8	2,182.5	964.7	950.6	498.1	781.2
Other property use type								
Palmerston North City	6,131.2	298.9	162.8	109.8	68.6	100.6	35.7	27.5
Whanganui District	51,009.4	222.5	142.3	83.9	57.9	27.6	13.3	58
Horowhenua District	17,576.9	413	309.1	127.3	104.5	107.7	17.9	14.2
Manawatū District	36,545.9	294.4	166.5	88.5	32.2	30.9	15.8	18.9
Tararua District	38,157.8	398.9	182	99.1	44.6	41.7	25.4	45.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	230.6	135	70.4	31.5	30.9	9	7.6
Ruapehu District	92,049.8	1,091.2	578	309.9	146.5	140.7	71.8	126.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.4: Total hectares of property use type for district flooded for town/settlement for 2% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	313	129.9	50	20.1	14.6	2.9	0.4
Whanganui District	2,537.4	198.9	90.8	49.8	13.5	4.7	1.6	0.6
Horowhenua District	2,664.3	452.2	118.6	45.1	11.7	10.3	0.2	0.1
Manawatū District	1,941.5	279.5	82.3	29.1	8.4	8.2	2.2	0.4
Tararua District	965.5	111.1	32	11.6	4.3	7.8	3.3	5.1
Rangitīkei District	1,258.4	109.5	43.6	18	9.2	6	1.2	0.6
Ruapehu District	1,170.5	85.6	39.4	18.9	7.2	5.8	1.8	2.1
Commerical/Industrial property use type								
Palmerston North City	796.6	107	65.3	30.9	6.6	12.1	4.3	10.2
Whanganui District	420.8	53.4	26.2	6.5	2.7	8.2	1.7	0.1
Horowhenua District	350.4	118.4	19.3	7	3.6	2.4	0.6	0
Manawatū District	311.9	66	28.5	10.1	5.1	1.9	1.1	2.3
Tararua District	211.2	24.2	6.5	3.4	1.5	1.6	2.6	3.8
Rangitīkei District	335.1	32.7	23.8	45.3	20.4	9.6	1.3	1.9
Ruapehu District	25,319.4	250	117.4	68.4	26.8	18.3	4	2.7
Rural property use type								
Palmerston North City	27,505.4	2,085.6	1,434	870.1	442.2	444.6	141.3	171.6
Whanganui District	302,890.5	5,016.3	2,870.9	1,616	633.7	545	240.7	484.2
Horowhenua District	79,623.5	7,308.9	4,523.5	4,175.9	3,031.1	3,665.4	247.1	123.5
Manawatū District	225,094.6	16,433.6	8,730.8	5,144.3	2,358.2	2,597.4	1,642.7	1,417.7
Tararua District	405,511.5	12,278.8	5,565.4	2,769.7	1,246.4	1,267.8	723.3	2,968.9
Rangitīkei District	395,303.1	13,695.8	7,142.2	4,154.4	1,852.6	1,154.1	368.1	513.8
Ruapehu District	810,446.7	9,990.3	4,612.8	2,182.3	964.8	950.7	498.2	781.3
Other property use type								
Palmerston North City	6,131.2	298.6	165.9	112.2	74.1	107.9	48.7	29.2
Whanganui District	51,009.4	222.3	142.3	84.8	58	27.4	13.4	58
Horowhenua District	17,576.9	423.6	317.1	139.6	64.7	82.8	6.8	10.1
Manawatū District	36,545.9	309.3	179.7	89.9	32.4	33.9	15.4	19.4
Tararua District	38,157.8	214.7	93.3	69.2	30.6	26.5	14.4	30.6

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	232.1	136.1	71.7	31.1	31.2	9.1	7.2
Ruapehu District	92,049.8	1,091.6	579	308.1	144.9	140.6	71.8	126.2

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.5: Total hectares of property use type for district flooded for town/settlement for 1% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	310.7	172.9	91	30.3	17.6	2.3	0.4
Whanganui District	2,537.4	204.5	95.2	55.4	16.3	9.4	3.9	1.3
Horowhenua District	2,664.3	23.6	10.2	2.4	0.4	0	-	-
Manawatū District	1,941.5	245	64.9	23.4	11.5	4.9	1.1	0.4
Tararua District	965.5	71.4	19.8	10.8	5.4	7.8	7	7.7
Rangitīkei District	1,258.4	112.4	46.5	18.6	11.6	3.9	1	0.8
Ruapehu District	1,170.5	87	42.2	21.5	8.3	7.1	2.3	2.6
Commerical/Industrial property use type								
Palmerston North City	796.6	104.3	55.3	30	16.5	10	8.4	11.2
Whanganui District	420.8	51.6	33.9	13.6	2.2	9	3	0.1
Horowhenua District	350.4	2.4	1.4	-	-	-	-	-
Manawatū District	311.9	56.9	23.9	8.4	3.6	6.7	1.7	2.8
Tararua District	211.2	20.1	6.2	2.9	1.4	2.3	1.4	5.9
Rangitīkei District	335.1	37.4	28	32.5	26.2	6.6	1.4	2.4
Ruapehu District	25,319.4	254.7	120.1	70.2	30.7	20.3	5	3
Rural property use type								
Palmerston North City	27,505.4	1,921.3	1,187.6	717.9	345.4	422.2	199.2	195.5
Whanganui District	302,890.5	5,084.5	2,923.7	1,709.9	697.3	640.5	299.1	627.5
Horowhenua District	79,623.5	2,076	894.4	419	123.5	87.9	79.7	79.4
Manawatū District	225,094.6	16,962.8	8,758	5,078.4	2,373.9	2,710.3	1,274.2	463.9
Tararua District	405,511.5	8,260.2	3,463.5	1,806.3	878.5	967.9	575.2	3,240.3
Rangitīkei District	395,303.1	14,044.7	7,398.2	4,021.1	1,654.5	1,160	425.8	621.1
Ruapehu District	810,446.7	10,126.7	4,746.1	2,300.3	1,040.7	1,048.8	562.8	968.9
Other property use type								
Palmerston North City	6,131.2	250.9	136.1	100.8	61.9	105.6	47.3	35.1
Whanganui District	51,009.4	226.1	148.9	77.6	56.2	41.6	16.2	70.4
Horowhenua District	17,576.9	88.3	69.4	40.9	20.7	0.6	-	-
Manawatū District	36,545.9	305	169.4	94.7	36.8	34.8	16.2	20.7
Tararua District	38,157.8	205.3	92.6	63.7	37.7	29.9	16.4	37.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	231.7	139	76.3	32.8	34.4	10.8	10.2
Ruapehu District	92,049.8	1,104	584.7	328	153.2	153.8	77.9	146.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.6: Total hectares of property use type for district flooded for town/settlement for 1% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	329.2	153.9	67.6	26.8	25.1	4.5	1.4
Whanganui District	2,537.4	204.5	95	55.3	16.3	9.4	3.9	1.4
Horowhenua District	2,664.3	463.1	127	46.3	12.4	13.5	0.6	0.1
Manawatū District	1,941.5	281.9	93	35.5	11.7	8.8	3	0.6
Tararua District	965.5	112.5	33.1	12.9	5.6	8.3	7.1	7.8
Rangitīkei District	1,258.4	112.8	49.1	20.5	10.4	6.9	1.4	0.8
Ruapehu District	1,170.5	86.7	41.8	21.2	8.1	7	2.3	2.6
Commerical/Industrial property use type								
Palmerston North City	796.6	106	71.6	40.1	6.5	10.2	7.5	10.9
Whanganui District	420.8	55.3	28.9	8	1.6	8.9	3	0.1
Horowhenua District	350.4	120	18.7	5.9	5.3	5	0.7	0.1
Manawatū District	311.9	65.5	31.5	12	6.7	2.5	1.1	2.6
Tararua District	211.2	25.2	7.1	3	1.4	2.3	1.4	5.9
Rangitīkei District	335.1	32.8	17.4	36.4	33.8	17.1	1.7	2.2
Ruapehu District	25,319.4	254.7	120.1	70.2	30.7	20.3	5	3
Rural property use type								
Palmerston North City	27,505.4	2,085	1,511.5	976.7	514.4	543.3	185.7	193.1
Whanganui District	302,890.5	5,088.5	2,925.9	1,710.2	698.1	638.7	298.4	622.8
Horowhenua District	79,623.5	7,305.9	4,500.9	4,036.8	2,685.6	4,150.4	1,141.3	147.1
Manawatū District	225,094.6	16,643.5	8,968.4	5,504.4	2,500.1	2,787	1,703.4	1,840.8
Tararua District	405,511.5	12,512.8	5,750.4	2,900.4	1,310.8	1,325.6	727	3,298.8
Rangitīkei District	395,303.1	13,818.4	7,449.4	4,475.1	2,197.1	1,511.1	460.1	602.4
Ruapehu District	810,446.7	10,127.4	4,746	2,300.3	1,040.8	1,048.9	562.9	969.1
Other property use type								
Palmerston North City	6,131.2	295.8	170.2	123.7	69.8	121	63.5	44.8
Whanganui District	51,009.4	225.9	147.8	77.4	56.2	42.5	16.3	70.4
Horowhenua District	17,576.9	425	329.5	147	69.9	84.7	13.4	10.4
Manawatū District	36,545.9	314.9	182.6	98.2	36.7	36.7	16.9	22.5
Tararua District	38,157.8	220	94.8	66.1	35.1	26.9	16.2	32.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	231.6	140.6	77.9	32.5	34.6	10.9	9.7
Ruapehu District	92,049.8	1,104.4	585	327.4	150.4	153.5	78	146.5

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.7: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	320.7	177.2	97.8	33.5	19.6	2.6	0.4
Whanganui District	2,537.4	206.7	99.8	59.6	23.1	13.2	7.2	4.2
Horowhenua District	2,664.3	472.7	139	49	10.9	5.4	0.3	0
Manawatū District	1,941.5	252	75.6	27.6	13.2	6.8	1.2	0.5
Tararua District	965.5	118.6	37.7	15	7.6	10.8	8	14.7
Rangitīkei District	1,258.4	113.2	50.1	21.1	10.6	9.1	1.5	0.9
Ruapehu District	1,170.5	89.7	44.7	24.2	10.2	7.8	2.9	3.1
Commerical/Industrial property use type								
Palmerston North City	796.6	106.2	68.7	35.8	16.4	10.2	10.4	12.3
Whanganui District	420.8	51.9	33.8	18.1	4.2	6	7	0.2
Horowhenua District	350.4	126.7	20.7	4.5	1	1.7	0.8	0.2
Manawatū District	311.9	57.7	25.5	10.5	3.8	6.8	2.1	3.1
Tararua District	211.2	26.4	8.6	3.7	1.9	1.9	2	6.8
Rangitīkei District	335.1	35.7	21.1	34.6	33.5	14.5	1.7	2.6
Ruapehu District	25,319.4	260.1	121.6	73.5	33	22.9	5.5	3.7
Rural property use type								
Palmerston North City	27,505.4	2,126.4	1,410.9	852.5	399.2	476.8	263.1	233.9
Whanganui District	302,890.5	5,134.3	2,969.8	1,881.3	859	763.6	365.8	810.2
Horowhenua District	79,623.5	7,747.6	5,464.8	4,436.4	1,956.4	2,131.6	779.1	571.2
Manawatū District	225,094.6	17,199	8,990.1	5,378.6	2,506.9	2,700.6	1,749	886.1
Tararua District	405,511.5	15,399.3	7,128.3	3,521.6	1,612	1,685.5	899	3,909.1
Rangitīkei District	395,303.1	14,101.6	7,420.1	4,374.9	1,917.7	1,589.7	527.8	739.5
Ruapehu District	810,446.7	10,259.2	4,859.5	2,428.5	1,107.8	1,139.3	617.3	1,181.2
Other property use type								
Palmerston North City	6,131.2	303.2	170.7	111	67	103.6	60.2	46.5
Whanganui District	51,009.4	229.3	146.7	81.6	57.1	41.1	21.3	86.8
Horowhenua District	17,576.9	410.7	337.1	138.9	87.6	130.5	34	19.4
Manawatū District	36,545.9	321.6	171.6	103	40.4	36.2	16.6	22.7
Tararua District	38,157.8	416.1	181.7	107.2	55.5	46.2	28.1	61.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	232	144.1	79	33.8	38.1	12.4	13.2
Ruapehu District	92,049.8	1,112.8	590.6	335.5	164.3	165.2	84.7	168

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.8: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	340.2	178.9	87.4	38.6	37.3	8.9	3.3
Whanganui District	2,537.4	206.6	99.8	59.7	23	13.1	7.3	4.3
Horowhenua District	2,664.3	471.9	134.7	49.1	12.4	14.3	2.5	0.1
Manawatū District	1,941.5	285.5	100.1	42.2	15	9.7	3.7	0.7
Tararua District	965.5	113.5	33.8	13.4	6.8	9.8	7.6	14.2
Rangitīkei District	1,258.4	113.8	52.9	24	11.4	9.6	1.9	0.9
Ruapehu District	1,170.5	89.3	44.2	23.7	10	7.7	2.9	3.1
Commerical/Industrial property use type								
Palmerston North City	796.6	107.8	68.6	51.6	7.9	9.2	9.6	11.7
Whanganui District	420.8	53.6	33.2	15.6	3.6	6.1	7	0.2
Horowhenua District	350.4	124.7	19.6	6	3.5	7.9	0.8	0.2
Manawatū District	311.9	64.1	32.8	14.3	6.2	4.4	1.1	2.8
Tararua District	211.2	25.6	7.8	3.3	1.8	1.9	1.9	6.8
Rangitīkei District	335.1	34.7	15.6	25.8	41.7	25.6	2.2	2.4
Ruapehu District	25,319.4	260.1	121.6	73.5	33	22.9	5.5	3.7
Rural property use type								
Palmerston North City	27,505.4	2,078	1,575.5	1,074.9	572.6	629.4	232.2	213.9
Whanganui District	302,890.5	5,139.1	2,972.5	1,881.6	860.4	761.5	365.2	805
Horowhenua District	79,623.5	7,309.6	4,464.8	4,071	2,577.4	3,784.3	2,284.1	172.9
Manawatū District	225,094.6	16,846.5	9,113.4	5,840.4	2,630.5	2,940.8	1,768.6	2,180.8
Tararua District	405,511.5	12,717.8	5,922.6	2,999.8	1,379	1,387.2	718.5	3,585.9
Rangitīkei District	395,303.1	13,886.9	7,464.4	4,772	2,451.4	2,002.2	558.3	719.2
Ruapehu District	810,446.7	10,258.4	4,858.9	2,428.6	1,107.8	1,139.4	617.4	1,181.3
Other property use type								
Palmerston North City	6,131.2	293.3	168.6	125.3	79.9	119.3	81.4	61.9
Whanganui District	51,009.4	229.4	146.7	81.5	56.1	41.4	22.1	87
Horowhenua District	17,576.9	423.9	352.4	154.6	69.5	88.6	19.9	10.8
Manawatū District	36,545.9	322.5	184.3	105.9	42.4	37.2	17.7	25.3
Tararua District	38,157.8	226.3	89.5	72.6	38.4	28.4	16.8	35.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	231.4	146	80.6	34	38.1	12.6	12.5
Ruapehu District	92,049.8	1,112.7	590.4	336.5	161.9	164.7	84.7	168.1

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.9: Total hectares of property use type for district flooded for town/settlement for 0.2% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	333.6	182.7	104.5	36.5	22.2	2.8	0.6
Whanganui District	2,537.4	198.6	117.4	98.4	49.4	32.5	13	11.8
Horowhenua District	2,664.3	487	150.7	51.7	12.3	6.5	0.3	0
Manawatū District	1,941.5	260.1	75.8	44.4	20.7	10.7	1.2	0.9
Tararua District	965.5	120.5	38.7	14.9	7.3	11.8	10.4	23.2
Rangitīkei District	1,258.4	112.5	64	30.1	11.4	13	4.6	1.6
Ruapehu District	1,170.5	91.2	48.3	29.4	13	9.1	4.4	3.8
Commerical/Industrial property use type								
Palmerston North City	796.6	105.9	72.7	44.7	16.8	11.3	10.8	13
Whanganui District	420.8	53	35.2	23.3	7.6	7.3	9.9	0.3
Horowhenua District	350.4	129.5	22.3	4.8	1	1.6	0.6	0.4
Manawatū District	311.9	57.7	26.6	13.4	4.6	6.2	3.7	3.5
Tararua District	211.2	26.9	10.2	4.1	1.8	2.8	1.4	8.5
Rangitīkei District	335.1	37.8	22.2	16.5	36.7	43.8	4.7	3.5
Ruapehu District	25,319.4	266.3	123.7	77.7	36	26.4	6.5	4.3
Rural property use type								
Palmerston North City	27,505.4	2,170.8	1,481.6	927.6	433.9	498.7	286.9	256.6
Whanganui District	302,890.5	5,170.3	2,984.9	1,868.1	998.5	1,115.5	527.4	1,096.5
Horowhenua District	79,623.5	7,853	5,405.1	4,955.7	2,030.8	2,392.9	810.1	616.1
Manawatū District	225,094.6	17,740.4	9,261.4	5,536.9	2,550	2,870.2	1,848.4	1,520.4
Tararua District	405,511.5	15,739.1	7,378.1	3,722.1	1,746.5	1,831.7	934.4	4,256.8
Rangitīkei District	395,303.1	13,722.3	6,473.8	4,091.5	2,161.2	2,273	788	969.5
Ruapehu District	810,446.7	10,370	4,874.4	2,548.4	1,197.2	1,240.7	712.8	1,473.1
Other property use type								
Palmerston North City	6,131.2	308.4	176.5	112.5	70.1	104	65.2	53.8
Whanganui District	51,009.4	236.8	151.8	87.4	48.8	53.1	27.3	112.6
Horowhenua District	17,576.9	387	325.1	218.7	82.8	144.7	39.3	19.9
Manawatū District	36,545.9	334.2	176.4	103.8	40.9	30.5	18.1	19.6
Tararua District	38,157.8	422.3	188.9	111.3	59.4	51.2	28.3	68.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	235.2	122.9	67.9	33	48	13.6	19.1
Ruapehu District	92,049.8	1,127.9	600.1	339	172.8	183.6	88.5	198

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.10: Total hectares of property use type for district flooded for town/settlement for 0.1% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	341.5	190.5	109.9	38.5	27	3.4	0.8
Whanganui District	2,537.4	194.1	110.5	99.2	71	60.2	21.8	19.5
Horowhenua District	2,664.3	493.8	158.2	54.3	13.2	6.7	0.3	0
Manawatū District	1,941.5	266.4	76.3	43.7	28.1	13.3	2.5	0.9
Tararua District	965.5	122.2	38.7	17.3	7.3	9.7	11.3	29.5
Rangitīkei District	1,258.4	114.2	67.7	33	13.3	13.2	6.8	2.1
Ruapehu District	1,170.5	88.7	52.7	40.6	18.5	12.6	5	4.3
Commerical/Industrial property use type								
Palmerston North City	796.6	106.4	72.9	51.1	19.3	13.1	10.7	14.7
Whanganui District	420.8	46.5	27.8	33.9	18.1	11.4	10.6	2.9
Horowhenua District	350.4	132.1	23.7	5.1	1.1	1.6	0.5	0.6
Manawatū District	311.9	59.1	26.7	16.6	5.3	5.8	4.8	3.7
Tararua District	211.2	27.6	10.7	4.9	2.3	2.6	2	9.1
Rangitīkei District	335.1	39.3	22.3	12.9	28.1	57.2	6.8	4.4
Ruapehu District	25,319.4	272	125.7	80.6	37.3	29	7.6	4.6
Rural property use type								
Palmerston North City	27,505.4	2,172.8	1,533.3	1,009.2	483.7	549.6	321.7	290.7
Whanganui District	302,890.5	5,213.3	2,994.5	1,845.8	993.8	1,228.9	690.5	1,380.4
Horowhenua District	79,623.5	7,851.1	5,305	5,220.5	2,122.9	2,588.8	838.3	663
Manawatū District	225,094.6	17,880	9,384.2	5,772.5	2,593.1	3,084.2	1,775.3	2,207
Tararua District	405,511.5	15,934.4	7,514.8	3,848.9	1,821	1,981.8	998.7	4,451.9
Rangitīkei District	395,303.1	13,913.1	6,598.4	4,158.9	2,252.5	2,590.2	1,032	1,136.3
Ruapehu District	810,446.7	10,469.4	4,934.2	2,627.5	1,266.9	1,302.9	752.9	1,694.1
Other property use type								
Palmerston North City	6,131.2	309	179.5	116	72.4	99.4	73.5	62.5
Whanganui District	51,009.4	240.5	151.7	86.7	39.9	73.3	26.7	129.4
Horowhenua District	17,576.9	373.7	322.4	252.6	80.8	150.7	42.9	20.8
Manawatū District	36,545.9	336.6	178.1	114	46.6	33	18.8	20.7
Tararua District	38,157.8	428.2	193.3	110.7	61.8	53.3	28.2	73.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	240	124.9	69.5	33.3	50.4	15.3	21.6
Ruapehu District	92,049.8	1,139.9	602	349.6	180.8	191.8	94.9	215.9

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.11: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +1°C, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	333	184.9	104.1	37.2	23.5	3	0.6
Whanganui District	2,537.4	204.4	117.5	87.7	35.9	26	11	8.8
Horowhenua District	2,664.3	487.5	149.8	52.1	12.1	6.2	0.3	0
Manawatū District	1,941.5	257.5	80.7	36	13.6	8.4	2.2	0.6
Tararua District	965.5	122.2	40.5	16.8	8.1	10.1	7.8	11.4
Rangitīkei District	1,258.4	116.5	52.7	23.4	9.2	13.2	2.3	1.1
Ruapehu District	1,170.5	91.2	50.7	30.7	13.4	9.5	4.4	3.8
Commerical/Industrial property use type								
Palmerston North City	796.6	104.6	74.3	46.5	16.8	10.5	10.7	14
Whanganui District	420.8	52.2	34.7	23.1	7.6	5.4	10.9	0.3
Horowhenua District	350.4	130.1	22.3	4.8	1	1.6	0.6	0.5
Manawatū District	311.9	57.5	25.2	13	4	6.6	2.8	3.3
Tararua District	211.2	27.2	9.9	4	1.6	2.8	1.4	6.6
Rangitīkei District	335.1	36.3	19.2	26.5	39.2	25.3	2.9	2.9
Ruapehu District	25,319.4	266.2	123.9	77	35.4	26.1	6.4	4.3
Rural property use type								
Palmerston North City	27,505.4	2,153.3	1,483.3	955.8	455.2	524.5	307.3	276.7
Whanganui District	302,890.5	5,139.6	2,989.8	1,890.8	995	1,020	469.3	1,009.2
Horowhenua District	79,623.5	7,753.7	5,266.2	4,901.3	2,049.2	2,486.8	824	647.5
Manawatū District	225,094.6	17,428.5	9,187.5	5,613.9	2,575.5	2,857.6	1,741.3	1,674.6
Tararua District	405,511.5	15,779.9	7,407.2	3,721.9	1,753.8	1,864.4	1,024.4	3,941.2
Rangitīkei District	395,303.1	14,264.7	7,467.4	4,488.9	2,142.3	2,012.2	654.3	863
Ruapehu District	810,446.7	10,432.9	4,954.6	2,576	1,211.7	1,242.6	712.4	1,487.2
Other property use type								
Palmerston North City	6,131.2	306.3	175.4	113	70.6	100	71.3	59.2
Whanganui District	51,009.4	230.7	150.1	87.8	62	35.9	28.6	105.7
Horowhenua District	17,576.9	390.7	325	198	73.3	150.3	39	20.8
Manawatū District	36,545.9	330.1	180.7	108.4	43	40.4	16.5	24.1
Tararua District	38,157.8	424.6	188.6	110.7	58	49.8	26.6	69.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	232.1	149.1	79.6	36.1	38.6	14.3	16.9
Ruapehu District	92,049.8	1,132.6	601.8	338	171.3	182.5	87.3	198

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.12: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +1°C, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	362.7	205.8	115.5	46.6	48.7	18.9	5.6
Whanganui District	2,537.4	204.3	118.4	88	35.8	25.9	10.9	8.9
Horowhenua District	2,664.3	486.4	143.1	52.4	13.3	9.9	8.5	0.1
Manawatū District	1,941.5	288.2	104.8	48	18.6	11.8	4.1	0.8
Tararua District	965.5	115.1	35.1	12.5	6.8	10.8	9.5	20.1
Rangitīkei District	1,258.4	116.6	55.8	26.8	10.5	13.5	2.4	1.2
Ruapehu District	1,170.5	90.4	53.1	33.9	13.8	9.6	4.4	3.8
Commerical/Industrial property use type								
Palmerston North City	796.6	108.1	67.5	63	9.6	9.6	10.7	12.5
Whanganui District	420.8	49.9	33.2	28	10.1	5.5	10.9	0.3
Horowhenua District	350.4	127.9	21	6.3	2.6	8	2.1	0.5
Manawatū District	311.9	64.4	33.7	15.8	6.5	5.9	1.2	2.9
Tararua District	211.2	25.6	9	3.8	1.6	2.5	1.6	8.1
Rangitīkei District	335.1	36.6	17.1	14.6	40	39.4	4.3	2.8
Ruapehu District	25,319.4	266.2	124.2	77	35.3	26.1	6.4	4.3
Rural property use type								
Palmerston North City	27,505.4	2,090.5	1,608.7	1,176.5	622.7	704.5	271.6	238.4
Whanganui District	302,890.5	5,141.5	2,990.9	1,892.4	997.4	1,017.9	468.5	1,003.9
Horowhenua District	79,623.5	7,306.8	4,388.8	3,963.6	2,666.1	3,515.8	3,403.6	282.7
Manawatū District	225,094.6	17,116.9	9,252.2	6,133.5	2,774.2	3,114.7	1,818.5	2,460.9
Tararua District	405,511.5	13,000.8	6,145.4	3,140	1,467.9	1,482.9	734.2	3,824.5
Rangitīkei District	395,303.1	14,034.5	7,531.3	4,814	2,675.2	2,460.8	682.7	842
Ruapehu District	810,446.7	10,433	4,955	2,574.9	1,211.6	1,242.4	712.5	1,487.2
Other property use type								
Palmerston North City	6,131.2	301.2	170.4	123	86.1	120.7	94.1	82.2
Whanganui District	51,009.4	230.5	149.8	88.2	62	34.8	28.9	106.5
Horowhenua District	17,576.9	403	338	219	81.6	96.6	24.5	11.7
Manawatū District	36,545.9	330.5	187.8	109.2	47.3	39.8	19	27.2
Tararua District	38,157.8	231.3	91.5	74.1	41.3	29.9	16.4	38.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	232	151.2	81.6	36.7	38.4	14.6	15.9
Ruapehu District	92,049.8	1,132.5	601.1	338.6	171.8	182.6	87.4	197.9

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.13: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +2°C, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	346.2	199.8	111.3	40.3	30.4	3.7	0.8
Whanganui District	2,537.4	196.1	112.2	101	64.1	52.7	20.6	17.6
Horowhenua District	2,664.3	498.4	160.9	56.3	13.4	6.7	0.3	0
Manawatū District	1,941.5	265.7	84.6	41.3	17.2	10.3	3.2	0.7
Tararua District	965.5	123.9	41	17	7.1	10.3	11.5	28.4
Rangitīkei District	1,258.4	117.5	56.5	26.2	10.9	13.6	3.6	1.5
Ruapehu District	1,170.5	88.2	50.6	44.4	22.5	16	5.4	5
Commerical/Industrial property use type								
Palmerston North City	796.6	104.8	72.6	57.9	19.8	12.2	9.4	16.8
Whanganui District	420.8	46.4	26.4	33.6	18.4	11	7.8	5.6
Horowhenua District	350.4	132.5	24.9	5.3	1.1	1.6	0.5	0.6
Manawatū District	311.9	58.9	25	15.4	5	6.2	3.7	3.5
Tararua District	211.2	27.2	11.5	5.4	2.2	2.6	1.9	9.1
Rangitīkei District	335.1	37.3	18.9	17.8	36.5	40.1	4.6	3.2
Ruapehu District	25,319.4	274.1	126.4	80.7	37.3	29.3	7.5	4.7
Rural property use type								
Palmerston North City	27,505.4	2,154.7	1,530.5	1,050	525.5	584	349.6	325.6
Whanganui District	302,890.5	5,208.2	2,985.8	1,850.4	986.8	1,174.7	627.7	1,281
Horowhenua District	79,623.5	7,756	5,132.2	5,200.8	2,306.9	2,661	1,044.5	709.5
Manawatū District	225,094.6	17,582.4	9,309.5	5,909.2	2,631.4	3,033.9	1,680.2	2,484.9
Tararua District	405,511.5	16,097.1	7,599	3,883.2	1,839.6	1,982.3	998.4	4,443.2
Rangitīkei District	395,303.1	14,482.8	7,564.4	4,485	2,301.6	2,346.4	821.5	1,004.5
Ruapehu District	810,446.7	10,592.7	5,039.5	2,684.1	1,302.2	1,345.6	772	1,812.8
Other property use type								
Palmerston North City	6,131.2	310.6	177.2	121.7	72.6	98.3	76.3	72.2
Whanganui District	51,009.4	237.4	153	86.8	42.9	66.6	26.4	126.5
Horowhenua District	17,576.9	374.7	320.2	242.2	67	164.7	43.9	21.9
Manawatū District	36,545.9	333.5	189.5	116	46.8	42.1	17.7	25.2
Tararua District	38,157.8	433.4	194.1	112.1	61.4	53.7	28.4	73.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	235.7	146.7	84.3	35.1	42.8	14.8	20.4
Ruapehu District	92,049.8	1,151.5	604	350.7	179.3	192.7	99.9	222.1

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.14: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +2°C, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	391	283.2	163.8	60.1	60.7	25.4	8.6
Whanganui District	2,537.4	196.1	112.3	100.9	64.1	52.7	20.5	17.7
Horowhenua District	2,664.3	497.6	153.1	55.3	14.7	8.8	10.3	0.3
Manawatū District	1,941.5	295.3	109	48.9	24.1	14	3.9	1.6
Tararua District	965.5	119.2	37.8	13.4	6.4	9.5	10.9	27.3
Rangitīkei District	1,258.4	115.8	60	29.9	12.3	14.9	3.2	1.6
Ruapehu District	1,170.5	89	52.3	45.6	22.2	15.4	5.4	5
Commerical/Industrial property use type								
Palmerston North City	796.6	106.3	72.5	71.3	13.4	9.8	11	13.7
Whanganui District	420.8	45.9	23.3	31.3	23.9	13.4	7.7	5.7
Horowhenua District	350.4	130.2	23.1	6.5	2.7	6.9	3.6	0.6
Manawatū District	311.9	63.5	35.8	17.3	6.8	7.5	1.3	3.1
Tararua District	211.2	26.6	10.5	5.2	2.1	2.5	1.9	9
Rangitīkei District	335.1	37	18.7	9.6	31.4	52.8	7.1	3.2
Ruapehu District	25,319.4	273.9	126.3	80.7	37.3	29.3	7.5	4.7
Rural property use type								
Palmerston North City	27,505.4	2,066.3	1,619	1,256.3	685	779.3	307.8	263.1
Whanganui District	302,890.5	5,210.2	2,988.2	1,851.3	987.8	1,173.7	626	1,275.7
Horowhenua District	79,623.5	7,259.3	4,425.7	3,934.5	2,579.7	3,900.8	3,559.3	991.4
Manawatū District	225,094.6	17,361.8	9,346	6,404.2	2,938.7	3,250.4	1,909	2,717.3
Tararua District	405,511.5	13,289.2	6,333.1	3,276.7	1,551.3	1,646.3	791.2	4,024.1
Rangitīkei District	395,303.1	14,209.4	7,626.6	4,778.1	2,789.4	2,880.8	837	987
Ruapehu District	810,446.7	10,593.1	5,039.6	2,684.4	1,302	1,345.3	772	1,812.9
Other property use type								
Palmerston North City	6,131.2	311.6	190.2	139.5	84.7	123.2	104.7	98.2
Whanganui District	51,009.4	237.2	153.2	86.7	43.2	66.5	25.5	127.6
Horowhenua District	17,576.9	386.3	331.5	254.4	89.9	127	28.2	12.6
Manawatū District	36,545.9	335.6	196.4	112.2	52.8	41.3	20.6	28.9
Tararua District	38,157.8	237.9	94.2	71.6	44.2	30.6	16.3	40.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	234.9	148.6	87	36.3	42.5	15.2	19.2
Ruapehu District	92,049.8	1,151.4	604	350.6	179.1	192.7	100.2	222.1

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.15: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +3°C, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	355.4	227.9	128.7	43.7	39.7	7.6	1.8
Whanganui District	2,537.4	189.2	109.1	94.7	78.7	104	25.7	29.4
Horowhenua District	2,664.3	512.1	168.7	62.6	14.5	7.2	0.4	0
Manawatū District	1,941.5	272.9	82.5	47.7	20.7	14.3	2.8	2.2
Tararua District	965.5	129.8	44.9	17.2	9.5	12.4	10.4	23.2
Rangitīkei District	1,258.4	119.9	58.9	28.2	12.7	13.9	6.5	1.8
Ruapehu District	1,170.5	89.3	49.7	43.6	29.9	24.2	7.3	6.8
Commerical/Industrial property use type								
Palmerston North City	796.6	104.9	73.6	67	24.4	16	8	19.4
Whanganui District	420.8	44.1	25.1	21.9	27.9	30.4	6.8	10.9
Horowhenua District	350.4	134.3	28.1	6.5	1.1	1.7	0.4	0.8
Manawatū District	311.9	60.5	26.3	18	5	6.7	4.7	3.8
Tararua District	211.2	27	13.2	7.1	2.4	3.1	1.5	8.8
Rangitīkei District	335.1	38	18.1	12.5	29.4	54.1	6.7	4.2
Ruapehu District	25,319.4	280.4	128.5	84.3	39	32.2	9.2	5.3
Rural property use type								
Palmerston North City	27,505.4	2,131.4	1,558.2	1,134.9	607.4	656.8	391.3	375.2
Whanganui District	302,890.5	5,253.7	2,989.8	1,824.6	967	1,226.9	744.8	1,619.9
Horowhenua District	79,623.5	7,725.5	4,957.4	5,333.5	2,761.8	2,679.9	1,407.7	760.7
Manawatū District	225,094.6	17,727.1	9,369	6,166.2	2,803.7	3,074.3	1,859.6	3,085.4
Tararua District	405,511.5	16,397.8	7,839.7	4,125.5	1,988.8	2,140.2	1,093.5	4,531
Rangitīkei District	395,303.1	14,627.8	7,652.8	4,572.5	2,369.1	2,620	1,058.6	1,156.2
Ruapehu District	810,446.7	10,746.7	5,121.8	2,760.3	1,375.8	1,442.9	794.2	2,151.9
Other property use type								
Palmerston North City	6,131.2	315.8	181.6	125.9	80.2	106.2	77.9	86.2
Whanganui District	51,009.4	240.5	154.8	85.3	41.3	71.1	35	142.7
Horowhenua District	17,576.9	374.9	298	285.4	66.7	167.8	52.4	23
Manawatū District	36,545.9	333.1	190.4	123.5	50	41.3	19.5	27.2
Tararua District	38,157.8	441.6	197.7	118	66.5	54.8	29.2	80.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	241.3	147.4	87.7	34.8	44.9	16.8	23.3
Ruapehu District	92,049.8	1,174.9	606.6	357.2	184.7	200	113.2	251.3

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.16: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +3°C, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	362.2	330.7	226.8	83.7	72.7	32	11.5
Whanganui District	2,537.4	189.2	108.5	94.7	79	104.1	25.6	29.4
Horowhenua District	2,664.3	511.6	161.2	59.6	15.7	8.8	10.1	1.4
Manawatū District	1,941.5	302.1	113.3	47.6	29.3	17.9	3.8	2.3
Tararua District	965.5	121.9	40.7	14.1	7.3	9	9.6	35.3
Rangitīkei District	1,258.4	118.5	62	31.6	13.7	15.9	4.9	1.9
Ruapehu District	1,170.5	89.2	50.3	45.2	29.7	23.5	7.4	6.8
Commerical/Industrial property use type								
Palmerston North City	796.6	107.6	69	82.1	20.3	9.8	11.2	14.9
Whanganui District	420.8	43.5	25.1	20.6	26.8	34.2	6.9	11
Horowhenua District	350.4	131.9	26.1	6.8	2.5	6	5	0.8
Manawatū District	311.9	62.8	37.3	18.5	7.3	8.8	1.4	3.2
Tararua District	211.2	26.5	12.1	6.9	2.5	3.3	1.8	10
Rangitīkei District	335.1	37.7	18.6	9.3	19.3	64	10.6	4.3
Ruapehu District	25,319.4	280.3	128.5	84.2	39.2	32.2	9.2	5.3
Rural property use type								
Palmerston North City	27,505.4	2,037	1,618.3	1,321.8	745.9	853.9	347.5	288.9
Whanganui District	302,890.5	5,257.1	2,988.8	1,824.9	967.6	1,225.7	743.3	1,614.8
Horowhenua District	79,623.5	7,161.2	4,258.3	3,760	2,515.2	4,149.2	3,716.6	1,883.8
Manawatū District	225,094.6	17,597.1	9,427	6,612.6	3,129.9	3,357.1	2,014.6	2,972.4
Tararua District	405,511.5	13,503.5	6,513	3,410.7	1,619.6	1,774.9	891.4	4,224.6
Rangitīkei District	395,303.1	14,319	7,654.6	4,803.9	2,798.2	3,239.7	1,072.7	1,138.7
Ruapehu District	810,446.7	10,746.4	5,121.7	2,760.3	1,375.6	1,442.4	794.3	2,151.6
Other property use type								
Palmerston North City	6,131.2	303.7	203.7	156.1	89.6	128	112.4	111.6
Whanganui District	51,009.4	240	154.9	85.4	41.4	71.3	33.9	143.8
Horowhenua District	17,576.9	384.1	307.9	293.9	73.5	162.7	35.5	15.1
Manawatū District	36,545.9	336.7	197.6	117	55.2	42.4	21.7	31.4
Tararua District	38,157.8	243.3	95.9	74	46.9	30.9	17	43

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	241.1	148.5	90.6	36.3	44.7	17.3	21.8
Ruapehu District	92,049.8	1,174.9	606.5	357.1	184.9	199.2	113.4	251.7

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.5.17: Total hectares of property use type for district flooded for town/settlement for 0.5% AEP, Climate Warming +3°C + SLR, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	355.4	227.9	128.7	43.7	39.7	7.6	1.8
Whanganui District	2,537.4	190	108.7	95.2	79.1	106.8	26.2	30.2
Horowhenua District	2,664.3	511.2	170.4	65.1	15.5	7.4	0.4	0
Manawatū District	1,941.5	272.8	82.5	47.6	20.8	14.3	2.8	2.2
Tararua District	965.5	21.3	7.3	5.6	2.7	2.5	2.1	2.1
Rangitīkei District	1,258.4	120.2	58.7	28.4	12.8	14	6.5	1.8
Ruapehu District	1,170.5	48	32.4	34.8	25.3	21.5	6.4	6.7
Commerical/Industrial property use type								
Palmerston North City	796.6	104.9	73.6	67	24.4	16	8	19.4
Whanganui District	420.8	43.3	24.4	18.2	21.1	44.9	7.7	12.4
Horowhenua District	350.4	134.5	27.8	6.3	1.1	1.7	0.4	0.8
Manawatū District	311.9	60.5	26.3	18	5	6.7	4.7	3.8
Tararua District	211.2	3.3	1.6	1.1	0.6	0.6	0.4	2.2
Rangitīkei District	335.1	38	18.1	12.5	29.4	54.1	6.7	4.2
Ruapehu District	25,319.4	71.7	26.6	19.9	8.4	5.7	1.5	1.7
Rural property use type								
Palmerston North City	27,505.4	2,128.5	1,554.8	1,133.6	607	655.8	390.9	375.2
Whanganui District	302,890.5	5,149.8	2,944.9	1,815.8	965.5	1,223.7	742.9	1,594.8
Horowhenua District	79,623.5	7,784.4	5,015.1	5,327.2	2,576.3	2,959.6	1,074.3	760.2
Manawatū District	225,094.6	17,730.2	9,368.8	6,168.4	2,803.9	3,074.3	1,859.7	3,085.3
Tararua District	405,511.5	6,794.7	3,013.3	1,493.3	768.8	954.8	617	2,256.5
Rangitīkei District	395,303.1	14,629.6	7,643.4	4,557.2	2,387.2	2,632.8	1,059.9	1,157.7
Ruapehu District	810,446.7	8,275.2	4,056.9	2,195.9	1,151.1	1,253.9	714.4	2,027.1
Other property use type								
Palmerston North City	6,131.2	314	180.2	125.9	80.2	106.2	77.8	86.2
Whanganui District	51,009.4	232.7	150.4	85.4	42.4	71.5	35.3	138.1
Horowhenua District	17,576.9	366.7	298.1	298.6	72.8	164.4	48.7	23.1
Manawatū District	36,545.9	333	190.2	123.6	50.2	41.5	19.7	27.4
Tararua District	38,157.8	295.3	144.3	82.6	55	45.6	26.6	69.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	Area (ha) with modelled depth of 0.5 to 0.99m flooding	Area (ha) with modelled depth of 1.0 to 1.49m flooding	Area (ha) with modelled depth of 1.5 to 2.49m flooding	Area (ha) with modelled depth of 2.5 to 3.49m flooding	Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	238.4	148.4	91.2	39.3	47	16.8	23.3
Ruapehu District	92,049.8	1,095.5	567.4	330.7	170.8	185.7	108.4	248.6

Some isolated areas of flooding may be visible on flood hazard maps but do not return a value in hectares due to their very small spatial extent

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.1: Percentage of hectares of property use type flooded for district for 5% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	8.7	4.6	2	0.7	0.4	0	0
Whanganui District	2,537.4	7.6	3.4	1.8	0.4	0.1	0.1	0
Horowhenua District	2,664.3	16.5	4	1.4	0.2	0.1	0	0
Manawatū District	1,941.5	11.4	2.8	1	0.3	0.2	0	0
Tararua District	965.5	11.6	3.3	1.2	0.4	0.4	0.1	0.4
Rangitīkei District	1,258.4	8.3	2.8	1.4	0.3	0.2	0.1	0
Ruapehu District	1,170.5	7	3.1	1.5	0.5	0.4	0.1	0.1
Commerical/Industrial property use type								
Palmerston North City	796.6	12.2	6.4	3.3	1.3	1.2	0.3	1.2
Whanganui District	420.8	12	6.8	2.6	1.1	1.7	0	0
Horowhenua District	350.4	32.4	4.8	0.8	0.4	0.5	0.1	0
Manawatū District	311.9	16.8	5.5	2.4	1.6	0.7	0.4	0.7
Tararua District	211.2	11.1	3.6	1.4	0.8	1.4	0.3	1.3
Rangitīkei District	335.1	12.8	8.8	6.9	0.7	0.5	0.3	0.5
Ruapehu District	25,319.4	1	0.4	0.2	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.4	4.4	2.4	1.1	1	0.3	0.5
Whanganui District	302,890.5	1.6	0.9	0.5	0.2	0.1	0.1	0.1
Horowhenua District	79,623.5	10	6.7	3.9	2	1.9	0.7	0.2
Manawatū District	225,094.6	7.3	3.6	2	0.9	0.7	0.2	0.1
Tararua District	405,511.5	3.5	1.6	0.7	0.3	0.4	0.2	0.6
Rangitīkei District	395,303.1	3.4	1.7	0.8	0.3	0.2	0.1	0.1
Ruapehu District	810,446.7	1.2	0.5	0.2	0.1	0.1	0	0.1
Other property use type								
Palmerston North City	6,131.2	4.7	2.6	2	1.1	1.2	0.3	0.3
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0	0	0.1
Horowhenua District	17,576.9	2.4	1.6	0.7	0.6	0.5	0.1	0.1
Manawatū District	36,545.9	0.8	0.4	0.2	0.1	0.1	0	0
Tararua District	38,157.8	1	0.5	0.3	0.1	0.1	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.3	0.1	0.1	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.2: Percentage of hectares of property use type flooded for district for 5% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	8.7	3.3	1.2	0.4	0.2	0	0
Whanganui District	2,537.4	7.6	3.4	1.7	0.4	0.1	0	0
Horowhenua District	2,664.3	16.4	4	1.5	0.5	0.2	0	0
Manawatū District	1,941.5	13.8	3.5	1.1	0.4	0.3	0.1	0
Tararua District	965.5	11.2	3.1	1.1	0.4	0.3	0.1	0.4
Rangitīkei District	1,258.4	8.4	3	1.4	0.5	0.3	0.1	0
Ruapehu District	1,170.5	7	3	1.4	0.5	0.4	0.1	0.1
Commerical/Industrial property use type								
Palmerston North City	796.6	13.1	6.8	3	0.9	1.3	0.3	1.2
Whanganui District	420.8	12.8	5.4	1.5	1	1.7	0	0
Horowhenua District	350.4	32.2	5.2	1.5	0.7	0.6	0.1	0
Manawatū District	311.9	20.4	7.4	3	0.6	0.5	0.3	0.6
Tararua District	211.2	10.8	3.1	1.4	0.8	1.4	0.2	1.3
Rangitīkei District	335.1	10.8	10.9	10.2	3.5	1.2	0.2	0.4
Ruapehu District	25,319.4	1	0.4	0.2	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.5	4.7	2.6	1.2	1.1	0.4	0.5
Whanganui District	302,890.5	1.6	0.9	0.5	0.2	0.1	0.1	0.1
Horowhenua District	79,623.5	8.9	5.5	5.2	4.1	3.2	0.1	0.1
Manawatū District	225,094.6	7.1	3.7	2.1	1	1	0.7	0.4
Tararua District	405,511.5	2.9	1.3	0.6	0.3	0.3	0.2	0.6
Rangitīkei District	395,303.1	3.4	1.7	1	0.4	0.2	0.1	0.1
Ruapehu District	810,446.7	1.2	0.5	0.2	0.1	0.1	0	0.1
Other property use type								
Palmerston North City	6,131.2	4.8	2.6	2	1.2	1.2	0.5	0.3
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0	0	0.1
Horowhenua District	17,576.9	2.4	1.7	0.7	0.5	0.4	0	0.1
Manawatū District	36,545.9	0.8	0.5	0.2	0.1	0.1	0	0
Tararua District	38,157.8	0.5	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.3	0.1	0.1	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.3: Percentage of hectares of property use type flooded for district for 2% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	8.9	4.9	2.5	0.8	0.5	0.1	0
Whanganui District	2,537.4	7.8	3.6	2	0.5	0.2	0.1	0
Horowhenua District	2,664.3	17	4.6	1.6	0.3	0.1	0	0
Manawatū District	1,941.5	12.2	3	1.2	0.3	0.2	0.1	0
Tararua District	965.5	12	3.6	1.3	0.5	0.9	0.4	0.6
Rangitīkei District	1,258.4	8.7	3.2	1.5	0.7	0.2	0.1	0
Ruapehu District	1,170.5	7.3	3.4	1.6	0.6	0.5	0.2	0.2
Commerical/Industrial property use type								
Palmerston North City	796.6	12.5	6.7	3.7	1.7	1.5	0.6	1.3
Whanganui District	420.8	11.9	7.5	2.8	0.8	1.9	0.4	0
Horowhenua District	350.4	34.3	5	1	0.3	0.5	0.2	0
Manawatū District	311.9	18	6.7	2.3	1.4	1.6	0.4	0.8
Tararua District	211.2	11.7	3.7	1.6	0.7	0.8	1.2	1.8
Rangitīkei District	335.1	11.7	8.7	10.5	3.7	0.9	0.3	0.6
Ruapehu District	25,319.4	1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.5	4.7	2.6	1.2	1.4	0.5	0.6
Whanganui District	302,890.5	1.7	0.9	0.5	0.2	0.2	0.1	0.2
Horowhenua District	79,623.5	9.9	7.1	4.4	2.1	2.1	0.8	0.5
Manawatū District	225,094.6	7.4	3.8	2.2	1	1.1	0.3	0.2
Tararua District	405,511.5	3.7	1.7	0.8	0.4	0.4	0.2	0.8
Rangitīkei District	395,303.1	3.5	1.8	0.9	0.3	0.2	0.1	0.1
Ruapehu District	810,446.7	1.2	0.6	0.3	0.1	0.1	0.1	0.1
Other property use type								
Palmerston North City	6,131.2	4.9	2.7	1.8	1.1	1.6	0.6	0.4
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0.1	0	0.1
Horowhenua District	17,576.9	2.3	1.8	0.7	0.6	0.6	0.1	0.1
Manawatū District	36,545.9	0.8	0.5	0.2	0.1	0.1	0	0.1
Tararua District	38,157.8	1	0.5	0.3	0.1	0.1	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.3	0.2	0.2	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.4: Percentage of hectares of property use type flooded for district for 2% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	9.3	3.8	1.5	0.6	0.4	0.1	0
Whanganui District	2,537.4	7.8	3.6	2	0.5	0.2	0.1	0
Horowhenua District	2,664.3	17	4.5	1.7	0.4	0.4	0	0
Manawatū District	1,941.5	14.4	4.2	1.5	0.4	0.4	0.1	0
Tararua District	965.5	11.5	3.3	1.2	0.4	0.8	0.3	0.5
Rangitīkei District	1,258.4	8.7	3.5	1.4	0.7	0.5	0.1	0
Ruapehu District	1,170.5	7.3	3.4	1.6	0.6	0.5	0.2	0.2
Commerical/Industrial property use type								
Palmerston North City	796.6	13.4	8.2	3.9	0.8	1.5	0.5	1.3
Whanganui District	420.8	12.7	6.2	1.6	0.7	1.9	0.4	0
Horowhenua District	350.4	33.8	5.5	2	1	0.7	0.2	0
Manawatū District	311.9	21.2	9.1	3.3	1.6	0.6	0.3	0.7
Tararua District	211.2	11.5	3.1	1.6	0.7	0.8	1.2	1.8
Rangitīkei District	335.1	9.8	7.1	13.5	6.1	2.9	0.4	0.6
Ruapehu District	25,319.4	1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.6	5.2	3.2	1.6	1.6	0.5	0.6
Whanganui District	302,890.5	1.7	0.9	0.5	0.2	0.2	0.1	0.2
Horowhenua District	79,623.5	9.2	5.7	5.2	3.8	4.6	0.3	0.2
Manawatū District	225,094.6	7.3	3.9	2.3	1	1.2	0.7	0.6
Tararua District	405,511.5	3	1.4	0.7	0.3	0.3	0.2	0.7
Rangitīkei District	395,303.1	3.5	1.8	1.1	0.5	0.3	0.1	0.1
Ruapehu District	810,446.7	1.2	0.6	0.3	0.1	0.1	0.1	0.1
Other property use type								
Palmerston North City	6,131.2	4.9	2.7	1.8	1.2	1.8	0.8	0.5
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0.1	0	0.1
Horowhenua District	17,576.9	2.4	1.8	0.8	0.4	0.5	0	0.1
Manawatū District	36,545.9	0.8	0.5	0.2	0.1	0.1	0	0.1
Tararua District	38,157.8	0.6	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.3	0.2	0.2	0.1	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.5: Percentage of hectares of property use type flooded for district for 1% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	9.2	5.1	2.7	0.9	0.5	0.1	0
Whanganui District	2,537.4	8.1	3.8	2.2	0.6	0.4	0.2	0.1
Horowhenua District	2,664.3	0.9	0.4	0.1	0	0	-	-
Manawatū District	1,941.5	12.6	3.3	1.2	0.6	0.3	0.1	0
Tararua District	965.5	7.4	2.1	1.1	0.6	0.8	0.7	0.8
Rangitīkei District	1,258.4	8.9	3.7	1.5	0.9	0.3	0.1	0.1
Ruapehu District	1,170.5	7.4	3.6	1.8	0.7	0.6	0.2	0.2
Commerical/Industrial property use type								
Palmerston North City	796.6	13.1	6.9	3.8	2.1	1.3	1.1	1.4
Whanganui District	420.8	12.3	8.1	3.2	0.5	2.1	0.7	0
Horowhenua District	350.4	0.7	0.4	-	-	-	-	-
Manawatū District	311.9	18.2	7.7	2.7	1.2	2.1	0.6	0.9
Tararua District	211.2	9.5	3	1.4	0.7	1.1	0.7	2.8
Rangitīkei District	335.1	11.2	8.4	9.7	7.8	2	0.4	0.7
Ruapehu District	25,319.4	1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7	4.3	2.6	1.3	1.5	0.7	0.7
Whanganui District	302,890.5	1.7	1	0.6	0.2	0.2	0.1	0.2
Horowhenua District	79,623.5	2.6	1.1	0.5	0.2	0.1	0.1	0.1
Manawatū District	225,094.6	7.5	3.9	2.3	1.1	1.2	0.6	0.2
Tararua District	405,511.5	2	0.9	0.4	0.2	0.2	0.1	0.8
Rangitīkei District	395,303.1	3.6	1.9	1	0.4	0.3	0.1	0.2
Ruapehu District	810,446.7	1.2	0.6	0.3	0.1	0.1	0.1	0.1
Other property use type								
Palmerston North City	6,131.2	4.1	2.2	1.6	1	1.7	0.8	0.6
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0.1	0	0.1
Horowhenua District	17,576.9	0.5	0.4	0.2	0.1	0	-	-
Manawatū District	36,545.9	0.8	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	0.5	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.6: Percentage of hectares of property use type flooded for district for 1% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	9.7	4.6	2	0.8	0.7	0.1	0
Whanganui District	2,537.4	8.1	3.7	2.2	0.6	0.4	0.2	0.1
Horowhenua District	2,664.3	17.4	4.8	1.7	0.5	0.5	0	0
Manawatū District	1,941.5	14.5	4.8	1.8	0.6	0.5	0.2	0
Tararua District	965.5	11.7	3.4	1.3	0.6	0.9	0.7	0.8
Rangitīkei District	1,258.4	9	3.9	1.6	0.8	0.5	0.1	0.1
Ruapehu District	1,170.5	7.4	3.6	1.8	0.7	0.6	0.2	0.2
Commerical/Industrial property use type								
Palmerston North City	796.6	13.3	9	5	0.8	1.3	0.9	1.4
Whanganui District	420.8	13.1	6.9	1.9	0.4	2.1	0.7	0
Horowhenua District	350.4	34.2	5.3	1.7	1.5	1.4	0.2	0
Manawatū District	311.9	21	10.1	3.8	2.2	0.8	0.3	0.8
Tararua District	211.2	11.9	3.4	1.4	0.7	1.1	0.7	2.8
Rangitīkei District	335.1	9.8	5.2	10.9	10.1	5.1	0.5	0.7
Ruapehu District	25,319.4	1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.6	5.5	3.6	1.9	2	0.7	0.7
Whanganui District	302,890.5	1.7	1	0.6	0.2	0.2	0.1	0.2
Horowhenua District	79,623.5	9.2	5.7	5.1	3.4	5.2	1.4	0.2
Manawatū District	225,094.6	7.4	4	2.4	1.1	1.2	0.8	0.8
Tararua District	405,511.5	3.1	1.4	0.7	0.3	0.3	0.2	0.8
Rangitīkei District	395,303.1	3.5	1.9	1.1	0.6	0.4	0.1	0.2
Ruapehu District	810,446.7	1.2	0.6	0.3	0.1	0.1	0.1	0.1
Other property use type								
Palmerston North City	6,131.2	4.8	2.8	2	1.1	2	1	0.7
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0.1	0	0.1
Horowhenua District	17,576.9	2.4	1.9	0.8	0.4	0.5	0.1	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	0.6	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.7: Percentage of hectares of property use type flooded for district for 0.5% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	9.5	5.2	2.9	1	0.6	0.1	0
Whanganui District	2,537.4	8.1	3.9	2.4	0.9	0.5	0.3	0.2
Horowhenua District	2,664.3	17.7	5.2	1.8	0.4	0.2	0	0
Manawatū District	1,941.5	13	3.9	1.4	0.7	0.4	0.1	0
Tararua District	965.5	12.3	3.9	1.6	0.8	1.1	0.8	1.5
Rangitīkei District	1,258.4	9	4	1.7	0.8	0.7	0.1	0.1
Ruapehu District	1,170.5	7.7	3.8	2.1	0.9	0.7	0.2	0.3
Commerical/Industrial property use type								
Palmerston North City	796.6	13.3	8.6	4.5	2.1	1.3	1.3	1.5
Whanganui District	420.8	12.3	8	4.3	1	1.4	1.7	0
Horowhenua District	350.4	36.2	5.9	1.3	0.3	0.5	0.2	0
Manawatū District	311.9	18.5	8.2	3.4	1.2	2.2	0.7	1
Tararua District	211.2	12.5	4.1	1.8	0.9	0.9	0.9	3.2
Rangitīkei District	335.1	10.7	6.3	10.3	10	4.3	0.5	0.8
Ruapehu District	25,319.4	1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.7	5.1	3.1	1.5	1.7	1	0.9
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.3	0.1	0.3
Horowhenua District	79,623.5	9.7	6.9	5.6	2.5	2.7	1	0.7
Manawatū District	225,094.6	7.6	4	2.4	1.1	1.2	0.8	0.4
Tararua District	405,511.5	3.8	1.8	0.9	0.4	0.4	0.2	1
Rangitīkei District	395,303.1	3.6	1.9	1.1	0.5	0.4	0.1	0.2
Ruapehu District	810,446.7	1.3	0.6	0.3	0.1	0.1	0.1	0.1
Other property use type								
Palmerston North City	6,131.2	4.9	2.8	1.8	1.1	1.7	1	0.8
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0.1	0	0.2
Horowhenua District	17,576.9	2.3	1.9	0.8	0.5	0.7	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	1.1	0.5	0.3	0.1	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.8: Percentage of hectares of property use type flooded for district for 0.5% AEP, Current Climate, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.1	5.3	2.6	1.1	1.1	0.3	0.1
Whanganui District	2,537.4	8.1	3.9	2.4	0.9	0.5	0.3	0.2
Horowhenua District	2,664.3	17.7	5.1	1.8	0.5	0.5	0.1	0
Manawatū District	1,941.5	14.7	5.2	2.2	0.8	0.5	0.2	0
Tararua District	965.5	11.8	3.5	1.4	0.7	1	0.8	1.5
Rangitīkei District	1,258.4	9	4.2	1.9	0.9	0.8	0.2	0.1
Ruapehu District	1,170.5	7.6	3.8	2	0.9	0.7	0.2	0.3
Commerical/Industrial property use type								
Palmerston North City	796.6	13.5	8.6	6.5	1	1.2	1.2	1.5
Whanganui District	420.8	12.7	7.9	3.7	0.9	1.4	1.7	0
Horowhenua District	350.4	35.6	5.6	1.7	1	2.3	0.2	0
Manawatū District	311.9	20.6	10.5	4.6	2	1.4	0.4	0.9
Tararua District	211.2	12.1	3.7	1.6	0.9	0.9	0.9	3.2
Rangitīkei District	335.1	10.3	4.6	7.7	12.4	7.6	0.7	0.7
Ruapehu District	25,319.4	1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.6	5.7	3.9	2.1	2.3	0.8	0.8
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.3	0.1	0.3
Horowhenua District	79,623.5	9.2	5.6	5.1	3.2	4.8	2.9	0.2
Manawatū District	225,094.6	7.5	4	2.6	1.2	1.3	0.8	1
Tararua District	405,511.5	3.1	1.5	0.7	0.3	0.3	0.2	0.9
Rangitīkei District	395,303.1	3.5	1.9	1.2	0.6	0.5	0.1	0.2
Ruapehu District	810,446.7	1.3	0.6	0.3	0.1	0.1	0.1	0.1
Other property use type								
Palmerston North City	6,131.2	4.8	2.8	2	1.3	1.9	1.3	1
Whanganui District	51,009.4	0.4	0.3	0.2	0.1	0.1	0	0.2
Horowhenua District	17,576.9	2.4	2	0.9	0.4	0.5	0.1	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	0.6	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.6	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.9: Percentage of hectares of property use type flooded for district for 0.2% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	9.9	5.4	3.1	1.1	0.7	0.1	0
Whanganui District	2,537.4	7.8	4.6	3.9	1.9	1.3	0.5	0.5
Horowhenua District	2,664.3	18.3	5.7	1.9	0.5	0.2	0	0
Manawatū District	1,941.5	13.4	3.9	2.3	1.1	0.5	0.1	0
Tararua District	965.5	12.5	4	1.5	0.8	1.2	1.1	2.4
Rangitīkei District	1,258.4	8.9	5.1	2.4	0.9	1	0.4	0.1
Ruapehu District	1,170.5	7.8	4.1	2.5	1.1	0.8	0.4	0.3
Commerical/Industrial property use type								
Palmerston North City	796.6	13.3	9.1	5.6	2.1	1.4	1.4	1.6
Whanganui District	420.8	12.6	8.4	5.5	1.8	1.7	2.4	0.1
Horowhenua District	350.4	37	6.4	1.4	0.3	0.5	0.2	0.1
Manawatū District	311.9	18.5	8.5	4.3	1.5	2	1.2	1.1
Tararua District	211.2	12.7	4.8	1.9	0.9	1.3	0.6	4
Rangitīkei District	335.1	11.3	6.6	4.9	10.9	13.1	1.4	1
Ruapehu District	25,319.4	1.1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.9	5.4	3.4	1.6	1.8	1	0.9
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.4
Horowhenua District	79,623.5	9.9	6.8	6.2	2.6	3	1	0.8
Manawatū District	225,094.6	7.9	4.1	2.5	1.1	1.3	0.8	0.7
Tararua District	405,511.5	3.9	1.8	0.9	0.4	0.5	0.2	1
Rangitīkei District	395,303.1	3.5	1.6	1	0.5	0.6	0.2	0.2
Ruapehu District	810,446.7	1.3	0.6	0.3	0.1	0.2	0.1	0.2
Other property use type								
Palmerston North City	6,131.2	5	2.9	1.8	1.1	1.7	1.1	0.9
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.2
Horowhenua District	17,576.9	2.2	1.8	1.2	0.5	0.8	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	1.1	0.5	0.3	0.2	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.7	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.10: Percentage of hectares of property use type flooded for district for 0.1% AEP, Current Climate, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.1	5.6	3.3	1.1	0.8	0.1	0
Whanganui District	2,537.4	7.7	4.4	3.9	2.8	2.4	0.9	0.8
Horowhenua District	2,664.3	18.5	5.9	2	0.5	0.3	0	0
Manawatū District	1,941.5	13.7	3.9	2.3	1.4	0.7	0.1	0
Tararua District	965.5	12.7	4	1.8	0.8	1	1.2	3.1
Rangitīkei District	1,258.4	9.1	5.4	2.6	1.1	1	0.5	0.2
Ruapehu District	1,170.5	7.6	4.5	3.5	1.6	1.1	0.4	0.4
Commerical/Industrial property use type								
Palmerston North City	796.6	13.4	9.1	6.4	2.4	1.6	1.3	1.8
Whanganui District	420.8	11.1	6.6	8	4.3	2.7	2.5	0.7
Horowhenua District	350.4	37.7	6.8	1.5	0.3	0.5	0.2	0.2
Manawatū District	311.9	19	8.6	5.3	1.7	1.9	1.5	1.2
Tararua District	211.2	13.1	5.1	2.3	1.1	1.2	0.9	4.3
Rangitīkei District	335.1	11.7	6.7	3.9	8.4	17.1	2	1.3
Ruapehu District	25,319.4	1.1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.9	5.6	3.7	1.8	2	1.2	1.1
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.5
Horowhenua District	79,623.5	9.9	6.7	6.6	2.7	3.3	1.1	0.8
Manawatū District	225,094.6	7.9	4.2	2.6	1.2	1.4	0.8	1
Tararua District	405,511.5	3.9	1.9	0.9	0.4	0.5	0.2	1.1
Rangitīkei District	395,303.1	3.5	1.7	1.1	0.6	0.7	0.3	0.3
Ruapehu District	810,446.7	1.3	0.6	0.3	0.2	0.2	0.1	0.2
Other property use type								
Palmerston North City	6,131.2	5	2.9	1.9	1.2	1.6	1.2	1
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.3
Horowhenua District	17,576.9	2.1	1.8	1.4	0.5	0.9	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0.1	0.1
Tararua District	38,157.8	1.1	0.5	0.3	0.2	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.3	0.2	0.1	0.1	0	0.1
Ruapehu District	92,049.8	1.2	0.7	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.11: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +1°C, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	9.9	5.5	3.1	1.1	0.7	0.1	0
Whanganui District	2,537.4	8.1	4.6	3.5	1.4	1	0.4	0.3
Horowhenua District	2,664.3	18.3	5.6	2	0.5	0.2	0	0
Manawatū District	1,941.5	13.3	4.2	1.9	0.7	0.4	0.1	0
Tararua District	965.5	12.7	4.2	1.7	0.8	1	0.8	1.2
Rangitīkei District	1,258.4	9.3	4.2	1.9	0.7	1	0.2	0.1
Ruapehu District	1,170.5	7.8	4.3	2.6	1.1	0.8	0.4	0.3
Commerical/Industrial property use type								
Palmerston North City	796.6	13.1	9.3	5.8	2.1	1.3	1.3	1.8
Whanganui District	420.8	12.4	8.2	5.5	1.8	1.3	2.6	0.1
Horowhenua District	350.4	37.1	6.4	1.4	0.3	0.5	0.2	0.1
Manawatū District	311.9	18.4	8.1	4.2	1.3	2.1	0.9	1.1
Tararua District	211.2	12.9	4.7	1.9	0.7	1.3	0.7	3.1
Rangitīkei District	335.1	10.8	5.7	7.9	11.7	7.5	0.9	0.9
Ruapehu District	25,319.4	1.1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.8	5.4	3.5	1.7	1.9	1.1	1
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.3	0.2	0.3
Horowhenua District	79,623.5	9.7	6.6	6.2	2.6	3.1	1	0.8
Manawatū District	225,094.6	7.7	4.1	2.5	1.1	1.3	0.8	0.7
Tararua District	405,511.5	3.9	1.8	0.9	0.4	0.5	0.3	1
Rangitīkei District	395,303.1	3.6	1.9	1.1	0.5	0.5	0.2	0.2
Ruapehu District	810,446.7	1.3	0.6	0.3	0.1	0.2	0.1	0.2
Other property use type								
Palmerston North City	6,131.2	5	2.9	1.8	1.2	1.6	1.2	1
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.2
Horowhenua District	17,576.9	2.2	1.8	1.1	0.4	0.9	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	1.1	0.5	0.3	0.2	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.7	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.12: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +1°C, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.7	6.1	3.4	1.4	1.4	0.6	0.2
Whanganui District	2,537.4	8.1	4.7	3.5	1.4	1	0.4	0.4
Horowhenua District	2,664.3	18.3	5.4	2	0.5	0.4	0.3	0
Manawatū District	1,941.5	14.8	5.4	2.5	1	0.6	0.2	0
Tararua District	965.5	11.9	3.6	1.3	0.7	1.1	1	2.1
Rangitīkei District	1,258.4	9.3	4.4	2.1	0.8	1.1	0.2	0.1
Ruapehu District	1,170.5	7.7	4.5	2.9	1.2	0.8	0.4	0.3
Commerical/Industrial property use type								
Palmerston North City	796.6	13.6	8.5	7.9	1.2	1.2	1.3	1.6
Whanganui District	420.8	11.9	7.9	6.7	2.4	1.3	2.6	0.1
Horowhenua District	350.4	36.5	6	1.8	0.7	2.3	0.6	0.1
Manawatū District	311.9	20.6	10.8	5.1	2.1	1.9	0.4	0.9
Tararua District	211.2	12.1	4.3	1.8	0.8	1.2	0.8	3.8
Rangitīkei District	335.1	10.9	5.1	4.4	11.9	11.8	1.3	0.8
Ruapehu District	25,319.4	1.1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.6	5.8	4.3	2.3	2.6	1	0.9
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.3	0.2	0.3
Horowhenua District	79,623.5	9.2	5.5	5	3.3	4.4	4.3	0.4
Manawatū District	225,094.6	7.6	4.1	2.7	1.2	1.4	0.8	1.1
Tararua District	405,511.5	3.2	1.5	0.8	0.4	0.4	0.2	0.9
Rangitīkei District	395,303.1	3.6	1.9	1.2	0.7	0.6	0.2	0.2
Ruapehu District	810,446.7	1.3	0.6	0.3	0.1	0.2	0.1	0.2
Other property use type								
Palmerston North City	6,131.2	4.9	2.8	2	1.4	2	1.5	1.3
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.2
Horowhenua District	17,576.9	2.3	1.9	1.2	0.5	0.5	0.1	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0.1	0.1
Tararua District	38,157.8	0.6	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.2	0.7	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.13: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +2°C, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.2	5.9	3.3	1.2	0.9	0.1	0
Whanganui District	2,537.4	7.7	4.4	4	2.5	2.1	0.8	0.7
Horowhenua District	2,664.3	18.7	6	2.1	0.5	0.3	0	0
Manawatū District	1,941.5	13.7	4.4	2.1	0.9	0.5	0.2	0
Tararua District	965.5	12.8	4.2	1.8	0.7	1.1	1.2	2.9
Rangitīkei District	1,258.4	9.3	4.5	2.1	0.9	1.1	0.3	0.1
Ruapehu District	1,170.5	7.5	4.3	3.8	1.9	1.4	0.5	0.4
Commerical/Industrial property use type								
Palmerston North City	796.6	13.2	9.1	7.3	2.5	1.5	1.2	2.1
Whanganui District	420.8	11	6.3	8	4.4	2.6	1.8	1.3
Horowhenua District	350.4	37.8	7.1	1.5	0.3	0.5	0.1	0.2
Manawatū District	311.9	18.9	8	5	1.6	2	1.2	1.1
Tararua District	211.2	12.9	5.4	2.6	1.1	1.2	0.9	4.3
Rangitīkei District	335.1	11.1	5.7	5.3	10.9	12	1.4	1
Ruapehu District	25,319.4	1.1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.8	5.6	3.8	1.9	2.1	1.3	1.2
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.4
Horowhenua District	79,623.5	9.7	6.4	6.5	2.9	3.3	1.3	0.9
Manawatū District	225,094.6	7.8	4.1	2.6	1.2	1.3	0.7	1.1
Tararua District	405,511.5	4	1.9	1	0.5	0.5	0.2	1.1
Rangitīkei District	395,303.1	3.7	1.9	1.1	0.6	0.6	0.2	0.3
Ruapehu District	810,446.7	1.3	0.6	0.3	0.2	0.2	0.1	0.2
Other property use type								
Palmerston North City	6,131.2	5.1	2.9	2	1.2	1.6	1.2	1.2
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.2
Horowhenua District	17,576.9	2.1	1.8	1.4	0.4	0.9	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0	0.1
Tararua District	38,157.8	1.1	0.5	0.3	0.2	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0.1
Ruapehu District	92,049.8	1.3	0.7	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.14: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +2°C, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	11.6	8.4	4.8	1.8	1.8	0.8	0.3
Whanganui District	2,537.4	7.7	4.4	4	2.5	2.1	0.8	0.7
Horowhenua District	2,664.3	18.7	5.7	2.1	0.6	0.3	0.4	0
Manawatū District	1,941.5	15.2	5.6	2.5	1.2	0.7	0.2	0.1
Tararua District	965.5	12.3	3.9	1.4	0.7	1	1.1	2.8
Rangitīkei District	1,258.4	9.2	4.8	2.4	1	1.2	0.3	0.1
Ruapehu District	1,170.5	7.6	4.5	3.9	1.9	1.3	0.5	0.4
Commerical/Industrial property use type								
Palmerston North City	796.6	13.3	9.1	9	1.7	1.2	1.4	1.7
Whanganui District	420.8	10.9	5.5	7.4	5.7	3.2	1.8	1.4
Horowhenua District	350.4	37.1	6.6	1.9	0.8	2	1	0.2
Manawatū District	311.9	20.4	11.5	5.6	2.2	2.4	0.4	1
Tararua District	211.2	12.6	5	2.4	1	1.2	0.9	4.3
Rangitīkei District	335.1	11	5.6	2.9	9.4	15.8	2.1	1
Ruapehu District	25,319.4	1.1	0.5	0.3	0.1	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.5	5.9	4.6	2.5	2.8	1.1	1
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.4
Horowhenua District	79,623.5	9.1	5.6	4.9	3.2	4.9	4.5	1.2
Manawatū District	225,094.6	7.7	4.2	2.8	1.3	1.4	0.8	1.2
Tararua District	405,511.5	3.3	1.6	0.8	0.4	0.4	0.2	1
Rangitīkei District	395,303.1	3.6	1.9	1.2	0.7	0.7	0.2	0.2
Ruapehu District	810,446.7	1.3	0.6	0.3	0.2	0.2	0.1	0.2
Other property use type								
Palmerston North City	6,131.2	5.1	3.1	2.3	1.4	2	1.7	1.6
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0	0.3
Horowhenua District	17,576.9	2.2	1.9	1.4	0.5	0.7	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0.1	0.1
Tararua District	38,157.8	0.6	0.2	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0
Ruapehu District	92,049.8	1.3	0.7	0.4	0.2	0.2	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.15: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +3°C, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.5	6.7	3.8	1.3	1.2	0.2	0.1
Whanganui District	2,537.4	7.5	4.3	3.7	3.1	4.1	1	1.2
Horowhenua District	2,664.3	19.2	6.3	2.4	0.5	0.3	0	0
Manawatū District	1,941.5	14.1	4.3	2.5	1.1	0.7	0.1	0.1
Tararua District	965.5	13.4	4.7	1.8	1	1.3	1.1	2.4
Rangitīkei District	1,258.4	9.5	4.7	2.2	1	1.1	0.5	0.1
Ruapehu District	1,170.5	7.6	4.2	3.7	2.6	2.1	0.6	0.6
Commerical/Industrial property use type								
Palmerston North City	796.6	13.2	9.2	8.4	3.1	2	1	2.4
Whanganui District	420.8	10.5	6	5.2	6.6	7.2	1.6	2.6
Horowhenua District	350.4	38.3	8	1.8	0.3	0.5	0.1	0.2
Manawatū District	311.9	19.4	8.4	5.8	1.6	2.2	1.5	1.2
Tararua District	211.2	12.8	6.3	3.4	1.1	1.5	0.7	4.2
Rangitīkei District	335.1	11.3	5.4	3.7	8.8	16.1	2	1.3
Ruapehu District	25,319.4	1.1	0.5	0.3	0.2	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.7	5.7	4.1	2.2	2.4	1.4	1.4
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.5
Horowhenua District	79,623.5	9.7	6.2	6.7	3.5	3.4	1.8	1
Manawatū District	225,094.6	7.9	4.2	2.7	1.2	1.4	0.8	1.4
Tararua District	405,511.5	4	1.9	1	0.5	0.5	0.3	1.1
Rangitīkei District	395,303.1	3.7	1.9	1.2	0.6	0.7	0.3	0.3
Ruapehu District	810,446.7	1.3	0.6	0.3	0.2	0.2	0.1	0.3
Other property use type								
Palmerston North City	6,131.2	5.2	3	2.1	1.3	1.7	1.3	1.4
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.3
Horowhenua District	17,576.9	2.1	1.7	1.6	0.4	1	0.3	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0.1	0.1
Tararua District	38,157.8	1.2	0.5	0.3	0.2	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0.1
Ruapehu District	92,049.8	1.3	0.7	0.4	0.2	0.2	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.16: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +3°C, Defences Down

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.7	9.8	6.7	2.5	2.2	0.9	0.3
Whanganui District	2,537.4	7.5	4.3	3.7	3.1	4.1	1	1.2
Horowhenua District	2,664.3	19.2	6.1	2.2	0.6	0.3	0.4	0.1
Manawatū District	1,941.5	15.6	5.8	2.5	1.5	0.9	0.2	0.1
Tararua District	965.5	12.6	4.2	1.5	0.8	0.9	1	3.7
Rangitīkei District	1,258.4	9.4	4.9	2.5	1.1	1.3	0.4	0.2
Ruapehu District	1,170.5	7.6	4.3	3.9	2.5	2	0.6	0.6
Commerical/Industrial property use type								
Palmerston North City	796.6	13.5	8.7	10.3	2.5	1.2	1.4	1.9
Whanganui District	420.8	10.3	6	4.9	6.4	8.1	1.6	2.6
Horowhenua District	350.4	37.6	7.5	1.9	0.7	1.7	1.4	0.2
Manawatū District	311.9	20.1	12	5.9	2.3	2.8	0.4	1
Tararua District	211.2	12.5	5.7	3.2	1.2	1.5	0.9	4.8
Rangitīkei District	335.1	11.2	5.6	2.8	5.8	19.1	3.2	1.3
Ruapehu District	25,319.4	1.1	0.5	0.3	0.2	0.1	0	0
Rural property use type								
Palmerston North City	27,505.4	7.4	5.9	4.8	2.7	3.1	1.3	1.1
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.5
Horowhenua District	79,623.5	9	5.3	4.7	3.2	5.2	4.7	2.4
Manawatū District	225,094.6	7.8	4.2	2.9	1.4	1.5	0.9	1.3
Tararua District	405,511.5	3.3	1.6	0.8	0.4	0.4	0.2	1
Rangitīkei District	395,303.1	3.6	1.9	1.2	0.7	0.8	0.3	0.3
Ruapehu District	810,446.7	1.3	0.6	0.3	0.2	0.2	0.1	0.3
Other property use type								
Palmerston North City	6,131.2	5	3.3	2.5	1.5	2.1	1.8	1.8
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.3
Horowhenua District	17,576.9	2.2	1.8	1.7	0.4	0.9	0.2	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.2	0.1	0.1	0.1
Tararua District	38,157.8	0.6	0.3	0.2	0.1	0.1	0	0.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0.1
Ruapehu District	92,049.8	1.3	0.7	0.4	0.2	0.2	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.6.17: Percentage of hectares of property use type flooded for district for 0.5% AEP, Climate Warming +3°C + SLR, Defences Up

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Residental property use type								
Palmerston North City	3,379.1	10.5	6.7	3.8	1.3	1.2	0.2	0.1
Whanganui District	2,537.4	7.5	4.3	3.8	3.1	4.2	1	1.2
Horowhenua District	2,664.3	19.2	6.4	2.4	0.6	0.3	0	0
Manawatū District	1,941.5	14	4.2	2.5	1.1	0.7	0.1	0.1
Tararua District	965.5	2.2	0.8	0.6	0.3	0.3	0.2	0.2
Rangitīkei District	1,258.4	9.6	4.7	2.3	1	1.1	0.5	0.1
Ruapehu District	1,170.5	4.1	2.8	3	2.2	1.8	0.6	0.6
Commerical/Industrial property use type								
Palmerston North City	796.6	13.2	9.2	8.4	3.1	2	1	2.4
Whanganui District	420.8	10.3	5.8	4.3	5	10.7	1.8	3
Horowhenua District	350.4	38.4	7.9	1.8	0.3	0.5	0.1	0.2
Manawatū District	311.9	19.4	8.4	5.8	1.6	2.2	1.5	1.2
Tararua District	211.2	1.6	0.8	0.5	0.3	0.3	0.2	1
Rangitīkei District	335.1	11.3	5.4	3.7	8.8	16.1	2	1.3
Ruapehu District	25,319.4	0.3	0.1	0.1	0	0	0	0
Rural property use type								
Palmerston North City	27,505.4	7.7	5.7	4.1	2.2	2.4	1.4	1.4
Whanganui District	302,890.5	1.7	1	0.6	0.3	0.4	0.2	0.5
Horowhenua District	79,623.5	9.8	6.3	6.7	3.2	3.7	1.3	1
Manawatū District	225,094.6	7.9	4.2	2.7	1.2	1.4	0.8	1.4
Tararua District	405,511.5	1.7	0.7	0.4	0.2	0.2	0.2	0.6
Rangitīkei District	395,303.1	3.7	1.9	1.2	0.6	0.7	0.3	0.3
Ruapehu District	810,446.7	1	0.5	0.3	0.1	0.2	0.1	0.3
Other property use type								
Palmerston North City	6,131.2	5.1	2.9	2.1	1.3	1.7	1.3	1.4
Whanganui District	51,009.4	0.5	0.3	0.2	0.1	0.1	0.1	0.3
Horowhenua District	17,576.9	2.1	1.7	1.7	0.4	0.9	0.3	0.1
Manawatū District	36,545.9	0.9	0.5	0.3	0.1	0.1	0.1	0.1
Tararua District	38,157.8	0.8	0.4	0.2	0.1	0.1	0.1	0.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

District (totals area including within and outside the town settlements).	Area of the district in hectares of property use type specified	% of Area (ha) with modelled depth of 0.05 to 0.19m flooding	Area (ha) with modelled depth of 0.2 to 0.49m flooding	% of Area (ha) with modelled depth of 0.5 to 0.99m flooding	% of Area (ha) with modelled depth of 1.0 to 1.49m flooding	% of Area (ha) with modelled depth of 1.5 to 2.49m flooding	% of Area (ha) with modelled depth of 2.5 to 3.49m flooding	% of Area (ha) with modelled depth of >=3.5 flooding
Rangitīkei District	40,026.4	0.6	0.4	0.2	0.1	0.1	0	0.1
Ruapehu District	92,049.8	1.2	0.6	0.4	0.2	0.2	0.1	0.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.7.1: Total count of resident population and number of buildings by building type, for each town/settlement

Town/Settlement	Usual resident population	Total number of buildings	Total number of residential buildings (primary structures)	Total number of residential buildings (secondary structures)	Total number of commercial/industrial buildings (primary structures)	Total number of commercial/industrial buildings (secondary structures)	Total number of rural buildings (primary structures)	Total number of rural buildings (secondary structures)	Total number of other buildings (primary structures)	Total number of other buildings (secondary structures)
Palmerston North	60,795	47,822	27,913	13,396	1,955	434	1,862	1,240	695	327
Whanganui	32,904	34,005	17,797	11,653	1,203	328	1,246	1,048	479	251
Levin	15,666	16,911	8,518	5,385	592	162	1,211	824	153	66
Feilding	13,893	12,604	6,511	3,816	425	131	830	646	166	79
Dannevirke	6,146	8,602	2,870	1,987	323	99	1,809	1,262	167	85
Marton	5,504	8,099	2,773	2,229	235	114	1,358	1,135	169	86
Taumarunui	3,715	5,081	2,264	1,506	213	79	442	430	88	59
Ashhurst	3,533	3,964	1,450	1,044	42	26	767	589	32	14
Pahiatua	3,144	5,071	1,499	1,045	145	28	1,231	984	76	63
Foxton	3,062	4,357	1,608	1,206	141	50	633	549	94	76
Taihape	2,171	4,329	1,060	906	172	48	988	948	109	98
Bulls	1,981	2,798	976	781	158	52	421	305	66	39
Bunnythorpe	1,714	2,670	545	443	16	9	930	651	46	30
Shannon	1,703	2,247	837	707	56	29	291	228	55	44
Foxton Beach	1,700	3,241	1,641	1,364	5	0	47	36	22	126
Woodville	1,688	2,851	886	701	68	33	577	487	55	44
Rongotea	1,459	2,537	674	543	42	9	746	478	28	17
Linton	1,364	2,230	507	275	21	7	646	421	236	117
Halcombe	1,337	2,353	362	350	18	11	868	649	57	38
Ohakune	1,195	3,026	1,314	813	109	49	365	311	37	28
Eketāhuna	1,149	2,734	466	385	41	16	1,004	731	56	35
Raetihi	1,042	1,900	533	438	67	33	367	393	41	28
Hunterville	970	2,423	422	344	38	25	785	664	75	70
Sanson	886	1,296	365	315	49	26	290	196	31	24
Ōhau	874	1,416	413	378	8	4	302	280	16	15
Tokomaru	819	1,070	334	260	9	9	244	179	15	20
Kairanga	788	1,605	277	210	13	10	647	413	17	18
Manakau	745	1,506	369	319	1	0	409	361	27	20
Pohangina	705	1,542	107	80	0	0	661	610	49	35

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Usual resident population	Total number of buildings	Total number of residential buildings (primary structures)	Total number of residential buildings (secondary structures)	Total number of commercial/industrial buildings (primary structures)	Total number of commercial/industrial buildings (secondary structures)	Total number of rural buildings (primary structures)	Total number of rural buildings (secondary structures)	Total number of other buildings (primary structures)	Total number of other buildings (secondary structures)
Waitārere Beach	644	1,708	817	819	4	1	2	1	10	54
Kai Iwi	540	1,015	166	137	2	3	299	306	42	60
Himatangi Beach	526	1,106	498	488	1	1	50	43	7	18
Longburn	519	931	266	177	99	62	178	125	15	9
Waiouru	511	980	221	144	17	17	306	267	3	5
Tangimoana	505	1,147	337	356	7	11	230	153	32	21
Ormondville	441	1,094	143	184	8	2	387	334	20	16
Hokio Beach	405	907	268	276	1	1	173	148	13	27
Norsewood	374	792	128	105	7	7	296	201	24	24
Kimbolton	366	725	188	154	5	3	195	137	18	25
Ōwhango	346	1,003	167	128	11	19	315	318	29	16
Rātana	329	379	164	98	1	1	53	48	9	5
Mangaweka	318	971	127	109	24	10	336	305	35	25
Ohakea	289	589	146	89	0	0	187	148	10	9
Pongaroa	283	1,011	122	78	12	7	357	321	63	51
Ōhura	222	751	132	177	5	6	199	191	25	16
National Park	193	604	295	192	23	3	35	19	17	20
Rangataua	181	486	189	138	0	0	95	64	0	0
Mangatainoka	175	581	93	87	21	23	185	157	7	8
Waikawa Beach	156	565	279	236	0	0	23	26	0	1
Mangamutu	155	340	42	35	12	18	124	100	4	5
Koitiata	134	302	141	147	0	0	5	4	1	4
Raurimu	125	394	91	84	1	5	85	119	3	6
Other	14,276	39,243	4,752	4,120	305	190	14,796	12,582	1,262	1,236

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.1: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 5% AEP with Current Climate and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	13,698	14	10,792	6,465	3,263	506	104	145	118	121	70
Whanganui	6,069	5	6,474	3,370	2,303	265	114	118	133	103	68
Levin	6,646	2	6,612	3,637	2,101	377	97	160	132	78	30
Feilding	1,633	0 to 1	1,731	839	549	95	52	65	87	26	18
Dannevirke	382	0 to 1	629	200	157	32	13	103	93	22	9
Marton	670	0 to 1	1,035	370	318	57	38	102	109	32	9
Taumarunui	334	4	500	204	198	24	7	18	29	11	9
Ashhurst	478	0 to 1	519	228	151	21	8	56	47	6	2
Pahiatua	657	0 to 1	937	403	291	51	4	76	80	22	10
Foxton	976	0 to 1	1,270	545	400	44	18	100	105	31	27
Taihape	46	0 to 1	104	25	44	3	2	5	19	3	3
Bulls	284	0 to 1	416	144	127	13	5	58	50	7	12
Bunnythorpe	92	0 to 1	210	26	30	3	1	62	75	8	5
Shannon	114	0 to 1	124	47	22	6	6	17	19	3	4
Foxton Beach	368	0 to 1	848	419	386	1	0	9	5	7	21
Woodville	518	2	886	215	196	19	11	223	206	9	7
Rongotea	169	0 to 1	271	82	64	5	1	59	57	0	3
Linton	45	0 to 1	192	24	10	1	0	41	48	41	27
Halcombe	40	0 to 1	80	12	18	1	2	17	30	0	0
Ohakune	189	0 to 1	449	207	146	19	7	21	41	2	6
Eketāhuna	55	0 to 1	160	20	33	0	2	55	45	3	2
Raetihi	120	0 to 1	209	71	66	6	2	25	35	3	1
Hunterville	101	0 to 1	172	49	42	10	12	11	24	10	14
Sanson	47	0 to 1	98	22	29	12	11	9	13	0	2
Ōhau	69	0 to 1	124	28	34	1	0	23	34	2	2
Tokomaru	53	0 to 1	60	15	13	0	1	15	14	0	2
Kairanga	137	0 to 1	268	59	36	1	0	96	65	5	6
Manakau	97	0 to 1	233	62	52	0	0	41	68	5	5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	51	0 to 1	99	10	2	0	0	33	46	1	7
Waitārere Beach	108	0 to 1	320	124	161	1	0	0	0	4	30
Kai Iwi	23	0 to 1	59	10	10	0	0	10	22	1	6
Himatangi Beach	76	0 to 1	188	74	74	0	0	14	22	2	2
Longburn	74	0 to 1	166	43	37	20	13	23	28	1	1
Waiouru	20	0 to 1	71	15	12	0	2	21	20	1	0
Tangimoana	155	0 to 1	348	122	163	0	1	17	21	14	10
Ormondville	14	0 to 1	60	5	11	0	0	17	24	2	1
Hokio Beach	38	0 to 1	152	38	64	0	1	13	31	0	5
Norsewood	33	0 to 1	60	14	14	1	4	13	13	0	1
Kimbolton	21	0 to 1	34	8	9	0	0	6	9	0	2
Ōwhango	22	0 to 1	68	16	19	2	3	7	21	0	0
Rātana	66	0 to 1	69	32	20	0	0	4	10	2	1
Mangaweka	15	0 to 1	27	11	5	2	0	1	3	4	1
Ohakea	26	0 to 1	56	10	12	0	0	13	16	3	2
Pongaroa	19	0 to 1	62	9	12	1	2	11	18	3	6
Ōhura	11	0 to 1	60	14	24	1	0	7	13	1	0
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	31	9	12	0	0	3	7	0	0
Mangatainoka	23	0 to 1	127	17	12	1	1	59	36	1	0
Waikawa Beach	9	0 to 1	68	26	35	0	0	2	5	0	0
Mangamutu	10	0 to 1	44	2	4	5	12	8	13	0	0
Koitiata	45	0 to 1	91	41	46	0	0	3	1	0	0
Raurimu	8	0 to 1	29	2	8	0	0	8	11	0	0
Other	1,246	1	3,334	502	547	33	29	915	1,101	93	114

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.2: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 5% AEP with Current Climate and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	10,672	8	8,562	5,034	2,544	454	88	158	128	96	60
Whanganui	6,013	5	6,397	3,342	2,286	255	102	118	133	101	60
Levin	6,646	2	6,612	3,637	2,101	377	97	160	132	78	30
Feilding	2,339	0 to 1	2,479	1,201	814	163	64	79	92	36	30
Dannevirke	382	0 to 1	632	200	157	32	13	106	93	22	9
Marton	713	0 to 1	1,068	390	325	60	38	103	109	32	11
Taumarunui	331	4	491	200	193	24	7	18	29	11	9
Ashhurst	456	0 to 1	491	214	148	16	7	50	48	6	2
Pahiatua	656	0 to 1	931	400	292	51	4	74	78	22	10
Foxton	985	1	1,288	547	403	44	18	109	109	30	28
Taihape	46	0 to 1	104	25	44	3	2	5	19	3	3
Bulls	288	0 to 1	425	147	128	13	5	60	53	7	12
Bunnythorpe	92	0 to 1	209	26	30	3	1	62	75	7	5
Shannon	120	0 to 1	162	50	23	6	6	31	32	9	5
Foxton Beach	361	0 to 1	822	408	375	1	0	9	5	6	18
Woodville	531	2	906	226	205	19	11	223	207	8	7
Rongotea	227	0 to 1	379	104	84	5	1	93	84	2	6
Linton	49	0 to 1	211	31	10	1	0	48	53	41	27
Halcombe	40	0 to 1	80	12	18	1	2	17	30	0	0
Ohakune	189	0 to 1	449	207	146	19	7	21	41	2	6
Eketāhuna	55	0 to 1	161	20	33	0	2	56	45	3	2
Raetihi	120	0 to 1	209	71	66	6	2	25	35	3	1
Hunterville	117	0 to 1	202	60	51	12	13	13	28	10	15
Sanson	47	0 to 1	98	22	29	12	11	9	13	0	2
Ōhau	68	0 to 1	123	28	34	1	0	22	34	2	2
Tokomaru	57	0 to 1	59	12	13	0	1	18	13	0	2
Kairanga	258	0 to 1	472	92	68	1	0	191	109	5	6
Manakau	97	0 to 1	233	62	52	0	0	41	68	5	5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	51	0 to 1	99	10	2	0	0	33	46	1	7
Waitārere Beach	108	0 to 1	320	124	161	1	0	0	0	4	30
Kai Iwi	23	0 to 1	59	10	10	0	0	10	22	1	6
Himatangi Beach	76	0 to 1	188	74	74	0	0	14	22	2	2
Longburn	88	0 to 1	234	53	49	38	19	33	35	4	3
Waiouru	20	0 to 1	71	15	12	0	2	21	20	1	0
Tangimoana	135	0 to 1	316	108	149	0	1	18	21	13	6
Ormondville	14	0 to 1	60	5	11	0	0	17	24	2	1
Hokio Beach	38	0 to 1	152	38	64	0	1	13	31	0	5
Norsewood	33	0 to 1	60	14	14	1	4	13	13	0	1
Kimbolton	21	0 to 1	34	8	9	0	0	6	9	0	2
Ōwhango	22	0 to 1	68	16	19	2	3	7	21	0	0
Rātana	66	0 to 1	69	32	20	0	0	4	10	2	1
Mangaweka	15	0 to 1	27	11	5	2	0	1	3	4	1
Ohakea	26	0 to 1	56	10	12	0	0	13	16	3	2
Pongaroa	19	0 to 1	62	9	12	1	2	11	18	3	6
Ōhura	11	0 to 1	60	14	24	1	0	7	13	1	0
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	31	9	12	0	0	3	7	0	0
Mangatainoka	23	0 to 1	127	17	12	1	1	59	36	1	0
Waikawa Beach	9	0 to 1	68	26	35	0	0	2	5	0	0
Mangamutu	10	0 to 1	33	2	5	4	2	8	12	0	0
Koitiata	45	0 to 1	91	41	46	0	0	3	1	0	0
Raurimu	8	0 to 1	29	2	8	0	0	8	11	0	0
Other	1,532	2	4,144	649	644	35	29	1,269	1,302	98	118

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.3: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 2% AEP with Current Climate and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	14,892	17	11,785	7,033	3,559	575	111	159	132	137	79
Whanganui	6,498	5	6,944	3,631	2,451	284	117	129	145	115	72
Levin	7,019	2	6,975	3,817	2,216	399	103	185	144	80	31
Feilding	1,805	0 to 1	1,927	944	606	100	56	77	96	28	20
Dannevirke	404	0 to 1	682	217	168	34	18	111	99	25	10
Marton	756	0 to 1	1,130	410	343	62	37	113	119	33	13
Taumarunui	364	8	557	231	223	24	8	20	30	12	9
Ashhurst	524	0 to 1	570	252	165	21	8	60	55	7	2
Pahiatua	703	0 to 1	1,008	426	316	54	4	83	91	24	10
Foxton	1,011	1	1,322	571	409	46	21	105	112	31	27
Taihape	46	0 to 1	109	26	47	3	2	6	19	3	3
Bulls	315	0 to 1	475	168	135	15	6	72	60	7	12
Bunnythorpe	107	0 to 1	229	30	30	3	1	72	80	8	5
Shannon	122	0 to 1	144	50	26	6	6	22	26	3	5
Foxton Beach	384	0 to 1	885	436	403	1	0	9	6	7	23
Woodville	660	4	1,078	308	270	22	14	234	214	9	7
Rongotea	198	0 to 1	313	92	67	5	1	73	67	2	6
Linton	51	0 to 1	208	27	13	2	0	41	49	46	30
Halcombe	40	0 to 1	85	12	20	1	3	18	31	0	0
Ohakune	217	0 to 1	505	234	165	22	8	26	42	2	6
Eketāhuna	69	0 to 1	167	19	34	0	2	57	50	3	2
Raetihi	127	0 to 1	218	73	68	8	3	24	38	3	1
Hunterville	115	0 to 1	215	62	50	13	13	17	34	10	16
Sanson	49	0 to 1	102	24	29	12	11	11	13	0	2
Ōhau	76	0 to 1	135	32	36	1	0	26	36	2	2
Tokomaru	57	0 to 1	63	16	14	0	1	14	16	0	2
Kairanga	178	0 to 1	334	73	51	1	0	122	76	5	6
Manakau	101	0 to 1	252	69	55	0	0	43	73	5	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	53	0 to 1	111	13	4	0	0	35	50	2	7
Waitārere Beach	129	0 to 1	384	155	187	1	0	0	0	6	35
Kai Iwi	23	0 to 1	59	10	10	0	0	10	22	1	6
Himatangi Beach	79	0 to 1	206	79	81	0	0	16	24	2	4
Longburn	82	0 to 1	179	46	42	23	14	24	28	1	1
Waiouru	20	0 to 1	76	18	12	1	2	22	20	1	0
Tangimoana	167	0 to 1	382	133	182	0	1	19	23	14	10
Ormondville	14	0 to 1	64	5	11	0	0	18	26	2	2
Hokio Beach	49	0 to 1	168	43	70	0	1	15	34	0	5
Norsewood	37	0 to 1	63	14	14	1	4	16	13	0	1
Kimbolton	21	0 to 1	35	8	9	0	0	6	10	0	2
Ōwhango	26	0 to 1	70	17	19	2	3	7	22	0	0
Rātana	68	0 to 1	69	33	20	0	0	4	9	2	1
Mangaweka	16	0 to 1	34	13	6	3	1	1	5	4	1
Ohakea	26	0 to 1	58	10	13	0	0	14	16	3	2
Pongaroa	17	0 to 1	72	10	10	1	2	17	23	3	6
Ōhura	12	0 to 1	65	15	26	1	0	7	15	0	1
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	34	11	12	0	0	3	8	0	0
Mangatainoka	22	0 to 1	135	16	14	1	1	62	40	1	0
Waikawa Beach	9	0 to 1	75	30	38	0	0	2	5	0	0
Mangamutu	10	0 to 1	46	4	6	5	12	8	11	0	0
Koitiata	45	0 to 1	94	41	49	0	0	3	1	0	0
Raurimu	9	0 to 1	32	3	9	0	0	9	11	0	0
Other	1,355	6	3,760	563	626	34	31	1,045	1,231	106	124

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.4: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 2% AEP with Current Climate and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	12,217	11	9,831	5,740	2,894	517	104	226	169	114	67
Whanganui	6,478	5	6,898	3,623	2,447	270	106	130	145	112	65
Levin	7,019	2	6,975	3,817	2,216	399	103	185	144	80	31
Feilding	2,603	0 to 1	2,777	1,341	917	183	69	90	102	45	30
Dannevirke	404	0 to 1	683	217	168	34	18	113	98	25	10
Marton	801	0 to 1	1,163	430	346	75	38	111	118	32	13
Taumarunui	353	8	539	221	215	24	8	20	30	12	9
Ashhurst	501	0 to 1	538	231	164	17	7	57	53	7	2
Pahiatua	702	0 to 1	996	426	309	54	4	79	90	24	10
Foxton	1,027	1	1,340	574	412	47	21	113	114	31	28
Taihape	46	0 to 1	109	26	47	3	2	6	19	3	3
Bulls	315	0 to 1	478	169	135	15	6	73	61	7	12
Bunnythorpe	107	0 to 1	228	30	30	3	1	72	80	7	5
Shannon	130	0 to 1	180	53	28	7	6	33	36	10	7
Foxton Beach	377	0 to 1	857	424	393	1	0	9	6	6	18
Woodville	690	4	1,103	327	274	22	15	234	215	9	7
Rongotea	247	0 to 1	406	112	88	5	1	103	89	2	6
Linton	62	0 to 1	232	35	14	2	0	51	54	46	30
Halcombe	40	0 to 1	85	12	20	1	3	18	31	0	0
Ohakune	217	0 to 1	505	234	165	22	8	26	42	2	6
Eketāhuna	69	0 to 1	167	19	34	0	2	57	50	3	2
Raetihi	127	0 to 1	218	73	68	8	3	24	38	3	1
Hunterville	127	0 to 1	234	71	56	15	13	21	34	10	14
Sanson	49	0 to 1	102	24	29	12	11	11	13	0	2
Ōhau	76	0 to 1	132	32	35	1	0	25	35	2	2
Tokomaru	57	0 to 1	65	13	14	0	1	19	16	0	2
Kairanga	309	0 to 1	536	104	77	1	0	218	125	5	6
Manakau	101	0 to 1	252	69	55	0	0	43	73	5	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	53	0 to 1	111	13	4	0	0	35	50	2	7
Waitārere Beach	129	0 to 1	384	155	187	1	0	0	0	6	35
Kai Iwi	23	0 to 1	59	10	10	0	0	10	22	1	6
Himatangi Beach	79	0 to 1	206	79	81	0	0	16	24	2	4
Longburn	106	0 to 1	263	63	55	39	21	38	40	4	3
Waiouru	20	0 to 1	76	18	12	1	2	22	20	1	0
Tangimoana	208	0 to 1	459	170	221	0	1	20	23	14	10
Ormondville	14	0 to 1	64	5	11	0	0	18	26	2	2
Hokio Beach	49	0 to 1	168	43	70	0	1	15	34	0	5
Norsewood	37	0 to 1	63	14	14	1	4	16	13	0	1
Kimbolton	21	0 to 1	35	8	9	0	0	6	10	0	2
Ōwhango	26	0 to 1	70	17	19	2	3	7	22	0	0
Rātana	68	0 to 1	69	33	20	0	0	4	9	2	1
Mangaweka	16	0 to 1	34	13	6	3	1	1	5	4	1
Ohakea	26	0 to 1	58	10	13	0	0	14	16	3	2
Pongaroa	17	0 to 1	72	10	10	1	2	17	23	3	6
Ōhura	12	0 to 1	65	15	26	1	0	7	15	0	1
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	34	11	12	0	0	3	8	0	0
Mangatainoka	22	0 to 1	135	16	14	1	1	62	40	1	0
Waikawa Beach	9	0 to 1	75	30	38	0	0	2	5	0	0
Mangamutu	10	0 to 1	38	5	6	5	4	8	10	0	0
Koitiata	45	0 to 1	94	41	49	0	0	3	1	0	0
Raurimu	9	0 to 1	32	3	9	0	0	9	11	0	0
Other	1,716	8	4,699	738	727	38	31	1,470	1,452	114	129

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.5: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 1% AEP with Current Climate and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	15,617	18	12,410	7,388	3,747	610	115	183	141	144	82
Whanganui	7,003	6	7,453	3,914	2,620	306	121	142	149	123	78
Levin	7,253	2	7,239	3,954	2,315	406	106	198	150	80	30
Feilding	1,949	0 to 1	2,100	1,029	665	110	57	86	101	30	22
Dannevirke	436	0 to 1	722	226	173	34	18	119	110	31	11
Marton	840	0 to 1	1,207	444	359	70	39	117	123	39	16
Taumarunui	392	9	608	254	239	25	11	22	33	14	10
Ashhurst	556	0 to 1	615	268	178	21	8	68	63	7	2
Pahiatua	722	0 to 1	1,055	436	328	54	5	93	102	25	12
Foxton	1,042	1	1,363	589	419	49	22	109	116	31	28
Taihape	50	3	116	28	50	3	3	6	20	3	3
Bulls	339	0 to 1	513	179	144	21	10	72	67	8	12
Bunnythorpe	108	0 to 1	236	31	31	3	1	75	82	8	5
Shannon	122	0 to 1	156	51	28	6	6	27	27	5	6
Foxton Beach	394	0 to 1	912	446	414	1	0	10	6	8	27
Woodville	775	5	1,221	375	332	24	18	241	214	10	7
Rongotea	204	0 to 1	334	95	69	5	1	79	77	2	6
Linton	56	0 to 1	216	29	14	2	0	40	50	48	33
Halcombe	47	0 to 1	98	15	22	1	3	22	35	0	0
Ohakune	239	0 to 1	544	252	174	24	8	31	46	3	6
Eketāhuna	73	0 to 1	172	18	36	0	2	58	53	3	2
Raetihi	137	0 to 1	231	78	71	9	4	26	38	3	2
Hunterville	124	0 to 1	242	72	55	16	13	24	37	10	15
Sanson	56	0 to 1	107	26	30	12	11	13	13	0	2
Ōhau	76	0 to 1	141	33	37	1	0	29	37	2	2
Tokomaru	57	0 to 1	66	16	14	0	1	17	16	0	2
Kairanga	228	0 to 1	395	83	59	1	0	157	84	5	6
Manakau	108	0 to 1	274	75	62	0	0	46	77	7	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	57	0 to 1	125	16	7	0	0	39	52	3	8
Waitārere Beach	138	0 to 1	425	176	201	1	0	0	0	8	39
Kai Iwi	23	0 to 1	59	10	10	0	0	10	22	1	6
Himatangi Beach	85	0 to 1	222	84	88	0	0	17	24	2	7
Longburn	94	0 to 1	209	51	45	28	17	34	32	1	1
Waiouru	20	0 to 1	80	20	13	1	2	22	21	1	0
Tangimoana	184	0 to 1	419	145	201	0	2	19	25	17	10
Ormondville	14	0 to 1	66	6	11	0	0	19	26	2	2
Hokio Beach	51	0 to 1	174	45	72	0	1	16	35	0	5
Norsewood	37	0 to 1	63	14	14	1	4	16	13	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	72	17	19	2	3	8	23	0	0
Rātana	68	0 to 1	69	33	20	0	0	4	9	2	1
Mangaweka	16	0 to 1	37	14	7	3	1	1	6	4	1
Ohakea	26	0 to 1	68	11	13	0	0	15	24	3	2
Pongaroa	16	0 to 1	67	11	10	1	2	16	18	3	6
Ōhura	12	0 to 1	66	11	29	1	0	8	15	1	1
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	35	12	12	0	0	3	8	0	0
Mangatainoka	22	0 to 1	136	16	14	1	1	62	40	1	1
Waikawa Beach	13	0 to 1	79	33	39	0	0	2	5	0	0
Mangamutu	10	0 to 1	51	4	6	5	13	11	12	0	0
Koitiata	49	0 to 1	95	42	49	0	0	3	1	0	0
Raurimu	9	0 to 1	33	4	9	0	0	9	11	0	0
Other	1,579	9	4,244	649	713	34	32	1,214	1,356	112	134

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.6: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 1% AEP with Current Climate and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	14,433	17	11,566	6,800	3,413	555	114	274	197	133	80
Whanganui	6,991	6	7,416	3,912	2,618	293	110	142	149	121	71
Levin	7,253	2	7,239	3,954	2,315	406	106	198	150	80	30
Feilding	2,778	0 to 1	2,950	1,429	966	196	73	100	107	47	32
Dannevirke	436	0 to 1	723	226	173	34	18	120	110	31	11
Marton	858	0 to 1	1,233	458	362	79	41	114	122	41	16
Taumarunui	378	9	583	242	228	25	10	22	33	13	10
Ashhurst	521	0 to 1	575	243	175	17	7	64	60	7	2
Pahiatua	718	0 to 1	1,037	436	321	54	5	86	98	25	12
Foxton	1,058	1	1,384	592	421	49	22	120	120	31	29
Taihape	50	3	116	28	50	3	3	6	20	3	3
Bulls	339	0 to 1	515	179	145	21	10	73	67	8	12
Bunnythorpe	108	0 to 1	235	31	31	3	1	75	82	7	5
Shannon	133	0 to 1	192	54	31	7	6	35	38	12	9
Foxton Beach	386	0 to 1	876	434	401	1	0	10	6	6	18
Woodville	807	5	1,253	395	341	26	19	238	216	11	7
Rongotea	266	0 to 1	428	118	89	5	1	110	97	2	6
Linton	72	0 to 1	244	39	15	2	0	51	56	48	33
Halcombe	47	0 to 1	98	15	22	1	3	22	35	0	0
Ohakune	239	0 to 1	544	252	174	24	8	31	46	3	6
Eketāhuna	73	0 to 1	172	18	36	0	2	58	53	3	2
Raetihi	137	0 to 1	231	78	71	9	4	26	38	3	2
Hunterville	149	0 to 1	254	77	59	15	13	26	39	11	14
Sanson	56	0 to 1	107	26	30	12	11	13	13	0	2
Ōhau	76	0 to 1	137	33	36	1	0	27	36	2	2
Tokomaru	57	0 to 1	67	14	14	0	1	20	16	0	2
Kairanga	357	0 to 1	607	117	87	1	0	250	141	5	6
Manakau	108	0 to 1	274	75	62	0	0	46	77	7	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	57	0 to 1	125	16	7	0	0	39	52	3	8
Waitārere Beach	138	0 to 1	425	176	201	1	0	0	0	8	39
Kai Iwi	23	0 to 1	59	10	10	0	0	10	22	1	6
Himatangi Beach	85	0 to 1	222	84	88	0	0	17	24	2	7
Longburn	118	0 to 1	277	69	58	39	21	43	40	4	3
Waiouru	20	0 to 1	80	20	13	1	2	22	21	1	0
Tangimoana	261	0 to 1	534	203	254	0	2	21	27	17	10
Ormondville	14	0 to 1	66	6	11	0	0	19	26	2	2
Hokio Beach	51	0 to 1	174	45	72	0	1	16	35	0	5
Norsewood	37	0 to 1	63	14	14	1	4	16	13	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	72	17	19	2	3	8	23	0	0
Rātana	68	0 to 1	69	33	20	0	0	4	9	2	1
Mangaweka	16	0 to 1	37	14	7	3	1	1	6	4	1
Ohakea	26	0 to 1	68	11	13	0	0	15	24	3	2
Pongaroa	16	0 to 1	67	11	10	1	2	16	18	3	6
Ōhura	12	0 to 1	66	11	29	1	0	8	15	1	1
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	35	12	12	0	0	3	8	0	0
Mangatainoka	22	0 to 1	136	16	14	1	1	62	40	1	1
Waikawa Beach	13	0 to 1	79	33	39	0	0	2	5	0	0
Mangamutu	10	0 to 1	42	5	6	5	4	10	12	0	0
Koitiata	49	0 to 1	95	42	49	0	0	3	1	0	0
Raurimu	9	0 to 1	33	4	9	0	0	9	11	0	0
Other	1,901	11	5,170	820	805	38	33	1,626	1,582	124	142

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.7: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Current Climate and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	16,236	21	12,968	7,700	3,894	627	119	224	168	148	88
Whanganui	7,505	8	8,017	4,212	2,798	356	133	149	156	130	83
Levin	7,419	2	7,445	4,071	2,374	416	107	211	152	83	31
Feilding	2,052	0 to 1	2,217	1,086	705	115	58	94	103	33	23
Dannevirke	448	0 to 1	753	232	181	35	18	128	117	30	12
Marton	878	0 to 1	1,269	468	373	79	41	126	125	41	16
Taumarunui	423	9	663	280	256	27	14	24	36	14	12
Ashhurst	586	0 to 1	649	281	185	21	8	76	69	7	2
Pahiatua	760	0 to 1	1,108	453	336	56	5	105	114	26	13
Foxton	1,057	1	1,394	600	426	50	22	112	122	32	30
Taihape	55	3	123	29	51	4	4	7	21	3	4
Bulls	369	0 to 1	565	194	157	33	11	78	69	10	13
Bunnythorpe	109	0 to 1	248	31	32	3	1	81	87	8	5
Shannon	133	0 to 1	165	54	29	6	6	28	30	6	6
Foxton Beach	402	0 to 1	933	455	423	1	0	10	6	9	29
Woodville	906	7	1,374	444	383	29	23	250	225	11	9
Rongotea	222	0 to 1	354	100	74	5	1	83	83	2	6
Linton	58	0 to 1	222	31	14	2	0	43	51	48	33
Halcombe	57	0 to 1	105	19	24	1	3	24	34	0	0
Ohakune	249	0 to 1	577	268	182	25	8	33	51	3	7
Eketāhuna	71	0 to 1	178	19	39	0	2	59	54	3	2
Raetihi	150	0 to 1	249	86	77	9	4	28	40	3	2
Hunterville	137	0 to 1	254	76	59	15	13	26	38	10	17
Sanson	56	0 to 1	108	26	30	12	11	13	14	0	2
Ōhau	83	0 to 1	153	37	40	1	0	34	37	2	2
Tokomaru	57	0 to 1	71	16	15	0	1	20	17	0	2
Kairanga	287	0 to 1	483	94	76	5	0	187	109	6	6
Manakau	119	0 to 1	284	81	62	0	0	48	79	7	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	76	0 to 1	150	19	9	0	0	49	61	4	8
Waitārere Beach	147	0 to 1	464	190	222	3	0	0	0	8	41
Kai Iwi	23	0 to 1	58	10	10	0	0	10	21	1	6
Himatangi Beach	86	0 to 1	236	89	93	0	0	18	24	3	9
Longburn	102	0 to 1	259	61	55	39	21	39	37	4	3
Waiouru	20	0 to 1	82	21	13	1	2	23	21	1	0
Tangimoana	238	0 to 1	515	190	243	0	2	24	28	18	10
Ormondville	14	0 to 1	66	6	11	0	0	19	26	2	2
Hokio Beach	59	0 to 1	182	49	74	0	1	18	35	0	5
Norsewood	37	0 to 1	63	14	14	1	4	16	13	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	76	18	19	2	3	8	25	0	1
Rātana	68	0 to 1	69	33	20	0	0	5	8	2	1
Mangaweka	20	0 to 1	39	16	7	3	1	1	6	4	1
Ohakea	41	0 to 1	103	13	16	0	0	30	39	3	2
Pongaroa	16	0 to 1	69	11	10	1	2	16	20	3	6
Ōhura	12	0 to 1	71	11	33	1	0	8	16	1	1
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	36	12	12	0	0	4	8	0	0
Mangatainoka	22	0 to 1	147	16	14	1	1	68	45	1	1
Waikawa Beach	13	0 to 1	82	33	42	0	0	2	5	0	0
Mangamutu	10	0 to 1	52	4	7	5	13	11	12	0	0
Koitiata	49	0 to 1	96	43	49	0	0	3	1	0	0
Raurimu	9	0 to 1	35	5	10	0	0	9	11	0	0
Other	1,805	16	4,801	738	785	36	34	1,389	1,523	132	164

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.8: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Current Climate and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	17,091	27	13,473	8,053	3,918	583	125	327	228	148	91
Whanganui	7,507	8	8,007	4,213	2,797	351	128	149	156	130	83
Levin	7,419	2	7,445	4,071	2,374	416	107	211	152	83	31
Feilding	2,945	1	3,106	1,509	1,017	209	74	104	108	53	32
Dannevirke	448	0 to 1	755	232	181	35	18	130	117	30	12
Marton	891	0 to 1	1,285	476	376	85	43	122	125	42	16
Taumarunui	405	9	633	265	244	27	13	24	36	13	11
Ashhurst	551	0 to 1	615	251	184	18	7	76	70	7	2
Pahiatua	758	0 to 1	1,096	452	336	54	5	100	110	26	13
Foxton	1,075	1	1,412	602	428	50	22	124	124	32	30
Taihape	55	3	123	29	51	4	4	7	21	3	4
Bulls	369	0 to 1	568	196	157	33	11	78	70	10	13
Bunnythorpe	109	0 to 1	247	31	32	3	1	81	87	7	5
Shannon	143	0 to 1	205	58	32	7	8	41	38	12	9
Foxton Beach	393	0 to 1	895	443	409	1	0	10	6	7	19
Woodville	928	7	1,396	459	389	30	23	248	226	12	9
Rongotea	271	0 to 1	448	123	93	5	1	117	101	2	6
Linton	75	0 to 1	251	42	15	2	0	54	57	48	33
Halcombe	57	0 to 1	105	19	24	1	3	24	34	0	0
Ohakune	249	0 to 1	577	268	182	25	8	33	51	3	7
Eketāhuna	71	0 to 1	178	19	39	0	2	59	54	3	2
Raetihi	150	0 to 1	249	86	77	9	4	28	40	3	2
Hunterville	166	0 to 1	276	85	63	16	14	30	40	11	17
Sanson	56	0 to 1	108	26	30	12	11	13	14	0	2
Ōhau	82	0 to 1	147	36	39	1	0	31	36	2	2
Tokomaru	57	0 to 1	71	16	15	0	1	20	17	0	2
Kairanga	395	0 to 1	685	125	90	5	0	285	166	8	6
Manakau	119	0 to 1	284	81	62	0	0	48	79	7	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	76	0 to 1	150	19	9	0	0	49	61	4	8
Waitārere Beach	147	0 to 1	464	190	222	3	0	0	0	8	41
Kai Iwi	23	0 to 1	58	10	10	0	0	10	21	1	6
Himatangi Beach	86	0 to 1	236	89	93	0	0	18	24	3	9
Longburn	116	0 to 1	281	70	58	39	21	43	43	4	3
Waiouru	20	0 to 1	82	21	13	1	2	23	21	1	0
Tangimoana	283	0 to 1	581	217	278	0	2	26	30	18	10
Ormondville	14	0 to 1	66	6	11	0	0	19	26	2	2
Hokio Beach	59	0 to 1	182	49	74	0	1	18	35	0	5
Norsewood	37	0 to 1	63	14	14	1	4	16	13	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	76	18	19	2	3	8	25	0	1
Rātana	68	0 to 1	69	33	20	0	0	5	8	2	1
Mangaweka	20	0 to 1	39	16	7	3	1	1	6	4	1
Ohakea	37	0 to 1	100	13	16	0	0	28	38	3	2
Pongaroa	16	0 to 1	69	11	10	1	2	16	20	3	6
Ōhura	12	0 to 1	71	11	33	1	0	8	16	1	1
National Park	12	0 to 1	44	20	12	4	0	3	0	2	3
Rangataua	15	0 to 1	36	12	12	0	0	4	8	0	0
Mangatainoka	22	0 to 1	147	16	14	1	1	68	45	1	1
Waikawa Beach	13	0 to 1	82	33	42	0	0	2	5	0	0
Mangamutu	10	0 to 1	41	5	7	5	3	10	11	0	0
Koitiata	49	0 to 1	96	43	49	0	0	3	1	0	0
Raurimu	9	0 to 1	35	5	10	0	0	9	11	0	0
Other	2,128	18	5,682	887	869	40	35	1,793	1,742	143	173

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.9: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.2% AEP with Current Climate and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	16,774	22	13,455	7,989	4,069	653	126	214	164	151	89
Whanganui	9,548	16	10,186	5,407	3,635	434	147	158	170	147	88
Levin	7,622	2	7,700	4,196	2,473	421	110	221	162	85	32
Feilding	2,196	0 to 1	2,385	1,176	756	129	60	96	105	35	28
Dannevirke	491	0 to 1	809	252	196	38	18	135	125	32	13
Marton	1,001	3	1,478	567	446	101	56	120	131	41	16
Taumarunui	557	22	836	372	314	32	17	28	39	19	15
Ashhurst	628	0 to 1	697	297	200	21	9	83	77	8	2
Pahiatua	801	0 to 1	1,164	466	349	58	5	117	129	27	13
Foxton	1,112	1	1,463	636	455	50	22	109	128	33	30
Taihape	84	5	183	45	77	4	6	12	30	4	5
Bulls	560	0 to 1	829	298	222	76	27	90	80	16	20
Bunnythorpe	102	0 to 1	255	31	35	3	2	84	86	9	5
Shannon	142	0 to 1	183	62	32	7	6	30	33	5	8
Foxton Beach	422	0 to 1	991	472	452	2	0	11	6	9	39
Woodville	1,014	20	1,560	519	433	35	24	275	248	17	9
Rongotea	219	0 to 1	369	97	84	4	1	86	87	4	6
Linton	61	0 to 1	233	34	15	2	0	42	56	50	34
Halcombe	98	0 to 1	193	27	41	1	5	52	63	2	2
Ohakune	283	0 to 1	635	301	196	27	8	36	57	3	7
Eketāhuna	73	0 to 1	191	19	40	0	2	65	60	3	2
Raetihi	168	0 to 1	259	94	78	10	4	28	40	3	2
Hunterville	163	0 to 1	317	94	70	18	14	41	51	11	18
Sanson	58	0 to 1	115	33	34	15	11	6	13	0	3
Ōhau	91	0 to 1	166	40	44	1	0	35	41	2	3
Tokomaru	57	0 to 1	75	18	17	0	1	20	17	0	2
Kairanga	293	0 to 1	515	94	77	5	0	205	121	7	6
Manakau	123	0 to 1	295	83	67	0	0	51	80	7	7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	81	0 to 1	156	24	11	0	0	45	63	5	8
Waitārere Beach	171	0 to 1	526	210	263	3	1	0	0	8	41
Kai Iwi	21	0 to 1	60	11	10	0	0	11	20	2	6
Himatangi Beach	102	0 to 1	261	92	113	0	0	17	27	3	9
Longburn	120	0 to 1	266	69	58	29	17	45	41	4	3
Waiouru	25	0 to 1	98	28	16	0	2	24	26	1	1
Tangimoana	316	0 to 1	659	247	300	2	4	32	46	16	12
Ormondville	14	0 to 1	68	6	11	0	0	20	26	2	3
Hokio Beach	66	0 to 1	197	55	82	0	1	18	36	0	5
Norsewood	37	0 to 1	65	14	14	1	4	17	14	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	76	18	19	2	3	8	25	0	1
Rātana	76	0 to 1	71	35	20	0	0	4	8	2	2
Mangaweka	20	0 to 1	51	18	11	3	2	3	7	4	3
Ohakea	63	0 to 1	166	31	18	0	0	47	62	5	3
Pongaroa	33	0 to 1	87	17	16	1	2	20	21	4	6
Ōhura	20	0 to 1	82	14	37	1	0	10	18	1	1
National Park	12	0 to 1	47	23	12	4	0	3	0	2	3
Rangataua	18	0 to 1	41	13	16	0	0	4	8	0	0
Mangatainoka	24	0 to 1	152	16	15	1	1	69	48	1	1
Waikawa Beach	16	0 to 1	88	36	45	0	0	2	5	0	0
Mangamutu	10	0 to 1	60	5	7	6	14	12	15	1	0
Koitiata	45	0 to 1	101	44	53	0	0	3	1	0	0
Raurimu	9	0 to 1	37	5	10	0	0	10	12	0	0
Other	2,032	38	5,458	834	900	43	47	1,568	1,711	157	198

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.10: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.1% AEP with Current Climate and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	17,239	22	13,884	8,237	4,193	678	128	233	167	157	91
Whanganui	10,522	29	11,257	5,984	4,024	485	168	167	179	158	92
Levin	7,764	2	7,872	4,286	2,532	428	112	230	166	86	32
Feilding	2,298	0 to 1	2,514	1,232	785	147	67	99	112	38	34
Dannevirke	517	0 to 1	841	264	202	41	19	139	131	32	13
Marton	1,110	4	1,615	626	491	110	57	128	140	45	18
Taumarunui	882	23	1,192	564	451	35	21	32	47	21	21
Ashhurst	643	0 to 1	710	300	207	21	9	85	77	9	2
Pahiatua	828	0 to 1	1,217	482	354	60	5	132	144	27	13
Foxton	1,131	1	1,490	645	462	50	22	116	132	33	30
Taihape	84	6	190	46	77	5	7	14	32	4	5
Bulls	581	0 to 1	862	312	229	77	28	97	83	16	20
Bunnythorpe	109	0 to 1	266	31	36	3	2	89	89	10	6
Shannon	148	0 to 1	192	65	35	7	6	30	34	6	9
Foxton Beach	444	0 to 1	1,023	487	468	2	0	11	6	9	40
Woodville	1,095	29	1,662	557	468	44	28	285	253	18	9
Rongotea	221	0 to 1	390	102	90	4	1	92	91	4	6
Linton	68	0 to 1	238	37	15	2	0	43	56	51	34
Halcombe	113	0 to 1	210	33	42	1	5	55	68	3	3
Ohakune	302	1	670	317	208	27	8	38	60	5	7
Eketāhuna	73	0 to 1	199	19	40	0	2	67	66	3	2
Raetihi	179	0 to 1	266	99	79	10	4	29	40	3	2
Hunterville	192	0 to 1	355	106	81	19	14	48	54	12	21
Sanson	58	0 to 1	118	34	36	15	11	6	13	0	3
Ōhau	97	0 to 1	176	42	47	1	0	37	44	2	3
Tokomaru	57	0 to 1	76	18	17	0	1	21	17	0	2
Kairanga	321	0 to 1	573	108	87	5	0	227	132	7	7
Manakau	129	0 to 1	313	89	70	0	0	56	83	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	81	0 to 1	171	25	12	0	0	53	68	5	8
Waitārere Beach	171	0 to 1	535	216	266	3	1	0	0	8	41
Kai Iwi	21	0 to 1	60	11	10	0	0	11	20	2	6
Himatangi Beach	113	0 to 1	278	99	122	0	0	17	27	3	10
Longburn	120	0 to 1	288	70	59	39	21	48	44	4	3
Waiouru	26	0 to 1	99	28	16	0	2	25	26	1	1
Tangimoana	321	1	673	253	304	2	6	32	48	16	12
Ormondville	14	0 to 1	69	6	11	0	0	21	26	2	3
Hokio Beach	66	0 to 1	201	55	86	0	1	18	36	0	5
Norsewood	37	0 to 1	66	14	14	1	4	17	15	0	1
Kimbolton	26	0 to 1	37	8	9	0	0	7	11	0	2
Ōwhango	26	0 to 1	78	18	19	2	3	10	25	0	1
Rātana	76	0 to 1	71	35	20	0	0	4	8	2	2
Mangaweka	23	0 to 1	58	19	15	3	2	3	9	4	3
Ohakea	72	0 to 1	174	32	21	0	0	49	64	5	3
Pongaroa	40	0 to 1	95	17	17	1	2	24	24	4	6
Ōhura	23	0 to 1	89	17	37	1	1	10	18	3	2
National Park	12	0 to 1	47	23	12	4	0	3	0	2	3
Rangataua	18	0 to 1	42	13	16	0	0	5	8	0	0
Mangatainoka	25	0 to 1	167	18	17	1	1	74	51	2	3
Waikawa Beach	16	0 to 1	94	37	49	0	0	2	6	0	0
Mangamutu	23	0 to 1	81	9	12	7	14	19	18	1	1
Koitiata	45	0 to 1	104	46	54	0	0	3	1	0	0
Raurimu	9	0 to 1	39	5	11	0	0	10	13	0	0
Other	2,278	73	5,968	945	975	46	51	1,728	1,816	186	221

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.11: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +1°C and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	17,005	21	13,683	8,096	4,084	652	124	278	198	159	92
Whanganui	8,905	26	9,547	5,050	3,392	421	141	154	166	139	84
Levin	7,677	2	7,765	4,240	2,491	423	112	223	161	84	31
Feilding	2,211	0 to 1	2,372	1,169	750	125	58	101	111	35	23
Dannevirke	489	0 to 1	803	249	196	38	18	134	123	32	13
Marton	914	2	1,316	490	385	83	43	129	128	42	16
Taumarunui	628	22	904	406	344	32	18	29	40	19	16
Ashhurst	638	0 to 1	691	304	199	21	9	77	71	8	2
Pahiatua	809	0 to 1	1,169	468	349	58	5	119	130	27	13
Foxton	1,098	1	1,440	623	438	50	22	116	124	33	34
Taihape	55	0 to 1	131	32	54	4	4	7	23	3	4
Bulls	395	0 to 1	673	225	171	63	23	91	76	11	13
Bunnythorpe	109	0 to 1	254	32	32	3	1	85	88	8	5
Shannon	145	0 to 1	187	63	34	7	6	30	34	6	7
Foxton Beach	415	0 to 1	967	470	438	2	0	11	6	9	31
Woodville	847	15	1,316	412	363	29	22	249	223	11	7
Rongotea	234	0 to 1	383	111	78	6	1	90	89	2	6
Linton	70	0 to 1	241	37	15	2	0	45	58	50	34
Halcombe	54	0 to 1	108	19	27	1	3	25	33	0	0
Ohakune	278	0 to 1	628	298	194	27	8	35	56	3	7
Eketāhuna	83	0 to 1	204	20	40	0	2	72	65	3	2
Raetihi	168	0 to 1	259	94	78	10	4	28	40	3	2
Hunterville	162	0 to 1	268	80	62	16	13	29	40	11	17
Sanson	64	0 to 1	114	30	31	12	11	13	14	0	3
Ōhau	91	0 to 1	166	39	45	1	0	36	41	2	2
Tokomaru	57	0 to 1	76	18	17	0	1	21	17	0	2
Kairanga	338	0 to 1	559	105	85	5	0	223	128	6	7
Manakau	123	0 to 1	298	84	67	0	0	52	80	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	77	0 to 1	157	21	11	0	0	49	64	4	8
Waitārere Beach	164	0 to 1	497	202	242	3	1	0	0	8	41
Kai Iwi	25	0 to 1	60	11	10	0	0	10	21	2	6
Himatangi Beach	98	0 to 1	257	97	104	0	0	19	25	3	9
Longburn	120	0 to 1	280	69	59	39	21	44	41	4	3
Waiouru	21	0 to 1	84	22	13	1	2	23	22	1	0
Tangimoana	268	0 to 1	559	210	260	0	3	28	28	18	12
Ormondville	14	0 to 1	68	6	11	0	0	20	26	2	3
Hokio Beach	66	0 to 1	195	54	80	0	1	18	36	0	6
Norsewood	37	0 to 1	65	14	14	1	4	17	14	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	76	18	19	2	3	8	25	0	1
Rātana	76	0 to 1	72	35	20	0	0	4	9	2	2
Mangaweka	20	0 to 1	40	16	8	3	1	1	6	4	1
Ohakea	65	0 to 1	138	25	24	0	0	35	49	3	2
Pongaroa	33	0 to 1	87	17	16	1	2	20	21	4	6
Ōhura	16	0 to 1	82	13	37	1	0	10	18	1	2
National Park	12	0 to 1	47	23	12	4	0	3	0	2	3
Rangataua	18	0 to 1	41	13	16	0	0	4	8	0	0
Mangatainoka	22	2	141	16	15	1	1	64	42	1	1
Waikawa Beach	16	0 to 1	88	36	45	0	0	2	5	0	0
Mangamutu	10	0 to 1	58	5	7	6	14	12	13	1	0
Koitiata	49	0 to 1	97	43	50	0	0	3	1	0	0
Raurimu	9	0 to 1	38	5	11	0	0	10	12	0	0
Other	2,074	34	5,447	843	890	41	45	1,582	1,695	155	196

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.12: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +1°C and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	20,530	43	15,909	9,651	4,576	631	129	391	251	178	102
Whanganui	8,928	27	9,589	5,068	3,403	431	143	154	166	140	84
Levin	7,677	2	7,765	4,240	2,491	423	112	223	161	84	31
Feilding	3,133	1	3,270	1,599	1,066	219	75	107	116	54	34
Dannevirke	491	0 to 1	806	249	196	38	18	137	123	32	13
Marton	931	2	1,333	499	388	91	44	125	128	42	16
Taumarunui	727	22	1,009	462	387	32	21	29	39	19	20
Ashhurst	607	0 to 1	668	279	198	18	8	81	73	9	2
Pahiatua	795	0 to 1	1,157	469	349	56	5	114	124	27	13
Foxton	1,109	1	1,452	625	438	50	22	125	125	33	34
Taihape	55	0 to 1	131	32	54	4	4	7	23	3	4
Bulls	398	0 to 1	674	226	171	62	23	92	76	11	13
Bunnythorpe	109	0 to 1	253	32	32	3	1	85	88	7	5
Shannon	160	0 to 1	236	68	38	7	8	48	44	12	11
Foxton Beach	399	0 to 1	907	446	417	1	0	11	6	7	19
Woodville	1,013	18	1,538	516	425	34	24	269	244	17	9
Rongotea	289	0 to 1	469	128	93	6	1	126	107	2	6
Linton	85	0 to 1	264	46	16	2	0	55	61	50	34
Halcombe	54	0 to 1	108	19	27	1	3	25	33	0	0
Ohakune	278	0 to 1	628	298	194	27	8	35	56	3	7
Eketāhuna	73	0 to 1	191	19	40	0	2	64	61	3	2
Raetihi	168	0 to 1	259	94	78	10	4	28	40	3	2
Hunterville	174	0 to 1	292	89	67	18	14	35	41	11	17
Sanson	64	0 to 1	114	30	31	12	11	13	14	0	3
Ōhau	90	0 to 1	161	38	43	1	0	35	40	2	2
Tokomaru	57	0 to 1	77	18	17	0	1	22	17	0	2
Kairanga	411	0 to 1	738	131	100	5	0	306	181	8	7
Manakau	123	0 to 1	298	84	67	0	0	52	80	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	77	0 to 1	157	21	11	0	0	49	64	4	8
Waitārere Beach	164	0 to 1	497	202	242	3	1	0	0	8	41
Kai Iwi	25	0 to 1	60	11	10	0	0	10	21	2	6
Himatangi Beach	98	0 to 1	257	97	104	0	0	19	25	3	9
Longburn	116	0 to 1	283	70	58	39	21	45	43	4	3
Waiouru	21	0 to 1	84	22	13	1	2	23	22	1	0
Tangimoana	295	0 to 1	613	230	290	0	3	30	30	18	12
Ormondville	14	0 to 1	68	6	11	0	0	20	26	2	3
Hokio Beach	66	0 to 1	195	54	80	0	1	18	36	0	6
Norsewood	37	0 to 1	65	14	14	1	4	17	14	0	1
Kimbolton	26	0 to 1	36	8	9	0	0	7	10	0	2
Ōwhango	26	0 to 1	76	18	19	2	3	8	25	0	1
Rātana	76	0 to 1	72	35	20	0	0	4	9	2	2
Mangaweka	20	0 to 1	40	16	8	3	1	1	6	4	1
Ohakea	65	0 to 1	135	24	23	0	0	35	48	3	2
Pongaroa	33	0 to 1	87	17	16	1	2	20	21	4	6
Ōhura	16	0 to 1	82	13	37	1	0	10	18	1	2
National Park	12	0 to 1	47	23	12	4	0	3	0	2	3
Rangataua	18	0 to 1	41	13	16	0	0	4	8	0	0
Mangatainoka	24	2	152	16	15	1	1	69	48	1	1
Waikawa Beach	16	0 to 1	88	36	45	0	0	2	5	0	0
Mangamutu	10	0 to 1	49	5	7	5	7	11	13	1	0
Koitiata	49	0 to 1	97	43	50	0	0	3	1	0	0
Raurimu	9	0 to 1	38	5	11	0	0	10	12	0	0
Other	2,358	37	6,279	982	962	45	46	1,963	1,906	168	207

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.13: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +2°C and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	18,121	26	14,655	8,615	4,355	703	138	341	229	173	101
Whanganui	10,312	62	11,035	5,852	3,951	482	170	162	174	154	90
Levin	7,936	2	8,045	4,386	2,588	432	113	241	168	85	32
Feilding	2,350	0 to 1	2,519	1,246	784	142	63	103	115	37	29
Dannevirke	531	0 to 1	852	266	204	41	19	144	132	33	13
Marton	958	4	1,382	522	396	90	45	136	133	43	17
Taumarunui	1,029	24	1,354	646	512	39	23	36	51	25	22
Ashhurst	669	0 to 1	729	320	212	21	9	87	69	9	2
Pahiatua	838	0 to 1	1,244	489	361	60	5	138	150	28	13
Foxton	1,121	1	1,481	639	446	53	22	124	129	34	34
Taihape	55	4	134	33	54	4	4	8	24	3	4
Bulls	421	0 to 1	720	237	182	72	24	100	79	13	13
Bunnythorpe	115	0 to 1	269	32	34	3	1	91	93	9	6
Shannon	162	0 to 1	204	70	37	7	6	33	36	7	8
Foxton Beach	448	0 to 1	1,008	489	458	2	0	11	6	9	33
Woodville	1,101	42	1,651	557	464	42	26	282	252	19	9
Rongotea	263	0 to 1	408	116	81	6	1	98	98	2	6
Linton	75	0 to 1	254	40	17	2	0	49	59	52	35
Halcombe	54	0 to 1	116	20	29	1	5	26	35	0	0
Ohakune	304	1	685	322	212	28	8	41	61	5	8
Eketāhuna	87	0 to 1	211	22	43	0	2	72	67	3	2
Raetihi	184	0 to 1	269	102	79	10	4	29	40	3	2
Hunterville	176	0 to 1	292	89	65	18	14	33	43	12	18
Sanson	64	0 to 1	115	31	31	12	11	13	14	0	3
Ōhau	97	0 to 1	179	42	51	1	0	37	43	2	3
Tokomaru	57	0 to 1	77	18	18	0	1	21	17	0	2
Kairanga	392	0 to 1	683	122	93	5	0	284	166	6	7
Manakau	136	0 to 1	322	91	74	0	0	58	84	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	84	0 to 1	173	25	11	0	0	55	69	5	8
Waitārere Beach	171	0 to 1	521	210	258	3	1	0	0	8	41
Kai Iwi	21	0 to 1	61	11	10	0	0	12	20	2	6
Himatangi Beach	105	0 to 1	279	105	113	0	0	19	26	3	13
Longburn	120	0 to 1	283	69	59	39	21	47	41	4	3
Waiouru	21	0 to 1	89	22	14	1	2	27	22	1	0
Tangimoana	290	0 to 1	596	223	279	1	3	28	31	19	12
Ormondville	14	0 to 1	71	7	11	0	0	21	27	2	3
Hokio Beach	66	0 to 1	203	55	85	0	1	18	37	0	7
Norsewood	37	0 to 1	67	14	14	1	4	18	15	0	1
Kimbolton	26	0 to 1	37	8	9	0	0	7	11	0	2
Ōwhango	29	0 to 1	82	19	22	2	3	10	25	0	1
Rātana	76	0 to 1	72	35	20	0	0	4	9	2	2
Mangaweka	23	0 to 1	42	17	9	3	1	1	6	4	1
Ohakea	75	0 to 1	149	27	24	0	0	37	56	3	2
Pongaroa	40	0 to 1	95	17	17	1	2	24	24	4	6
Ōhura	23	0 to 1	93	17	38	1	1	11	19	4	2
National Park	12	0 to 1	47	23	12	4	0	3	0	2	3
Rangataua	18	0 to 1	41	13	16	0	0	4	8	0	0
Mangatainoka	31	2	172	21	20	1	1	74	49	3	3
Waikawa Beach	16	0 to 1	96	37	50	0	0	2	7	0	0
Mangamutu	33	0 to 1	91	12	13	8	16	21	19	1	1
Koitiata	49	0 to 1	98	43	51	0	0	3	1	0	0
Raurimu	9	0 to 1	39	5	11	0	0	10	13	0	0
Other	2,322	70	6,111	967	989	41	50	1,812	1,845	182	225

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.14: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +2°C and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	26,805	72	20,513	12,647	5,923	723	141	444	274	239	122
Whanganui	10,312	64	11,036	5,853	3,951	483	170	162	174	153	90
Levin	7,936	2	8,045	4,386	2,588	432	113	241	168	85	32
Feilding	3,312	1	3,444	1,695	1,119	225	78	111	118	59	39
Dannevirke	533	0 to 1	854	266	204	41	19	146	132	33	13
Marton	985	4	1,404	536	405	93	46	133	131	43	17
Taumarunui	1,065	24	1,418	680	544	39	23	36	51	24	21
Ashhurst	640	0 to 1	705	295	208	19	8	91	72	10	2
Pahiatua	847	0 to 1	1,231	491	362	60	5	133	139	28	13
Foxton	1,128	1	1,487	640	445	54	22	128	130	34	34
Taihape	55	4	134	33	54	4	4	8	24	3	4
Bulls	422	0 to 1	724	239	183	72	24	100	80	13	13
Bunnythorpe	115	0 to 1	267	32	34	3	1	91	92	8	6
Shannon	177	0 to 1	251	75	41	7	8	53	44	12	11
Foxton Beach	416	0 to 1	922	453	425	1	0	11	6	7	19
Woodville	1,114	42	1,671	572	466	42	26	283	255	19	8
Rongotea	298	0 to 1	484	130	93	6	1	130	116	2	6
Linton	87	0 to 1	274	49	17	2	0	57	62	52	35
Halcombe	54	0 to 1	116	20	29	1	5	26	35	0	0
Ohakune	304	1	685	322	212	28	8	41	61	5	8
Eketāhuna	87	0 to 1	211	22	43	0	2	72	67	3	2
Raetihi	184	0 to 1	269	102	79	10	4	29	40	3	2
Hunterville	183	0 to 1	305	94	69	18	14	37	43	12	18
Sanson	64	0 to 1	115	31	31	12	11	13	14	0	3
Ōhau	96	0 to 1	174	41	49	1	0	36	42	2	3
Tokomaru	58	0 to 1	81	18	18	0	1	24	18	0	2
Kairanga	429	1	774	135	104	5	0	321	194	8	7
Manakau	136	0 to 1	322	91	74	0	0	58	84	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	84	0 to 1	172	25	11	0	0	55	68	5	8
Waitārere Beach	171	0 to 1	521	210	258	3	1	0	0	8	41
Kai Iwi	21	0 to 1	61	11	10	0	0	12	20	2	6
Himatangi Beach	105	0 to 1	279	105	113	0	0	19	26	3	13
Longburn	116	0 to 1	284	70	58	39	21	46	43	4	3
Waiouru	21	0 to 1	89	22	14	1	2	27	22	1	0
Tangimoana	309	0 to 1	629	240	294	0	3	30	32	18	12
Ormondville	14	0 to 1	71	7	11	0	0	21	27	2	3
Hokio Beach	66	0 to 1	203	55	85	0	1	18	37	0	7
Norsewood	37	0 to 1	67	14	14	1	4	18	15	0	1
Kimbolton	26	0 to 1	37	8	9	0	0	7	11	0	2
Ōwhango	29	0 to 1	82	19	22	2	3	10	25	0	1
Rātana	76	0 to 1	72	35	20	0	0	4	9	2	2
Mangaweka	23	0 to 1	42	17	9	3	1	1	6	4	1
Ohakea	75	0 to 1	148	27	24	0	0	37	55	3	2
Pongaroa	40	0 to 1	95	17	17	1	2	24	24	4	6
Ōhura	23	0 to 1	93	17	38	1	1	11	19	4	2
National Park	12	0 to 1	47	23	12	4	0	3	0	2	3
Rangataua	18	0 to 1	41	13	16	0	0	4	8	0	0
Mangatainoka	33	2	174	22	21	1	1	74	49	3	3
Waikawa Beach	16	0 to 1	96	37	50	0	0	2	7	0	0
Mangamutu	42	0 to 1	97	21	14	7	14	20	19	1	1
Koitiata	49	0 to 1	98	43	51	0	0	3	1	0	0
Raurimu	15	0 to 1	42	5	11	0	0	10	16	0	0
Other	2,600	72	6,903	1,098	1,064	45	51	2,166	2,045	194	240

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.15: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +3°C and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	20,238	32	16,287	9,604	4,782	781	142	412	267	191	108
Whanganui	12,027	126	12,706	6,825	4,528	534	188	170	183	176	102
Levin	8,255	3	8,347	4,550	2,687	441	119	252	178	86	34
Feilding	2,489	0 to 1	2,685	1,321	829	161	73	108	122	39	32
Dannevirke	582	0 to 1	905	280	219	44	21	155	137	35	14
Marton	1,038	4	1,478	568	426	97	48	142	136	44	17
Taumarunui	1,199	29	1,608	777	605	47	27	44	55	31	22
Ashhurst	704	0 to 1	761	333	222	21	9	93	71	10	2
Pahiatua	891	0 to 1	1,340	508	386	65	7	163	167	28	16
Foxton	1,148	1	1,514	649	455	54	23	132	133	34	34
Taihape	55	6	137	34	54	4	4	8	26	3	4
Bulls	445	0 to 1	754	252	194	72	24	105	81	13	13
Bunnythorpe	129	0 to 1	276	32	38	3	1	94	93	9	6
Shannon	172	0 to 1	226	77	38	9	6	40	37	10	9
Foxton Beach	477	0 to 1	1,054	506	477	3	0	14	6	9	39
Woodville	1,031	50	1,577	523	439	35	24	279	250	18	9
Rongotea	274	0 to 1	440	124	88	6	1	109	103	3	6
Linton	77	0 to 1	268	39	20	3	0	52	62	56	36
Halcombe	54	0 to 1	121	21	29	1	5	28	36	0	1
Ohakune	316	1	731	340	225	33	10	43	67	5	8
Eketāhuna	99	2	245	24	45	1	2	85	83	3	2
Raetihi	188	0 to 1	280	105	82	10	4	30	44	3	2
Hunterville	184	0 to 1	312	96	72	18	14	37	44	12	19
Sanson	64	0 to 1	116	32	31	12	11	13	14	0	3
Ōhau	110	0 to 1	203	49	58	1	0	43	47	2	3
Tokomaru	57	0 to 1	78	18	19	0	1	21	17	0	2
Kairanga	413	1	752	131	100	7	0	311	189	7	7
Manakau	143	0 to 1	338	91	79	0	0	62	91	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	85	0 to 1	184	27	12	0	0	58	73	6	8
Waitārere Beach	182	0 to 1	540	221	266	3	1	0	0	8	41
Kai Iwi	21	0 to 1	62	11	11	0	0	12	20	2	6
Himatangi Beach	109	0 to 1	303	116	125	0	0	19	27	3	13
Longburn	116	0 to 1	286	70	59	39	21	47	43	4	3
Waiouru	24	0 to 1	97	25	14	1	2	29	25	1	0
Tangimoana	303	0 to 1	620	235	285	2	4	29	34	19	12
Ormondville	25	0 to 1	78	9	12	0	0	23	29	2	3
Hokio Beach	75	0 to 1	211	58	88	0	1	19	38	0	7
Norsewood	37	0 to 1	67	14	14	1	4	18	15	0	1
Kimbolton	26	0 to 1	37	8	9	0	0	7	11	0	2
Ōwhango	29	0 to 1	85	20	22	2	4	11	25	0	1
Rātana	76	0 to 1	71	35	20	0	0	4	8	2	2
Mangaweka	23	0 to 1	43	17	9	3	1	1	7	4	1
Ohakea	79	0 to 1	162	29	28	0	0	39	60	4	2
Pongaroa	45	1	101	19	19	1	2	26	24	4	6
Ōhura	23	0 to 1	99	18	39	1	1	11	23	4	2
National Park	12	0 to 1	48	23	13	4	0	3	0	2	3
Rangataua	18	0 to 1	43	13	17	0	0	5	8	0	0
Mangatainoka	45	6	210	38	29	1	9	72	53	4	4
Waikawa Beach	21	0 to 1	104	42	53	0	0	2	7	0	0
Mangamutu	41	0 to 1	107	24	18	9	16	20	18	1	1
Koitiata	49	0 to 1	101	45	52	0	0	3	1	0	0
Raurimu	15	0 to 1	45	5	12	0	2	10	16	0	0
Other	2,534	119	6,629	1,072	1,065	51	52	1,985	1,964	195	245

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.16: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +3°C and Defences Down

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	31,087	108	23,632	14,631	6,845	802	146	473	305	281	149
Whanganui	12,027	127	12,696	6,824	4,524	532	185	170	183	176	102
Levin	8,255	3	8,347	4,550	2,687	441	119	252	178	86	34
Feilding	3,458	1	3,612	1,781	1,173	235	83	113	124	62	41
Dannevirke	584	0 to 1	909	280	219	44	21	157	139	35	14
Marton	1,080	4	1,508	580	437	101	52	141	135	44	18
Taumarunui	1,224	30	1,628	787	616	47	27	44	55	30	22
Ashhurst	679	0 to 1	751	315	221	20	9	97	76	11	2
Pahiatua	892	0 to 1	1,331	508	389	65	6	154	166	28	15
Foxton	1,161	1	1,520	652	456	54	23	133	134	34	34
Taihape	55	6	137	34	54	4	4	8	26	3	4
Bulls	446	0 to 1	758	255	195	72	24	105	81	13	13
Bunnythorpe	129	0 to 1	274	32	38	3	1	94	92	8	6
Shannon	184	0 to 1	263	81	45	8	8	54	44	12	11
Foxton Beach	424	0 to 1	934	458	428	2	0	14	6	7	19
Woodville	1,167	54	1,773	613	487	58	32	293	260	20	10
Rongotea	307	0 to 1	506	137	99	6	1	135	119	3	6
Linton	87	0 to 1	283	48	18	3	0	59	63	56	36
Halcombe	54	0 to 1	120	21	29	1	5	28	36	0	0
Ohakune	316	1	731	340	225	33	10	43	67	5	8
Eketāhuna	89	0 to 1	233	23	45	1	2	77	80	3	2
Raetihi	188	0 to 1	280	105	82	10	4	30	44	3	2
Hunterville	188	0 to 1	315	97	73	18	14	39	44	12	18
Sanson	64	0 to 1	116	32	31	12	11	13	14	0	3
Ōhau	109	0 to 1	199	48	56	1	0	42	47	2	3
Tokomaru	58	0 to 1	86	19	19	0	1	26	19	0	2
Kairanga	438	1	805	138	105	7	0	336	204	8	7
Manakau	143	0 to 1	338	91	79	0	0	62	91	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	85	0 to 1	184	27	12	0	0	58	73	6	8
Waitārere Beach	182	0 to 1	540	221	266	3	1	0	0	8	41
Kai Iwi	21	0 to 1	62	11	11	0	0	12	20	2	6
Himatangi Beach	109	0 to 1	303	116	125	0	0	19	27	3	13
Longburn	120	0 to 1	286	70	58	39	21	47	44	4	3
Waiouru	24	0 to 1	97	25	14	1	2	29	25	1	0
Tangimoana	316	1	638	243	295	2	4	30	34	18	12
Ormondville	25	0 to 1	77	9	12	0	0	23	28	2	3
Hokio Beach	75	0 to 1	211	58	88	0	1	19	38	0	7
Norsewood	37	0 to 1	67	14	14	1	4	18	15	0	1
Kimbolton	26	0 to 1	37	8	9	0	0	7	11	0	2
Ōwhango	29	0 to 1	85	20	22	2	4	11	25	0	1
Rātana	76	0 to 1	71	35	20	0	0	4	8	2	2
Mangaweka	23	0 to 1	43	17	9	3	1	1	7	4	1
Ohakea	79	0 to 1	162	29	28	0	0	39	60	4	2
Pongaroa	45	1	101	19	19	1	2	26	24	4	6
Ōhura	23	0 to 1	99	18	39	1	1	11	23	4	2
National Park	12	0 to 1	48	23	13	4	0	3	0	2	3
Rangataua	18	0 to 1	43	13	17	0	0	5	8	0	0
Mangatainoka	46	6	222	37	29	2	8	76	62	4	4
Waikawa Beach	21	0 to 1	103	41	53	0	0	2	7	0	0
Mangamutu	44	0 to 1	119	24	20	8	16	23	26	1	1
Koitiata	49	0 to 1	101	45	52	0	0	3	1	0	0
Raurimu	15	0 to 1	45	5	12	0	2	10	16	0	0
Other	2,796	122	7,372	1,199	1,136	55	52	2,309	2,153	210	258

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.8.17: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Palmerston North	20,238	32	16,287	9,604	4,782	781	142	412	267	191	108
Whanganui	12,135	128	12,861	6,877	4,606	549	193	171	184	177	104
Levin	8,255	3	8,347	4,550	2,687	441	119	252	178	86	34
Feilding	2,489	0 to 1	2,684	1,321	828	161	73	108	122	39	32
Dannevirke	582	0 to 1	905	280	219	44	21	155	137	35	14
Marton	1,038	4	1,478	568	426	97	48	142	136	44	17
Taumarunui	1,199	29	1,608	777	605	47	27	44	55	31	22
Ashhurst	704	0 to 1	761	333	222	21	9	93	71	10	2
Pahiatua	891	0 to 1	1,340	508	386	65	7	163	167	28	16
Foxton	1,144	1	1,509	649	455	54	23	127	133	34	34
Taihape	55	6	137	34	54	4	4	8	26	3	4
Bulls	445	0 to 1	754	252	194	72	24	105	81	13	13
Bunnythorpe	129	0 to 1	277	32	39	3	1	94	93	9	6
Shannon	169	0 to 1	225	77	37	9	6	40	37	10	9
Foxton Beach	523	0 to 1	1,148	564	508	3	0	14	6	9	44
Woodville	1,031	50	1,577	523	439	35	24	279	250	18	9
Rongotea	274	0 to 1	440	124	88	6	1	109	103	3	6
Linton	77	0 to 1	268	39	20	3	0	52	62	56	36
Halcombe	54	0 to 1	121	21	29	1	5	28	36	0	1
Ohakune	316	1	731	340	225	33	10	43	67	5	8
Eketāhuna	99	2	245	24	45	1	2	85	83	3	2
Raetihi	188	0 to 1	280	105	82	10	4	30	44	3	2
Hunterville	184	0 to 1	312	96	72	18	14	37	44	12	19
Sanson	64	0 to 1	116	32	31	12	11	13	14	0	3
Ōhau	110	0 to 1	203	49	58	1	0	43	47	2	3
Tokomaru	57	0 to 1	78	18	19	0	1	21	17	0	2
Kairanga	413	1	752	131	100	7	0	311	189	7	7
Manakau	143	0 to 1	339	92	79	0	0	62	91	7	8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total population exposed to flooding	Total number of fatalities	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number of residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Pohangina	85	0 to 1	184	27	12	0	0	58	73	6	8
Waitārere Beach	173	0 to 1	536	212	271	3	1	0	0	8	41
Kai Iwi	21	0 to 1	62	11	11	0	0	12	20	2	6
Himatangi Beach	109	0 to 1	300	118	121	0	0	19	26	3	13
Longburn	116	0 to 1	286	70	59	39	21	47	43	4	3
Waiouru	24	0 to 1	97	25	14	1	2	29	25	1	0
Tangimoana	303	0 to 1	621	235	285	2	4	29	35	19	12
Ormondville	25	0 to 1	78	9	12	0	0	23	29	2	3
Hokio Beach	75	0 to 1	211	58	88	0	1	19	38	0	7
Norsewood	37	0 to 1	67	14	14	1	4	18	15	0	1
Kimbolton	26	0 to 1	37	8	9	0	0	7	11	0	2
Ōwhango	29	0 to 1	85	20	22	2	4	11	25	0	1
Rātana	76	0 to 1	71	35	20	0	0	4	8	2	2
Mangaweka	23	0 to 1	43	17	9	3	1	1	7	4	1
Ohakea	79	0 to 1	162	29	28	0	0	39	60	4	2
Pongaroa	45	1	101	19	19	1	2	26	24	4	6
Ōhura	23	0 to 1	99	18	39	1	1	11	23	4	2
National Park	12	0 to 1	48	23	13	4	0	3	0	2	3
Rangataua	18	0 to 1	43	13	17	0	0	5	8	0	0
Mangatainoka	45	6	210	38	29	1	9	72	53	4	4
Waikawa Beach	21	0 to 1	104	42	53	0	0	2	7	0	0
Mangamutu	41	0 to 1	107	24	18	9	16	20	18	1	1
Koitiata	48	0 to 1	113	49	60	0	0	3	1	0	0
Raurimu	15	0 to 1	45	5	12	0	2	10	16	0	0
Other	2,539	119	6,633	1,077	1,068	52	53	1,980	1,964	193	246

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.1: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 5% AEP with Current Climate and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	22.53	0.02	22.57	23.16	24.36	25.88	23.96	7.79	9.52	17.41	21.41
Whanganui	18.44	0.01	19.04	18.94	19.76	22.03	34.76	9.47	12.69	21.5	27.09
Levin	42.42	0.01	39.1	42.7	39.02	63.68	59.88	13.21	16.02	50.98	45.45
Feilding	11.75	0.0	13.73	12.89	14.39	22.35	39.69	7.83	13.47	15.66	22.78
Dannevirke	6.22	0.0	7.31	6.97	7.9	9.91	13.13	5.69	7.37	13.17	10.59
Marton	12.17	0.0	12.78	13.34	14.27	24.26	33.33	7.51	9.6	18.93	10.47
Taumarunui	8.99	0.11	9.84	9.01	13.15	11.27	8.86	4.07	6.74	12.5	15.25
Ashhurst	13.53	0.0	13.09	15.72	14.46	50.0	30.77	7.3	7.98	18.75	14.29
Pahiatua	20.9	0.01	18.48	26.88	27.85	35.17	14.29	6.17	8.13	28.95	15.87
Foxton	31.87	0.03	29.15	33.89	33.17	31.21	36.0	15.8	19.13	32.98	35.53
Taihape	2.12	0.01	2.4	2.36	4.86	1.74	4.17	0.51	2.0	2.75	3.06
Bulls	14.34	0.01	14.87	14.75	16.26	8.23	9.62	13.78	16.39	10.61	30.77
Bunnythorpe	5.37	0.0	7.87	4.77	6.77	18.75	11.11	6.67	11.52	17.39	16.67
Shannon	6.69	0.0	5.52	5.62	3.11	10.71	20.69	5.84	8.33	5.45	9.09
Foxton Beach	21.65	0.01	26.16	25.53	28.3	20.0	0.0	19.15	13.89	31.82	16.67
Woodville	30.69	0.12	31.08	24.27	27.96	27.94	33.33	38.65	42.3	16.36	15.91
Rongotea	11.58	0.01	10.68	12.17	11.79	11.9	11.11	7.91	11.92	0.0	17.65
Linton	3.3	0.0	8.61	4.73	3.64	4.76	0.0	6.35	11.4	17.37	23.08
Halcombe	2.99	0.0	3.4	3.31	5.14	5.56	18.18	1.96	4.62	0.0	0.0
Ohakune	15.82	0.01	14.84	15.75	17.96	17.43	14.29	5.75	13.18	5.41	21.43
Eketāhuna	4.79	0.0	5.85	4.29	8.57	0.0	12.5	5.48	6.16	5.36	5.71
Raetihi	11.52	0.01	11.0	13.32	15.07	8.96	6.06	6.81	8.91	7.32	3.57
Hunterville	10.41	0.01	7.1	11.61	12.21	26.32	48.0	1.4	3.61	13.33	20.0
Sanson	5.3	0.0	7.56	6.03	9.21	24.49	42.31	3.1	6.63	0.0	8.33
Ōhau	7.89	0.0	8.76	6.78	8.99	12.5	0.0	7.62	12.14	12.5	13.33
Tokomaru	6.47	0.01	5.61	4.49	5.0	0.0	11.11	6.15	7.82	0.0	10.0
Kairanga	17.39	0.01	16.7	21.3	17.14	7.69	0.0	14.84	15.74	29.41	33.33
Manakau	13.02	0.0	15.47	16.8	16.3	0.0	0.0	10.02	18.84	18.52	25.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	7.23	0.01	6.42	9.35	2.5	0.0	0.0	4.99	7.54	2.04	20.0
Waitārere Beach	16.77	0.02	18.74	15.18	19.66	25.0	0.0	0.0	0.0	40.0	55.56
Kai Iwi	4.26	0.0	5.81	6.02	7.3	0.0	0.0	3.34	7.19	2.38	10.0
Himatangi Beach	14.45	0.01	17.0	14.86	15.16	0.0	0.0	28.0	51.16	28.57	11.11
Longburn	14.26	0.01	17.83	16.17	20.9	20.2	20.97	12.92	22.4	6.67	11.11
Waiouru	3.91	0.0	7.24	6.79	8.33	0.0	11.76	6.86	7.49	33.33	0.0
Tangimoana	30.69	0.03	30.34	36.2	45.79	0.0	9.09	7.39	13.73	43.75	47.62
Ormondville	3.17	0.0	5.48	3.5	5.98	0.0	0.0	4.39	7.19	10.0	6.25
Hokio Beach	9.38	0.01	16.76	14.18	23.19	0.0	100.0	7.51	20.95	0.0	18.52
Norsewood	8.82	0.0	7.58	10.94	13.33	14.29	57.14	4.39	6.47	0.0	4.17
Kimbolton	5.74	0.01	4.69	4.26	5.84	0.0	0.0	3.08	6.57	0.0	8.0
Ōwhango	6.36	0.0	6.78	9.58	14.84	18.18	15.79	2.22	6.6	0.0	0.0
Rātana	20.06	0.02	18.21	19.51	20.41	0.0	0.0	7.55	20.83	22.22	20.0
Mangaweka	4.72	0.0	2.78	8.66	4.59	8.33	0.0	0.3	0.98	11.43	4.0
Ohakea	9.0	0.0	9.51	6.85	13.48	0.0	0.0	6.95	10.81	30.0	22.22
Pongaroa	6.71	0.0	6.13	7.38	15.38	8.33	28.57	3.08	5.61	4.76	11.76
Ōhura	4.95	0.0	7.99	10.61	13.56	20.0	0.0	3.52	6.81	4.0	0.0
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.0	6.38	4.76	8.7	0.0	0.0	3.16	10.94	0.0	0.0
Mangatainoka	13.14	0.11	21.86	18.28	13.79	4.76	4.35	31.89	22.93	14.29	0.0
Waikawa Beach	5.77	0.0	12.04	9.32	14.83	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	12.94	4.76	11.43	41.67	66.67	6.45	13.0	0.0	0.0
Koitiata	33.58	0.05	30.13	29.08	31.29	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	6.4	0.0	7.36	2.2	9.52	0.0	0.0	9.41	9.24	0.0	0.0
Other	8.73	0.01	8.5	10.56	13.28	10.82	15.26	6.18	8.75	7.37	9.22

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.2: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 5% AEP with Current Climate and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	17.55	0.01	17.9	18.03	18.99	23.22	20.28	8.49	10.32	13.81	18.35
Whanganui	18.27	0.01	18.81	18.78	19.62	21.2	31.1	9.47	12.69	21.09	23.9
Levin	42.42	0.01	39.1	42.7	39.02	63.68	59.88	13.21	16.02	50.98	45.45
Feilding	16.84	0.0	19.67	18.45	21.33	38.35	48.85	9.52	14.24	21.69	37.97
Dannevirke	6.22	0.0	7.35	6.97	7.9	9.91	13.13	5.86	7.37	13.17	10.59
Marton	12.95	0.01	13.19	14.06	14.58	25.53	33.33	7.58	9.6	18.93	12.79
Taumarunui	8.91	0.11	9.66	8.83	12.82	11.27	8.86	4.07	6.74	12.5	15.25
Ashhurst	12.91	0.0	12.39	14.76	14.18	38.1	26.92	6.52	8.15	18.75	14.29
Pahiatua	20.87	0.01	18.36	26.68	27.94	35.17	14.29	6.01	7.93	28.95	15.87
Foxton	32.17	0.03	29.56	34.02	33.42	31.21	36.0	17.22	19.85	31.91	36.84
Taihape	2.12	0.01	2.4	2.36	4.86	1.74	4.17	0.51	2.0	2.75	3.06
Bulls	14.54	0.01	15.19	15.06	16.39	8.23	9.62	14.25	17.38	10.61	30.77
Bunnythorpe	5.37	0.0	7.83	4.77	6.77	18.75	11.11	6.67	11.52	15.22	16.67
Shannon	7.05	0.0	7.21	5.97	3.25	10.71	20.69	10.65	14.04	16.36	11.36
Foxton Beach	21.24	0.01	25.36	24.86	27.49	20.0	0.0	19.15	13.89	27.27	14.29
Woodville	31.46	0.12	31.78	25.51	29.24	27.94	33.33	38.65	42.51	14.55	15.91
Rongotea	15.56	0.02	14.94	15.43	15.47	11.9	11.11	12.47	17.57	7.14	35.29
Linton	3.59	0.0	9.46	6.11	3.64	4.76	0.0	7.43	12.59	17.37	23.08
Halcombe	2.99	0.0	3.4	3.31	5.14	5.56	18.18	1.96	4.62	0.0	0.0
Ohakune	15.82	0.01	14.84	15.75	17.96	17.43	14.29	5.75	13.18	5.41	21.43
Eketāhuna	4.79	0.0	5.89	4.29	8.57	0.0	12.5	5.58	6.16	5.36	5.71
Raetihi	11.52	0.01	11.0	13.32	15.07	8.96	6.06	6.81	8.91	7.32	3.57
Hunterville	12.06	0.01	8.34	14.22	14.83	31.58	52.0	1.66	4.22	13.33	21.43
Sanson	5.3	0.0	7.56	6.03	9.21	24.49	42.31	3.1	6.63	0.0	8.33
Ōhau	7.78	0.0	8.69	6.78	8.99	12.5	0.0	7.28	12.14	12.5	13.33
Tokomaru	6.96	0.01	5.51	3.59	5.0	0.0	11.11	7.38	7.26	0.0	10.0
Kairanga	32.74	0.05	29.41	33.21	32.38	7.69	0.0	29.52	26.39	29.41	33.33
Manakau	13.02	0.0	15.47	16.8	16.3	0.0	0.0	10.02	18.84	18.52	25.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	7.23	0.01	6.42	9.35	2.5	0.0	0.0	4.99	7.54	2.04	20.0
Waitārere Beach	16.77	0.02	18.74	15.18	19.66	25.0	0.0	0.0	0.0	40.0	55.56
Kai Iwi	4.26	0.0	5.81	6.02	7.3	0.0	0.0	3.34	7.19	2.38	10.0
Himatangi Beach	14.45	0.01	17.0	14.86	15.16	0.0	0.0	28.0	51.16	28.57	11.11
Longburn	16.96	0.01	25.13	19.92	27.68	38.38	30.65	18.54	28.0	26.67	33.33
Waiouru	3.91	0.0	7.24	6.79	8.33	0.0	11.76	6.86	7.49	33.33	0.0
Tangimoana	26.73	0.02	27.55	32.05	41.85	0.0	9.09	7.83	13.73	40.62	28.57
Ormondville	3.17	0.0	5.48	3.5	5.98	0.0	0.0	4.39	7.19	10.0	6.25
Hokio Beach	9.38	0.01	16.76	14.18	23.19	0.0	100.0	7.51	20.95	0.0	18.52
Norsewood	8.82	0.0	7.58	10.94	13.33	14.29	57.14	4.39	6.47	0.0	4.17
Kimbolton	5.74	0.01	4.69	4.26	5.84	0.0	0.0	3.08	6.57	0.0	8.0
Ōwhango	6.36	0.0	6.78	9.58	14.84	18.18	15.79	2.22	6.6	0.0	0.0
Rātana	20.06	0.02	18.21	19.51	20.41	0.0	0.0	7.55	20.83	22.22	20.0
Mangaweka	4.72	0.0	2.78	8.66	4.59	8.33	0.0	0.3	0.98	11.43	4.0
Ohakea	9.0	0.0	9.51	6.85	13.48	0.0	0.0	6.95	10.81	30.0	22.22
Pongaroa	6.71	0.0	6.13	7.38	15.38	8.33	28.57	3.08	5.61	4.76	11.76
Ōhura	4.95	0.0	7.99	10.61	13.56	20.0	0.0	3.52	6.81	4.0	0.0
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.0	6.38	4.76	8.7	0.0	0.0	3.16	10.94	0.0	0.0
Mangatainoka	13.14	0.11	21.86	18.28	13.79	4.76	4.35	31.89	22.93	14.29	0.0
Waikawa Beach	5.77	0.0	12.04	9.32	14.83	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	9.71	4.76	14.29	33.33	11.11	6.45	12.0	0.0	0.0
Koitiata	33.58	0.05	30.13	29.08	31.29	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	6.4	0.0	7.36	2.2	9.52	0.0	0.0	9.41	9.24	0.0	0.0
Other	10.73	0.02	10.56	13.66	15.63	11.48	15.26	8.58	10.35	7.77	9.55

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.3: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 2% AEP with Current Climate and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	24.5	0.03	24.64	25.2	26.57	29.41	25.58	8.54	10.65	19.71	24.16
Whanganui	19.75	0.02	20.42	20.4	21.03	23.61	35.67	10.35	13.84	24.01	28.69
Levin	44.8	0.01	41.25	44.81	41.15	67.4	63.58	15.28	17.48	52.29	46.97
Feilding	12.99	0.0	15.29	14.5	15.88	23.53	42.75	9.28	14.86	16.87	25.32
Dannevirke	6.57	0.0	7.93	7.56	8.45	10.53	18.18	6.14	7.84	14.97	11.76
Marton	13.74	0.01	13.95	14.79	15.39	26.38	32.46	8.32	10.48	19.53	15.12
Taumarunui	9.8	0.22	10.96	10.2	14.81	11.27	10.13	4.52	6.98	13.64	15.25
Ashhurst	14.83	0.0	14.38	17.38	15.8	50.0	30.77	7.82	9.34	21.88	14.29
Pahiatua	22.36	0.01	19.88	28.42	30.24	37.24	14.29	6.74	9.25	31.58	15.87
Foxton	33.02	0.03	30.34	35.51	33.91	32.62	42.0	16.59	20.4	32.98	35.53
Taihape	2.12	0.01	2.52	2.45	5.19	1.74	4.17	0.61	2.0	2.75	3.06
Bulls	15.9	0.01	16.98	17.21	17.29	9.49	11.54	17.1	19.67	10.61	30.77
Bunnythorpe	6.24	0.0	8.58	5.5	6.77	18.75	11.11	7.74	12.29	17.39	16.67
Shannon	7.16	0.0	6.41	5.97	3.68	10.71	20.69	7.56	11.4	5.45	11.36
Foxton Beach	22.59	0.01	27.31	26.57	29.55	20.0	0.0	19.15	16.67	31.82	18.25
Woodville	39.1	0.21	37.81	34.76	38.52	32.35	42.42	40.55	43.94	16.36	15.91
Rongotea	13.57	0.01	12.34	13.65	12.34	11.9	11.11	9.79	14.02	7.14	35.29
Linton	3.74	0.0	9.33	5.33	4.73	9.52	0.0	6.35	11.64	19.49	25.64
Halcombe	2.99	0.0	3.61	3.31	5.71	5.56	27.27	2.07	4.78	0.0	0.0
Ohakune	18.16	0.01	16.69	17.81	20.3	20.18	16.33	7.12	13.5	5.41	21.43
Eketāhuna	6.01	0.0	6.11	4.08	8.83	0.0	12.5	5.68	6.84	5.36	5.71
Raetihi	12.19	0.01	11.47	13.7	15.53	11.94	9.09	6.54	9.67	7.32	3.57
Hunterville	11.86	0.01	8.87	14.69	14.53	34.21	52.0	2.17	5.12	13.33	22.86
Sanson	5.53	0.0	7.87	6.58	9.21	24.49	42.31	3.79	6.63	0.0	8.33
Ōhau	8.7	0.0	9.53	7.75	9.52	12.5	0.0	8.61	12.86	12.5	13.33
Tokomaru	6.96	0.01	5.89	4.79	5.38	0.0	11.11	5.74	8.94	0.0	10.0
Kairanga	22.59	0.01	20.81	26.35	24.29	7.69	0.0	18.86	18.4	29.41	33.33
Manakau	13.56	0.0	16.73	18.7	17.24	0.0	0.0	10.51	20.22	18.52	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	7.52	0.01	7.2	12.15	5.0	0.0	0.0	5.3	8.2	4.08	20.0
Waitārere Beach	20.03	0.03	22.48	18.97	22.83	25.0	0.0	0.0	0.0	60.0	64.81
Kai Iwi	4.26	0.0	5.81	6.02	7.3	0.0	0.0	3.34	7.19	2.38	10.0
Himatangi Beach	15.02	0.01	18.63	15.86	16.6	0.0	0.0	32.0	55.81	28.57	22.22
Longburn	15.8	0.01	19.23	17.29	23.73	23.23	22.58	13.48	22.4	6.67	11.11
Waiouru	3.91	0.0	7.76	8.14	8.33	5.88	11.76	7.19	7.49	33.33	0.0
Tangimoana	33.07	0.03	33.3	39.47	51.12	0.0	9.09	8.26	15.03	43.75	47.62
Ormondville	3.17	0.0	5.85	3.5	5.98	0.0	0.0	4.65	7.78	10.0	12.5
Hokio Beach	12.1	0.01	18.52	16.04	25.36	0.0	100.0	8.67	22.97	0.0	18.52
Norsewood	9.89	0.0	7.95	10.94	13.33	14.29	57.14	5.41	6.47	0.0	4.17
Kimbolton	5.74	0.01	4.83	4.26	5.84	0.0	0.0	3.08	7.3	0.0	8.0
Ōwhango	7.51	0.0	6.98	10.18	14.84	18.18	15.79	2.22	6.92	0.0	0.0
Rātana	20.67	0.02	18.21	20.12	20.41	0.0	0.0	7.55	18.75	22.22	20.0
Mangaweka	5.03	0.0	3.5	10.24	5.5	12.5	10.0	0.3	1.64	11.43	4.0
Ohakea	9.0	0.0	9.85	6.85	14.61	0.0	0.0	7.49	10.81	30.0	22.22
Pongaroa	6.01	0.0	7.12	8.2	12.82	8.33	28.57	4.76	7.17	4.76	11.76
Ōhura	5.41	0.0	8.66	11.36	14.69	20.0	0.0	3.52	7.85	0.0	6.25
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.0	7.0	5.82	8.7	0.0	0.0	3.16	12.5	0.0	0.0
Mangatainoka	12.57	0.14	23.24	17.2	16.09	4.76	4.35	33.51	25.48	14.29	0.0
Waikawa Beach	5.77	0.0	13.27	10.75	16.1	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	13.53	9.52	17.14	41.67	66.67	6.45	11.0	0.0	0.0
Koitiata	33.58	0.06	31.13	29.08	33.33	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	8.12	3.3	10.71	0.0	0.0	10.59	9.24	0.0	0.0
Other	9.49	0.04	9.58	11.85	15.19	11.15	16.32	7.06	9.78	8.4	10.03

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.4: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 2% AEP with Current Climate and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	20.1	0.02	20.56	20.56	21.6	26.45	23.96	12.14	13.63	16.4	20.49
Whanganui	19.69	0.02	20.29	20.36	21.0	22.44	32.32	10.43	13.84	23.38	25.9
Levin	44.8	0.01	41.25	44.81	41.15	67.4	63.58	15.28	17.48	52.29	46.97
Feilding	18.74	0.01	22.03	20.6	24.03	43.06	52.67	10.84	15.79	27.11	37.97
Dannevirke	6.57	0.0	7.94	7.56	8.45	10.53	18.18	6.25	7.77	14.97	11.76
Marton	14.55	0.01	14.36	15.51	15.52	31.91	33.33	8.17	10.4	18.93	15.12
Taumarunui	9.5	0.22	10.61	9.76	14.28	11.27	10.13	4.52	6.98	13.64	15.25
Ashhurst	14.18	0.0	13.57	15.93	15.71	40.48	26.92	7.43	9.0	21.88	14.29
Pahiatua	22.33	0.01	19.64	28.42	29.57	37.24	14.29	6.42	9.15	31.58	15.87
Foxton	33.54	0.04	30.76	35.7	34.16	33.33	42.0	17.85	20.77	32.98	36.84
Taihape	2.12	0.01	2.52	2.45	5.19	1.74	4.17	0.61	2.0	2.75	3.06
Bulls	15.9	0.01	17.08	17.32	17.29	9.49	11.54	17.34	20.0	10.61	30.77
Bunnythorpe	6.24	0.0	8.54	5.5	6.77	18.75	11.11	7.74	12.29	15.22	16.67
Shannon	7.63	0.01	8.01	6.33	3.96	12.5	20.69	11.34	15.79	18.18	15.91
Foxton Beach	22.18	0.01	26.44	25.84	28.81	20.0	0.0	19.15	16.67	27.27	14.29
Woodville	40.88	0.21	38.69	36.91	39.09	32.35	45.45	40.55	44.15	16.36	15.91
Rongotea	16.93	0.02	16.0	16.62	16.21	11.9	11.11	13.81	18.62	7.14	35.29
Linton	4.55	0.0	10.4	6.9	5.09	9.52	0.0	7.89	12.83	19.49	25.64
Halcombe	2.99	0.0	3.61	3.31	5.71	5.56	27.27	2.07	4.78	0.0	0.0
Ohakune	18.16	0.01	16.69	17.81	20.3	20.18	16.33	7.12	13.5	5.41	21.43
Eketāhuna	6.01	0.0	6.11	4.08	8.83	0.0	12.5	5.68	6.84	5.36	5.71
Raetihi	12.19	0.01	11.47	13.7	15.53	11.94	9.09	6.54	9.67	7.32	3.57
Hunterville	13.09	0.01	9.66	16.82	16.28	39.47	52.0	2.68	5.12	13.33	20.0
Sanson	5.53	0.0	7.87	6.58	9.21	24.49	42.31	3.79	6.63	0.0	8.33
Ōhau	8.7	0.0	9.32	7.75	9.26	12.5	0.0	8.28	12.5	12.5	13.33
Tokomaru	6.96	0.01	6.07	3.89	5.38	0.0	11.11	7.79	8.94	0.0	10.0
Kairanga	39.21	0.07	33.4	37.55	36.67	7.69	0.0	33.69	30.27	29.41	33.33
Manakau	13.56	0.0	16.73	18.7	17.24	0.0	0.0	10.51	20.22	18.52	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	7.52	0.01	7.2	12.15	5.0	0.0	0.0	5.3	8.2	4.08	20.0
Waitārere Beach	20.03	0.03	22.48	18.97	22.83	25.0	0.0	0.0	0.0	60.0	64.81
Kai Iwi	4.26	0.0	5.81	6.02	7.3	0.0	0.0	3.34	7.19	2.38	10.0
Himatangi Beach	15.02	0.01	18.63	15.86	16.6	0.0	0.0	32.0	55.81	28.57	22.22
Longburn	20.42	0.02	28.25	23.68	31.07	39.39	33.87	21.35	32.0	26.67	33.33
Waiouru	3.91	0.0	7.76	8.14	8.33	5.88	11.76	7.19	7.49	33.33	0.0
Tangimoana	41.19	0.05	40.02	50.45	62.08	0.0	9.09	8.7	15.03	43.75	47.62
Ormondville	3.17	0.0	5.85	3.5	5.98	0.0	0.0	4.65	7.78	10.0	12.5
Hokio Beach	12.1	0.01	18.52	16.04	25.36	0.0	100.0	8.67	22.97	0.0	18.52
Norsewood	9.89	0.0	7.95	10.94	13.33	14.29	57.14	5.41	6.47	0.0	4.17
Kimbolton	5.74	0.01	4.83	4.26	5.84	0.0	0.0	3.08	7.3	0.0	8.0
Ōwhango	7.51	0.0	6.98	10.18	14.84	18.18	15.79	2.22	6.92	0.0	0.0
Rātana	20.67	0.02	18.21	20.12	20.41	0.0	0.0	7.55	18.75	22.22	20.0
Mangaweka	5.03	0.0	3.5	10.24	5.5	12.5	10.0	0.3	1.64	11.43	4.0
Ohakea	9.0	0.0	9.85	6.85	14.61	0.0	0.0	7.49	10.81	30.0	22.22
Pongaroa	6.01	0.0	7.12	8.2	12.82	8.33	28.57	4.76	7.17	4.76	11.76
Ōhura	5.41	0.0	8.66	11.36	14.69	20.0	0.0	3.52	7.85	0.0	6.25
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.0	7.0	5.82	8.7	0.0	0.0	3.16	12.5	0.0	0.0
Mangatainoka	12.57	0.14	23.24	17.2	16.09	4.76	4.35	33.51	25.48	14.29	0.0
Waikawa Beach	5.77	0.0	13.27	10.75	16.1	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	11.18	11.9	17.14	41.67	22.22	6.45	10.0	0.0	0.0
Koitiata	33.58	0.06	31.13	29.08	33.33	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	8.12	3.3	10.71	0.0	0.0	10.59	9.24	0.0	0.0
Other	12.02	0.06	11.97	15.53	17.65	12.46	16.32	9.94	11.54	9.03	10.44

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.5: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 1% AEP with Current Climate and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	25.69	0.03	25.95	26.47	27.97	31.2	26.5	9.83	11.37	20.72	25.08
Whanganui	21.28	0.02	21.92	21.99	22.48	25.44	36.89	11.4	14.22	25.68	31.08
Levin	46.3	0.01	42.81	46.42	42.99	68.58	65.43	16.35	18.2	52.29	45.45
Feilding	14.03	0.0	16.66	15.8	17.43	25.88	43.51	10.36	15.63	18.07	27.85
Dannevirke	7.09	0.0	8.39	7.87	8.71	10.53	18.18	6.58	8.72	18.56	12.94
Marton	15.26	0.01	14.9	16.01	16.11	29.79	34.21	8.62	10.84	23.08	18.6
Taumarunui	10.55	0.23	11.97	11.22	15.87	11.74	13.92	4.98	7.67	15.91	16.95
Ashhurst	15.74	0.0	15.51	18.48	17.05	50.0	30.77	8.87	10.7	21.88	14.29
Pahiatua	22.96	0.01	20.8	29.09	31.39	37.24	17.86	7.55	10.37	32.89	19.05
Foxton	34.03	0.04	31.28	36.63	34.74	34.75	44.0	17.22	21.13	32.98	36.84
Taihape	2.3	0.16	2.68	2.64	5.52	1.74	6.25	0.61	2.11	2.75	3.06
Bulls	17.11	0.01	18.33	18.34	18.44	13.29	19.23	17.1	21.97	12.12	30.77
Bunnythorpe	6.3	0.0	8.84	5.69	7.0	18.75	11.11	8.06	12.6	17.39	16.67
Shannon	7.16	0.0	6.94	6.09	3.96	10.71	20.69	9.28	11.84	9.09	13.64
Foxton Beach	23.18	0.02	28.14	27.18	30.35	20.0	0.0	21.28	16.67	36.36	21.43
Woodville	45.91	0.3	42.83	42.33	47.36	35.29	54.55	41.77	43.94	18.18	15.91
Rongotea	13.98	0.01	13.17	14.09	12.71	11.9	11.11	10.59	16.11	7.14	35.29
Linton	4.11	0.0	9.69	5.72	5.09	9.52	0.0	6.19	11.88	20.34	28.21
Halcombe	3.52	0.0	4.16	4.14	6.29	5.56	27.27	2.53	5.39	0.0	0.0
Ohakune	20.0	0.02	17.98	19.18	21.4	22.02	16.33	8.49	14.79	8.11	21.43
Eketāhuna	6.35	0.0	6.29	3.86	9.35	0.0	12.5	5.78	7.25	5.36	5.71
Raetihi	13.15	0.01	12.16	14.63	16.21	13.43	12.12	7.08	9.67	7.32	7.14
Hunterville	12.78	0.01	9.99	17.06	15.99	42.11	52.0	3.06	5.57	13.33	21.43
Sanson	6.32	0.0	8.26	7.12	9.52	24.49	42.31	4.48	6.63	0.0	8.33
Ōhau	8.7	0.01	9.96	7.99	9.79	12.5	0.0	9.6	13.21	12.5	13.33
Tokomaru	6.96	0.01	6.17	4.79	5.38	0.0	11.11	6.97	8.94	0.0	10.0
Kairanga	28.93	0.02	24.61	29.96	28.1	7.69	0.0	24.27	20.34	29.41	33.33
Manakau	14.5	0.0	18.19	20.33	19.44	0.0	0.0	11.25	21.33	25.93	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	8.09	0.01	8.11	14.95	8.75	0.0	0.0	5.9	8.52	6.12	22.86
Waitārere Beach	21.43	0.04	24.88	21.54	24.54	25.0	0.0	0.0	0.0	80.0	72.22
Kai Iwi	4.26	0.0	5.81	6.02	7.3	0.0	0.0	3.34	7.19	2.38	10.0
Himatangi Beach	16.16	0.01	20.07	16.87	18.03	0.0	0.0	34.0	55.81	28.57	38.89
Longburn	18.11	0.01	22.45	19.17	25.42	28.28	27.42	19.1	25.6	6.67	11.11
Waiouru	3.91	0.0	8.16	9.05	9.03	5.88	11.76	7.19	7.87	33.33	0.0
Tangimoana	36.44	0.04	36.53	43.03	56.46	0.0	18.18	8.26	16.34	53.12	47.62
Ormondville	3.17	0.0	6.03	4.2	5.98	0.0	0.0	4.91	7.78	10.0	12.5
Hokio Beach	12.59	0.01	19.18	16.79	26.09	0.0	100.0	9.25	23.65	0.0	18.52
Norsewood	9.89	0.0	7.95	10.94	13.33	14.29	57.14	5.41	6.47	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.18	10.18	14.84	18.18	15.79	2.54	7.23	0.0	0.0
Rātana	20.67	0.02	18.21	20.12	20.41	0.0	0.0	7.55	18.75	22.22	20.0
Mangaweka	5.03	0.0	3.81	11.02	6.42	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	9.0	0.01	11.54	7.53	14.61	0.0	0.0	8.02	16.22	30.0	22.22
Pongaroa	5.65	0.0	6.63	9.02	12.82	8.33	28.57	4.48	5.61	4.76	11.76
Ōhura	5.41	0.0	8.79	8.33	16.38	20.0	0.0	4.02	7.85	4.0	6.25
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.0	7.2	6.35	8.7	0.0	0.0	3.16	12.5	0.0	0.0
Mangatainoka	12.57	0.16	23.41	17.2	16.09	4.76	4.35	33.51	25.48	14.29	12.5
Waikawa Beach	8.33	0.0	13.98	11.83	16.53	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	15.0	9.52	17.14	41.67	72.22	8.87	12.0	0.0	0.0
Koitiata	36.57	0.06	31.46	29.79	33.33	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	8.38	4.4	10.71	0.0	0.0	10.59	9.24	0.0	0.0
Other	11.06	0.06	10.81	13.66	17.31	11.15	16.84	8.2	10.78	8.87	10.84

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.6: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 1% AEP with Current Climate and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	23.74	0.03	24.19	24.36	25.48	28.39	26.27	14.72	15.89	19.14	24.46
Whanganui	21.25	0.02	21.81	21.98	22.47	24.36	33.54	11.4	14.22	25.26	28.29
Levin	46.3	0.01	42.81	46.42	42.99	68.58	65.43	16.35	18.2	52.29	45.45
Feilding	20.0	0.01	23.41	21.95	25.31	46.12	55.73	12.05	16.56	28.31	40.51
Dannevirke	7.09	0.0	8.41	7.87	8.71	10.53	18.18	6.63	8.72	18.56	12.94
Marton	15.59	0.01	15.22	16.52	16.24	33.62	35.96	8.39	10.75	24.26	18.6
Taumarunui	10.17	0.23	11.47	10.69	15.14	11.74	12.66	4.98	7.67	14.77	16.95
Ashhurst	14.75	0.0	14.51	16.76	16.76	40.48	26.92	8.34	10.19	21.88	14.29
Pahiatua	22.84	0.01	20.45	29.09	30.72	37.24	17.86	6.99	9.96	32.89	19.05
Foxton	34.55	0.04	31.76	36.82	34.91	34.75	44.0	18.96	21.86	32.98	38.16
Taihape	2.3	0.16	2.68	2.64	5.52	1.74	6.25	0.61	2.11	2.75	3.06
Bulls	17.11	0.01	18.41	18.34	18.57	13.29	19.23	17.34	21.97	12.12	30.77
Bunnythorpe	6.3	0.0	8.8	5.69	7.0	18.75	11.11	8.06	12.6	15.22	16.67
Shannon	7.81	0.01	8.54	6.45	4.38	12.5	20.69	12.03	16.67	21.82	20.45
Foxton Beach	22.71	0.01	27.03	26.45	29.4	20.0	0.0	21.28	16.67	27.27	14.29
Woodville	47.81	0.3	43.95	44.58	48.64	38.24	57.58	41.25	44.35	20.0	15.91
Rongotea	18.23	0.02	16.87	17.51	16.39	11.9	11.11	14.75	20.29	7.14	35.29
Linton	5.28	0.0	10.94	7.69	5.45	9.52	0.0	7.89	13.3	20.34	28.21
Halcombe	3.52	0.0	4.16	4.14	6.29	5.56	27.27	2.53	5.39	0.0	0.0
Ohakune	20.0	0.02	17.98	19.18	21.4	22.02	16.33	8.49	14.79	8.11	21.43
Eketāhuna	6.35	0.0	6.29	3.86	9.35	0.0	12.5	5.78	7.25	5.36	5.71
Raetihi	13.15	0.01	12.16	14.63	16.21	13.43	12.12	7.08	9.67	7.32	7.14
Hunterville	15.36	0.02	10.48	18.25	17.15	39.47	52.0	3.31	5.87	14.67	20.0
Sanson	6.32	0.0	8.26	7.12	9.52	24.49	42.31	4.48	6.63	0.0	8.33
Ōhau	8.7	0.0	9.68	7.99	9.52	12.5	0.0	8.94	12.86	12.5	13.33
Tokomaru	6.96	0.01	6.26	4.19	5.38	0.0	11.11	8.2	8.94	0.0	10.0
Kairanga	45.3	0.09	37.82	42.24	41.43	7.69	0.0	38.64	34.14	29.41	33.33
Manakau	14.5	0.0	18.19	20.33	19.44	0.0	0.0	11.25	21.33	25.93	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	8.09	0.01	8.11	14.95	8.75	0.0	0.0	5.9	8.52	6.12	22.86
Waitārere Beach	21.43	0.04	24.88	21.54	24.54	25.0	0.0	0.0	0.0	80.0	72.22
Kai Iwi	4.26	0.0	5.81	6.02	7.3	0.0	0.0	3.34	7.19	2.38	10.0
Himatangi Beach	16.16	0.01	20.07	16.87	18.03	0.0	0.0	34.0	55.81	28.57	38.89
Longburn	22.74	0.03	29.75	25.94	32.77	39.39	33.87	24.16	32.0	26.67	33.33
Waiouru	3.91	0.0	8.16	9.05	9.03	5.88	11.76	7.19	7.87	33.33	0.0
Tangimoana	51.68	0.08	46.56	60.24	71.35	0.0	18.18	9.13	17.65	53.12	47.62
Ormondville	3.17	0.0	6.03	4.2	5.98	0.0	0.0	4.91	7.78	10.0	12.5
Hokio Beach	12.59	0.01	19.18	16.79	26.09	0.0	100.0	9.25	23.65	0.0	18.52
Norsewood	9.89	0.0	7.95	10.94	13.33	14.29	57.14	5.41	6.47	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.18	10.18	14.84	18.18	15.79	2.54	7.23	0.0	0.0
Rātana	20.67	0.02	18.21	20.12	20.41	0.0	0.0	7.55	18.75	22.22	20.0
Mangaweka	5.03	0.0	3.81	11.02	6.42	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	9.0	0.0	11.54	7.53	14.61	0.0	0.0	8.02	16.22	30.0	22.22
Pongaroa	5.65	0.0	6.63	9.02	12.82	8.33	28.57	4.48	5.61	4.76	11.76
Ōhura	5.41	0.0	8.79	8.33	16.38	20.0	0.0	4.02	7.85	4.0	6.25
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.0	7.2	6.35	8.7	0.0	0.0	3.16	12.5	0.0	0.0
Mangatainoka	12.57	0.16	23.41	17.2	16.09	4.76	4.35	33.51	25.48	14.29	12.5
Waikawa Beach	8.33	0.0	13.98	11.83	16.53	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	12.35	11.9	17.14	41.67	22.22	8.06	12.0	0.0	0.0
Koitiata	36.57	0.06	31.46	29.79	33.33	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	8.38	4.4	10.71	0.0	0.0	10.59	9.24	0.0	0.0
Other	13.32	0.08	13.17	17.26	19.54	12.46	17.37	10.99	12.57	9.83	11.49

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.7: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Current Climate and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	26.71	0.03	27.12	27.59	29.07	32.07	27.42	12.03	13.55	21.29	26.91
Whanganui	22.81	0.02	23.58	23.67	24.01	29.59	40.55	11.96	14.89	27.14	33.07
Levin	47.36	0.01	44.02	47.79	44.09	70.27	66.05	17.42	18.45	54.25	46.97
Feilding	14.77	0.0	17.59	16.68	18.47	27.06	44.27	11.33	15.94	19.88	29.11
Dannevirke	7.29	0.0	8.75	8.08	9.11	10.84	18.18	7.08	9.27	17.96	14.12
Marton	15.95	0.01	15.67	16.88	16.73	33.62	35.96	9.28	11.01	24.26	18.6
Taumarunui	11.39	0.24	13.05	12.37	17.0	12.68	17.72	5.43	8.37	15.91	20.34
Ashhurst	16.59	0.01	16.37	19.38	17.72	50.0	30.77	9.91	11.71	21.88	14.29
Pahiatua	24.17	0.01	21.85	30.22	32.15	38.62	17.86	8.53	11.59	34.21	20.63
Foxton	34.52	0.04	31.99	37.31	35.32	35.46	44.0	17.69	22.22	34.04	39.47
Taihape	2.53	0.16	2.84	2.74	5.63	2.33	8.33	0.71	2.22	2.75	4.08
Bulls	18.63	0.01	20.19	19.88	20.1	20.89	21.15	18.53	22.62	15.15	33.33
Bunnythorpe	6.36	0.0	9.29	5.69	7.22	18.75	11.11	8.71	13.36	17.39	16.67
Shannon	7.81	0.0	7.34	6.45	4.1	10.71	20.69	9.62	13.16	10.91	13.64
Foxton Beach	23.65	0.02	28.79	27.73	31.01	20.0	0.0	21.28	16.67	40.91	23.02
Woodville	53.67	0.41	48.19	50.11	54.64	42.65	69.7	43.33	46.2	20.0	20.45
Rongotea	15.22	0.01	13.95	14.84	13.63	11.9	11.11	11.13	17.36	7.14	35.29
Linton	4.25	0.0	9.96	6.11	5.09	9.52	0.0	6.66	12.11	20.34	28.21
Halcombe	4.26	0.0	4.46	5.25	6.86	5.56	27.27	2.76	5.24	0.0	0.0
Ohakune	20.84	0.02	19.07	20.4	22.39	22.94	16.33	9.04	16.4	8.11	25.0
Eketāhuna	6.18	0.0	6.51	4.08	10.13	0.0	12.5	5.88	7.39	5.36	5.71
Raetihi	14.4	0.01	13.11	16.14	17.58	13.43	12.12	7.63	10.18	7.32	7.14
Hunterville	14.12	0.01	10.48	18.01	17.15	39.47	52.0	3.31	5.72	13.33	24.29
Sanson	6.32	0.0	8.33	7.12	9.52	24.49	42.31	4.48	7.14	0.0	8.33
Ōhau	9.5	0.01	10.81	8.96	10.58	12.5	0.0	11.26	13.21	12.5	13.33
Tokomaru	6.96	0.01	6.64	4.79	5.77	0.0	11.11	8.2	9.5	0.0	10.0
Kairanga	36.42	0.04	30.09	33.94	36.19	38.46	0.0	28.9	26.39	35.29	33.33
Manakau	15.97	0.01	18.86	21.95	19.44	0.0	0.0	11.74	21.88	25.93	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	10.78	0.01	9.73	17.76	11.25	0.0	0.0	7.41	10.0	8.16	22.86
Waitārere Beach	22.83	0.05	27.17	23.26	27.11	75.0	0.0	0.0	0.0	80.0	75.93
Kai Iwi	4.26	0.0	5.71	6.02	7.3	0.0	0.0	3.34	6.86	2.38	10.0
Himatangi Beach	16.35	0.01	21.34	17.87	19.06	0.0	0.0	36.0	55.81	42.86	50.0
Longburn	19.65	0.02	27.82	22.93	31.07	39.39	33.87	21.91	29.6	26.67	33.33
Waiouru	3.91	0.0	8.37	9.5	9.03	5.88	11.76	7.52	7.87	33.33	0.0
Tangimoana	47.13	0.06	44.9	56.38	68.26	0.0	18.18	10.43	18.3	56.25	47.62
Ormondville	3.17	0.0	6.03	4.2	5.98	0.0	0.0	4.91	7.78	10.0	12.5
Hokio Beach	14.57	0.01	20.07	18.28	26.81	0.0	100.0	10.4	23.65	0.0	18.52
Norsewood	9.89	0.0	7.95	10.94	13.33	14.29	57.14	5.41	6.47	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.58	10.78	14.84	18.18	15.79	2.54	7.86	0.0	6.25
Rātana	20.67	0.02	18.21	20.12	20.41	0.0	0.0	9.43	16.67	22.22	20.0
Mangaweka	6.29	0.01	4.02	12.6	6.42	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	14.19	0.01	17.49	8.9	17.98	0.0	0.0	16.04	26.35	30.0	22.22
Pongaroa	5.65	0.0	6.82	9.02	12.82	8.33	28.57	4.48	6.23	4.76	11.76
Ōhura	5.41	0.0	9.45	8.33	18.64	20.0	0.0	4.02	8.38	4.0	6.25
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.01	7.41	6.35	8.7	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	12.57	0.18	25.3	17.2	16.09	4.76	4.35	36.76	28.66	14.29	12.5
Waikawa Beach	8.33	0.0	14.51	11.83	17.8	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	15.29	9.52	20.0	41.67	72.22	8.87	12.0	0.0	0.0
Koitiata	36.57	0.06	31.79	30.5	33.33	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	8.88	5.49	11.9	0.0	0.0	10.59	9.24	0.0	0.0
Other	12.64	0.11	12.23	15.53	19.05	11.8	17.89	9.39	12.1	10.46	13.27

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.8: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Current Climate and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	28.11	0.04	28.17	28.85	29.25	29.82	28.8	17.56	18.39	21.29	27.83
Whanganui	22.81	0.02	23.55	23.67	24.0	29.18	39.02	11.96	14.89	27.14	33.07
Levin	47.36	0.01	44.02	47.79	44.09	70.27	66.05	17.42	18.45	54.25	46.97
Feilding	21.2	0.01	24.64	23.18	26.65	49.18	56.49	12.53	16.72	31.93	40.51
Dannevirke	7.29	0.0	8.78	8.08	9.11	10.84	18.18	7.19	9.27	17.96	14.12
Marton	16.19	0.01	15.87	17.17	16.87	36.17	37.72	8.98	11.01	24.85	18.6
Taumarunui	10.9	0.24	12.46	11.7	16.2	12.68	16.46	5.43	8.37	14.77	18.64
Ashhurst	15.6	0.0	15.51	17.31	17.62	42.86	26.92	9.91	11.88	21.88	14.29
Pahiatua	24.11	0.01	21.61	30.15	32.15	37.24	17.86	8.12	11.18	34.21	20.63
Foxton	35.11	0.04	32.41	37.44	35.49	35.46	44.0	19.59	22.59	34.04	39.47
Taihape	2.53	0.16	2.84	2.74	5.63	2.33	8.33	0.71	2.22	2.75	4.08
Bulls	18.63	0.01	20.3	20.08	20.1	20.89	21.15	18.53	22.95	15.15	33.33
Bunnythorpe	6.36	0.0	9.25	5.69	7.22	18.75	11.11	8.71	13.36	15.22	16.67
Shannon	8.4	0.01	9.12	6.93	4.53	12.5	27.59	14.09	16.67	21.82	20.45
Foxton Beach	23.12	0.01	27.61	27.0	29.99	20.0	0.0	21.28	16.67	31.82	15.08
Woodville	54.98	0.41	48.97	51.81	55.49	44.12	69.7	42.98	46.41	21.82	20.45
Rongotea	18.57	0.02	17.66	18.25	17.13	11.9	11.11	15.68	21.13	7.14	35.29
Linton	5.5	0.0	11.26	8.28	5.45	9.52	0.0	8.36	13.54	20.34	28.21
Halcombe	4.26	0.0	4.46	5.25	6.86	5.56	27.27	2.76	5.24	0.0	0.0
Ohakune	20.84	0.02	19.07	20.4	22.39	22.94	16.33	9.04	16.4	8.11	25.0
Eketāhuna	6.18	0.0	6.51	4.08	10.13	0.0	12.5	5.88	7.39	5.36	5.71
Raetihi	14.4	0.01	13.11	16.14	17.58	13.43	12.12	7.63	10.18	7.32	7.14
Hunterville	17.11	0.02	11.39	20.14	18.31	42.11	56.0	3.82	6.02	14.67	24.29
Sanson	6.32	0.0	8.33	7.12	9.52	24.49	42.31	4.48	7.14	0.0	8.33
Ōhau	9.38	0.01	10.38	8.72	10.32	12.5	0.0	10.26	12.86	12.5	13.33
Tokomaru	6.96	0.01	6.64	4.79	5.77	0.0	11.11	8.2	9.5	0.0	10.0
Kairanga	50.13	0.1	42.68	45.13	42.86	38.46	0.0	44.05	40.19	47.06	33.33
Manakau	15.97	0.01	18.86	21.95	19.44	0.0	0.0	11.74	21.88	25.93	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	10.78	0.01	9.73	17.76	11.25	0.0	0.0	7.41	10.0	8.16	22.86
Waitārere Beach	22.83	0.05	27.17	23.26	27.11	75.0	0.0	0.0	0.0	80.0	75.93
Kai Iwi	4.26	0.0	5.71	6.02	7.3	0.0	0.0	3.34	6.86	2.38	10.0
Himatangi Beach	16.35	0.01	21.34	17.87	19.06	0.0	0.0	36.0	55.81	42.86	50.0
Longburn	22.35	0.04	30.18	26.32	32.77	39.39	33.87	24.16	34.4	26.67	33.33
Waiouru	3.91	0.0	8.37	9.5	9.03	5.88	11.76	7.52	7.87	33.33	0.0
Tangimoana	56.04	0.12	50.65	64.39	78.09	0.0	18.18	11.3	19.61	56.25	47.62
Ormondville	3.17	0.0	6.03	4.2	5.98	0.0	0.0	4.91	7.78	10.0	12.5
Hokio Beach	14.57	0.01	20.07	18.28	26.81	0.0	100.0	10.4	23.65	0.0	18.52
Norsewood	9.89	0.0	7.95	10.94	13.33	14.29	57.14	5.41	6.47	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.58	10.78	14.84	18.18	15.79	2.54	7.86	0.0	6.25
Rātana	20.67	0.02	18.21	20.12	20.41	0.0	0.0	9.43	16.67	22.22	20.0
Mangaweka	6.29	0.01	4.02	12.6	6.42	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	12.8	0.01	16.98	8.9	17.98	0.0	0.0	14.97	25.68	30.0	22.22
Pongaroa	5.65	0.0	6.82	9.02	12.82	8.33	28.57	4.48	6.23	4.76	11.76
Ōhura	5.41	0.0	9.45	8.33	18.64	20.0	0.0	4.02	8.38	4.0	6.25
National Park	6.22	0.0	7.28	6.78	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	8.29	0.01	7.41	6.35	8.7	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	12.57	0.18	25.3	17.2	16.09	4.76	4.35	36.76	28.66	14.29	12.5
Waikawa Beach	8.33	0.0	14.51	11.83	17.8	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	12.06	11.9	20.0	41.67	16.67	8.06	11.0	0.0	0.0
Koitiata	36.57	0.06	31.79	30.5	33.33	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	8.88	5.49	11.9	0.0	0.0	10.59	9.24	0.0	0.0
Other	14.91	0.12	14.48	18.67	21.09	13.11	18.42	12.12	13.85	11.33	14.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.9: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.2% AEP with Current Climate and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	27.59	0.04	28.14	28.62	30.37	33.4	29.03	11.49	13.23	21.73	27.22
Whanganui	29.02	0.05	29.95	30.38	31.19	36.08	44.82	12.68	16.22	30.69	35.06
Levin	48.65	0.01	45.53	49.26	45.92	71.11	67.9	18.25	19.66	55.56	48.48
Feilding	15.81	0.0	18.92	18.06	19.81	30.35	45.8	11.57	16.25	21.08	35.44
Dannevirke	7.99	0.0	9.4	8.78	9.86	11.76	18.18	7.46	9.9	19.16	15.29
Marton	18.19	0.05	18.25	20.45	20.01	42.98	49.12	8.84	11.54	24.26	18.6
Taumarunui	14.99	0.58	16.45	16.43	20.85	15.02	21.52	6.33	9.07	21.59	25.42
Ashhurst	17.78	0.01	17.58	20.48	19.16	50.0	34.62	10.82	13.07	25.0	14.29
Pahiatua	25.48	0.01	22.95	31.09	33.4	40.0	17.86	9.5	13.11	35.53	20.63
Foxton	36.32	0.04	33.58	39.55	37.73	35.46	44.0	17.22	23.32	35.11	39.47
Taihape	3.87	0.23	4.23	4.25	8.5	2.33	12.5	1.21	3.16	3.67	5.1
Bulls	28.27	0.03	29.63	30.53	28.43	48.1	51.92	21.38	26.23	24.24	51.28
Bunnythorpe	5.95	0.0	9.55	5.69	7.9	18.75	22.22	9.03	13.21	19.57	16.67
Shannon	8.34	0.0	8.14	7.41	4.53	12.5	20.69	10.31	14.47	9.09	18.18
Foxton Beach	24.82	0.02	30.58	28.76	33.14	40.0	0.0	23.4	16.67	40.91	30.95
Woodville	60.07	1.2	54.72	58.58	61.77	51.47	72.73	47.66	50.92	30.91	20.45
Rongotea	15.01	0.01	14.54	14.39	15.47	9.52	11.11	11.53	18.2	14.29	35.29
Linton	4.47	0.0	10.45	6.71	5.45	9.52	0.0	6.5	13.3	21.19	29.06
Halcombe	7.33	0.01	8.2	7.46	11.71	5.56	45.45	5.99	9.71	3.51	5.26
Ohakune	23.68	0.02	20.98	22.91	24.11	24.77	16.33	9.86	18.33	8.11	25.0
Eketāhuna	6.35	0.0	6.99	4.08	10.39	0.0	12.5	6.47	8.21	5.36	5.71
Raetihi	16.12	0.01	13.63	17.64	17.81	14.93	12.12	7.63	10.18	7.32	7.14
Hunterville	16.8	0.02	13.08	22.27	20.35	47.37	56.0	5.22	7.68	14.67	25.71
Sanson	6.55	0.0	8.87	9.04	10.79	30.61	42.31	2.07	6.63	0.0	12.5
Ōhau	10.41	0.01	11.72	9.69	11.64	12.5	0.0	11.59	14.64	12.5	20.0
Tokomaru	6.96	0.01	7.01	5.39	6.54	0.0	11.11	8.2	9.5	0.0	10.0
Kairanga	37.18	0.04	32.09	33.94	36.67	38.46	0.0	31.68	29.3	41.18	33.33
Manakau	16.51	0.01	19.59	22.49	21.0	0.0	0.0	12.47	22.16	25.93	35.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	11.49	0.01	10.12	22.43	13.75	0.0	0.0	6.81	10.33	10.2	22.86
Waitārere Beach	26.55	0.06	30.8	25.7	32.11	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	5.91	6.63	7.3	0.0	0.0	3.68	6.54	4.76	10.0
Himatangi Beach	19.39	0.01	23.6	18.47	23.16	0.0	0.0	34.0	62.79	42.86	50.0
Longburn	23.12	0.01	28.57	25.94	32.77	29.29	27.42	25.28	32.8	26.67	33.33
Waiouru	4.89	0.0	10.0	12.67	11.11	0.0	11.76	7.84	9.74	33.33	20.0
Tangimoana	62.57	0.17	57.45	73.29	84.27	28.57	36.36	13.91	30.07	50.0	57.14
Ormondville	3.17	0.0	6.22	4.2	5.98	0.0	0.0	5.17	7.78	10.0	18.75
Hokio Beach	16.3	0.02	21.72	20.52	29.71	0.0	100.0	10.4	24.32	0.0	18.52
Norsewood	9.89	0.0	8.21	10.94	13.33	14.29	57.14	5.74	6.97	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.58	10.78	14.84	18.18	15.79	2.54	7.86	0.0	6.25
Rātana	23.1	0.02	18.73	21.34	20.41	0.0	0.0	7.55	16.67	22.22	40.0
Mangaweka	6.29	0.01	5.25	14.17	10.09	12.5	20.0	0.89	2.3	11.43	12.0
Ohakea	21.8	0.03	28.18	21.23	20.22	0.0	0.0	25.13	41.89	50.0	33.33
Pongaroa	11.66	0.17	8.61	13.93	20.51	8.33	28.57	5.6	6.54	6.35	11.76
Ōhura	9.01	0.01	10.92	10.61	20.9	20.0	0.0	5.03	9.42	4.0	6.25
National Park	6.22	0.0	7.78	7.8	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.44	6.88	11.59	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	13.71	0.21	26.16	17.2	17.24	4.76	4.35	37.3	30.57	14.29	12.5
Waikawa Beach	10.26	0.01	15.58	12.9	19.07	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	17.65	11.9	20.0	50.0	77.78	9.68	15.0	25.0	0.0
Koitiata	33.58	0.06	33.44	31.21	36.05	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	9.39	5.49	11.9	0.0	0.0	11.76	10.08	0.0	0.0
Other	14.23	0.27	13.91	17.55	21.84	14.1	24.74	10.6	13.6	12.44	16.02

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.10: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.1% AEP with Current Climate and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	28.36	0.04	29.03	29.51	31.3	34.68	29.49	12.51	13.47	22.59	27.83
Whanganui	31.98	0.09	33.1	33.62	34.53	40.32	51.22	13.4	17.08	32.99	36.65
Levin	49.56	0.02	46.55	50.32	47.02	72.3	69.14	18.99	20.15	56.21	48.48
Feilding	16.54	0.01	19.95	18.92	20.57	34.59	51.15	11.93	17.34	22.89	43.04
Dannevirke	8.41	0.0	9.78	9.2	10.17	12.69	19.19	7.68	10.38	19.16	15.29
Marton	20.17	0.07	19.94	22.57	22.03	46.81	50.0	9.43	12.33	26.63	20.93
Taumarunui	23.74	0.62	23.46	24.91	29.95	16.43	26.58	7.24	10.93	23.86	35.59
Ashhurst	18.2	0.01	17.91	20.69	19.83	50.0	34.62	11.08	13.07	28.12	14.29
Pahiatua	26.34	0.01	24.0	32.15	33.88	41.38	17.86	10.72	14.63	35.53	20.63
Foxton	36.94	0.04	34.2	40.11	38.31	35.46	44.0	18.33	24.04	35.11	39.47
Taihape	3.87	0.29	4.39	4.34	8.5	2.91	14.58	1.42	3.38	3.67	5.1
Bulls	29.33	0.03	30.81	31.97	29.32	48.73	53.85	23.04	27.21	24.24	51.28
Bunnythorpe	6.36	0.0	9.96	5.69	8.13	18.75	22.22	9.57	13.67	21.74	20.0
Shannon	8.69	0.0	8.54	7.77	4.95	12.5	20.69	10.31	14.91	10.91	20.45
Foxton Beach	26.12	0.02	31.56	29.68	34.31	40.0	0.0	23.4	16.67	40.91	31.75
Woodville	64.87	1.7	58.3	62.87	66.76	64.71	84.85	49.39	51.95	32.73	20.45
Rongotea	15.15	0.02	15.37	15.13	16.57	9.52	11.11	12.33	19.04	14.29	35.29
Linton	4.99	0.0	10.67	7.3	5.45	9.52	0.0	6.66	13.3	21.61	29.06
Halcombe	8.45	0.01	8.92	9.12	12.0	5.56	45.45	6.34	10.48	5.26	7.89
Ohakune	25.27	0.11	22.14	24.12	25.58	24.77	16.33	10.41	19.29	13.51	25.0
Eketāhuna	6.35	0.0	7.28	4.08	10.39	0.0	12.5	6.67	9.03	5.36	5.71
Raetihi	17.18	0.01	14.0	18.57	18.04	14.93	12.12	7.9	10.18	7.32	7.14
Hunterville	19.79	0.02	14.65	25.12	23.55	50.0	56.0	6.11	8.13	16.0	30.0
Sanson	6.55	0.0	9.1	9.32	11.43	30.61	42.31	2.07	6.63	0.0	12.5
Ōhau	11.1	0.01	12.43	10.17	12.43	12.5	0.0	12.25	15.71	12.5	20.0
Tokomaru	6.96	0.01	7.1	5.39	6.54	0.0	11.11	8.61	9.5	0.0	10.0
Kairanga	40.74	0.05	35.7	38.99	41.43	38.46	0.0	35.09	31.96	41.18	38.89
Manakau	17.32	0.01	20.78	24.12	21.94	0.0	0.0	13.69	22.99	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	11.49	0.01	11.09	23.36	15.0	0.0	0.0	8.02	11.15	10.2	22.86
Waitārere Beach	26.55	0.06	31.32	26.44	32.48	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	5.91	6.63	7.3	0.0	0.0	3.68	6.54	4.76	10.0
Himatangi Beach	21.48	0.01	25.14	19.88	25.0	0.0	0.0	34.0	62.79	42.86	55.56
Longburn	23.12	0.02	30.93	26.32	33.33	39.39	33.87	26.97	35.2	26.67	33.33
Waiouru	5.09	0.0	10.1	12.67	11.11	0.0	11.76	8.17	9.74	33.33	20.0
Tangimoana	63.56	0.22	58.67	75.07	85.39	28.57	54.55	13.91	31.37	50.0	57.14
Ormondville	3.17	0.0	6.31	4.2	5.98	0.0	0.0	5.43	7.78	10.0	18.75
Hokio Beach	16.3	0.02	22.16	20.52	31.16	0.0	100.0	10.4	24.32	0.0	18.52
Norsewood	9.89	0.0	8.33	10.94	13.33	14.29	57.14	5.74	7.46	0.0	4.17
Kimbolton	7.1	0.01	5.1	4.26	5.84	0.0	0.0	3.59	8.03	0.0	8.0
Ōwhango	7.51	0.0	7.78	10.78	14.84	18.18	15.79	3.17	7.86	0.0	6.25
Rātana	23.1	0.02	18.73	21.34	20.41	0.0	0.0	7.55	16.67	22.22	40.0
Mangaweka	7.23	0.01	5.97	14.96	13.76	12.5	20.0	0.89	2.95	11.43	12.0
Ohakea	24.91	0.03	29.54	21.92	23.6	0.0	0.0	26.2	43.24	50.0	33.33
Pongaroa	14.13	0.26	9.4	13.93	21.79	8.33	28.57	6.72	7.48	6.35	11.76
Ōhura	10.36	0.01	11.85	12.88	20.9	20.0	16.67	5.03	9.42	12.0	12.5
National Park	6.22	0.0	7.78	7.8	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.64	6.88	11.59	0.0	0.0	5.26	12.5	0.0	0.0
Mangatainoka	14.29	0.23	28.74	19.35	19.54	4.76	4.35	40.0	32.48	28.57	37.5
Waikawa Beach	10.26	0.01	16.64	13.26	20.76	0.0	0.0	8.7	23.08	0.0	0.0
Mangamutu	14.84	0.01	23.82	21.43	34.29	58.33	77.78	15.32	18.0	25.0	20.0
Koitiata	33.58	0.06	34.44	32.62	36.73	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	9.9	5.49	13.1	0.0	0.0	11.76	10.92	0.0	0.0
Other	15.96	0.51	15.21	19.89	23.67	15.08	26.84	11.68	14.43	14.74	17.88

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.11: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +1°C and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	27.97	0.03	28.61	29.0	30.49	33.35	28.57	14.93	15.97	22.88	28.13
Whanganui	27.06	0.08	28.08	28.38	29.11	35.0	42.99	12.36	15.84	29.02	33.47
Levin	49.0	0.01	45.92	49.78	46.26	71.45	69.14	18.41	19.54	54.9	46.97
Feilding	15.91	0.0	18.82	17.95	19.65	29.41	44.27	12.17	17.18	21.08	29.11
Dannevirke	7.96	0.0	9.34	8.68	9.86	11.76	18.18	7.41	9.75	19.16	15.29
Marton	16.61	0.04	16.25	17.67	17.27	35.32	37.72	9.5	11.28	24.85	18.6
Taumarunui	16.9	0.58	17.79	17.93	22.84	15.02	22.78	6.56	9.3	21.59	27.12
Ashhurst	18.06	0.01	17.43	20.97	19.06	50.0	34.62	10.04	12.05	25.0	14.29
Pahiatua	25.73	0.01	23.05	31.22	33.4	40.0	17.86	9.67	13.21	35.53	20.63
Foxton	35.86	0.04	33.05	38.74	36.32	35.46	44.0	18.33	22.59	35.11	44.74
Taihape	2.53	0.03	3.03	3.02	5.96	2.33	8.33	0.71	2.43	2.75	4.08
Bulls	19.94	0.02	24.05	23.05	21.9	39.87	44.23	21.62	24.92	16.67	33.33
Bunnythorpe	6.36	0.0	9.51	5.87	7.22	18.75	11.11	9.14	13.52	17.39	16.67
Shannon	8.51	0.0	8.32	7.53	4.81	12.5	20.69	10.31	14.91	10.91	15.91
Foxton Beach	24.41	0.02	29.84	28.64	32.11	40.0	0.0	23.4	16.67	40.91	24.6
Woodville	50.18	0.86	46.16	46.5	51.78	42.65	66.67	43.15	45.79	20.0	15.91
Rongotea	16.04	0.01	15.1	16.47	14.36	14.29	11.11	12.06	18.62	7.14	35.29
Linton	5.13	0.0	10.81	7.3	5.45	9.52	0.0	6.97	13.78	21.19	29.06
Halcombe	4.04	0.0	4.59	5.25	7.71	5.56	27.27	2.88	5.08	0.0	0.0
Ohakune	23.26	0.02	20.75	22.68	23.86	24.77	16.33	9.59	18.01	8.11	25.0
Eketāhuna	7.22	0.0	7.46	4.29	10.39	0.0	12.5	7.17	8.89	5.36	5.71
Raetihi	16.12	0.01	13.63	17.64	17.81	14.93	12.12	7.63	10.18	7.32	7.14
Hunterville	16.7	0.02	11.06	18.96	18.02	42.11	52.0	3.69	6.02	14.67	24.29
Sanson	7.22	0.0	8.8	8.22	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	10.41	0.01	11.72	9.44	11.9	12.5	0.0	11.92	14.64	12.5	13.33
Tokomaru	6.96	0.01	7.1	5.39	6.54	0.0	11.11	8.61	9.5	0.0	10.0
Kairanga	42.89	0.07	34.83	37.91	40.48	38.46	0.0	34.47	30.99	35.29	38.89
Manakau	16.51	0.01	19.79	22.76	21.0	0.0	0.0	12.71	22.16	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	10.92	0.01	10.18	19.63	13.75	0.0	0.0	7.41	10.49	8.16	22.86
Waitārere Beach	25.47	0.05	29.1	24.72	29.55	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	4.63	0.0	5.91	6.63	7.3	0.0	0.0	3.34	6.86	4.76	10.0
Himatangi Beach	18.63	0.01	23.24	19.48	21.31	0.0	0.0	38.0	58.14	42.86	50.0
Longburn	23.12	0.03	30.08	25.94	33.33	39.39	33.87	24.72	32.8	26.67	33.33
Waiouru	4.11	0.0	8.57	9.95	9.03	5.88	11.76	7.52	8.24	33.33	0.0
Tangimoana	53.07	0.08	48.74	62.31	73.03	0.0	27.27	12.17	18.3	56.25	57.14
Ormondville	3.17	0.0	6.22	4.2	5.98	0.0	0.0	5.17	7.78	10.0	18.75
Hokio Beach	16.3	0.02	21.5	20.15	28.99	0.0	100.0	10.4	24.32	0.0	22.22
Norsewood	9.89	0.0	8.21	10.94	13.33	14.29	57.14	5.74	6.97	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.58	10.78	14.84	18.18	15.79	2.54	7.86	0.0	6.25
Rātana	23.1	0.02	19.0	21.34	20.41	0.0	0.0	7.55	18.75	22.22	40.0
Mangaweka	6.29	0.01	4.12	12.6	7.34	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	22.49	0.01	23.43	17.12	26.97	0.0	0.0	18.72	33.11	30.0	22.22
Pongaroa	11.66	0.15	8.61	13.93	20.51	8.33	28.57	5.6	6.54	6.35	11.76
Ōhura	7.21	0.01	10.92	9.85	20.9	20.0	0.0	5.03	9.42	4.0	12.5
National Park	6.22	0.0	7.78	7.8	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.44	6.88	11.59	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	12.57	1.28	24.27	17.2	17.24	4.76	4.35	34.59	26.75	14.29	12.5
Waikawa Beach	10.26	0.01	15.58	12.9	19.07	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	17.06	11.9	20.0	50.0	77.78	9.68	13.0	25.0	0.0
Koitiata	36.57	0.06	32.12	30.5	34.01	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	9.64	5.49	13.1	0.0	0.0	11.76	10.08	0.0	0.0
Other	14.53	0.24	13.88	17.74	21.6	13.44	23.68	10.69	13.47	12.28	15.86

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.12: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +1°C and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	33.77	0.07	33.27	34.58	34.16	32.28	29.72	21.0	20.24	25.61	31.19
Whanganui	27.13	0.08	28.2	28.48	29.2	35.83	43.6	12.36	15.84	29.23	33.47
Levin	49.0	0.01	45.92	49.78	46.26	71.45	69.14	18.41	19.54	54.9	46.97
Feilding	22.55	0.01	25.94	24.56	27.94	51.53	57.25	12.89	17.96	32.53	43.04
Dannevirke	7.99	0.0	9.37	8.68	9.86	11.76	18.18	7.57	9.75	19.16	15.29
Marton	16.91	0.05	16.46	17.99	17.41	38.72	38.6	9.2	11.28	24.85	18.6
Taumarunui	19.57	0.59	19.86	20.41	25.7	15.02	26.58	6.56	9.07	21.59	33.9
Ashhurst	17.18	0.01	16.85	19.24	18.97	42.86	30.77	10.56	12.39	28.12	14.29
Pahiatua	25.29	0.01	22.82	31.29	33.4	38.62	17.86	9.26	12.6	35.53	20.63
Foxton	36.22	0.04	33.33	38.87	36.32	35.46	44.0	19.75	22.77	35.11	44.74
Taihape	2.53	0.03	3.03	3.02	5.96	2.33	8.33	0.71	2.43	2.75	4.08
Bulls	20.09	0.02	24.09	23.16	21.9	39.24	44.23	21.85	24.92	16.67	33.33
Bunnythorpe	6.36	0.0	9.48	5.87	7.22	18.75	11.11	9.14	13.52	15.22	16.67
Shannon	9.4	0.01	10.5	8.12	5.37	12.5	27.59	16.49	19.3	21.82	25.0
Foxton Beach	23.47	0.01	27.99	27.18	30.57	20.0	0.0	23.4	16.67	31.82	15.08
Woodville	60.01	1.05	53.95	58.24	60.63	50.0	72.73	46.62	50.1	30.91	20.45
Rongotea	19.81	0.02	18.49	18.99	17.13	14.29	11.11	16.89	22.38	7.14	35.29
Linton	6.23	0.0	11.84	9.07	5.82	9.52	0.0	8.51	14.49	21.19	29.06
Halcombe	4.04	0.0	4.59	5.25	7.71	5.56	27.27	2.88	5.08	0.0	0.0
Ohakune	23.26	0.02	20.75	22.68	23.86	24.77	16.33	9.59	18.01	8.11	25.0
Eketāhuna	6.35	0.0	6.99	4.08	10.39	0.0	12.5	6.37	8.34	5.36	5.71
Raetihi	16.12	0.01	13.63	17.64	17.81	14.93	12.12	7.63	10.18	7.32	7.14
Hunterville	17.94	0.02	12.05	21.09	19.48	47.37	56.0	4.46	6.17	14.67	24.29
Sanson	7.22	0.0	8.8	8.22	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	10.3	0.01	11.37	9.2	11.38	12.5	0.0	11.59	14.29	12.5	13.33
Tokomaru	6.96	0.01	7.2	5.39	6.54	0.0	11.11	9.02	9.5	0.0	10.0
Kairanga	52.16	0.12	45.98	47.29	47.62	38.46	0.0	47.3	43.83	47.06	38.89
Manakau	16.51	0.01	19.79	22.76	21.0	0.0	0.0	12.71	22.16	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	10.92	0.01	10.18	19.63	13.75	0.0	0.0	7.41	10.49	8.16	22.86
Waitārere Beach	25.47	0.05	29.1	24.72	29.55	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	4.63	0.0	5.91	6.63	7.3	0.0	0.0	3.34	6.86	4.76	10.0
Himatangi Beach	18.63	0.01	23.24	19.48	21.31	0.0	0.0	38.0	58.14	42.86	50.0
Longburn	22.35	0.04	30.4	26.32	32.77	39.39	33.87	25.28	34.4	26.67	33.33
Waiouru	4.11	0.0	8.57	9.95	9.03	5.88	11.76	7.52	8.24	33.33	0.0
Tangimoana	58.42	0.15	53.44	68.25	81.46	0.0	27.27	13.04	19.61	56.25	57.14
Ormondville	3.17	0.0	6.22	4.2	5.98	0.0	0.0	5.17	7.78	10.0	18.75
Hokio Beach	16.3	0.02	21.5	20.15	28.99	0.0	100.0	10.4	24.32	0.0	22.22
Norsewood	9.89	0.0	8.21	10.94	13.33	14.29	57.14	5.74	6.97	0.0	4.17
Kimbolton	7.1	0.01	4.97	4.26	5.84	0.0	0.0	3.59	7.3	0.0	8.0
Ōwhango	7.51	0.0	7.58	10.78	14.84	18.18	15.79	2.54	7.86	0.0	6.25
Rātana	23.1	0.02	19.0	21.34	20.41	0.0	0.0	7.55	18.75	22.22	40.0
Mangaweka	6.29	0.01	4.12	12.6	7.34	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	22.49	0.01	22.92	16.44	25.84	0.0	0.0	18.72	32.43	30.0	22.22
Pongaroa	11.66	0.15	8.61	13.93	20.51	8.33	28.57	5.6	6.54	6.35	11.76
Ōhura	7.21	0.01	10.92	9.85	20.9	20.0	0.0	5.03	9.42	4.0	12.5
National Park	6.22	0.0	7.78	7.8	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.44	6.88	11.59	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	13.71	1.31	26.16	17.2	17.24	4.76	4.35	37.3	30.57	14.29	12.5
Waikawa Beach	10.26	0.01	15.58	12.9	19.07	0.0	0.0	8.7	19.23	0.0	0.0
Mangamutu	6.45	0.0	14.41	11.9	20.0	41.67	38.89	8.87	13.0	25.0	0.0
Koitiata	36.57	0.06	32.12	30.5	34.01	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	9.64	5.49	13.1	0.0	0.0	11.76	10.08	0.0	0.0
Other	16.52	0.26	16.0	20.66	23.35	14.75	24.21	13.27	15.15	13.31	16.75

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.13: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +2°C and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	29.81	0.04	30.64	30.86	32.51	35.96	31.8	18.31	18.47	24.89	30.89
Whanganui	31.34	0.19	32.45	32.88	33.91	40.07	51.83	13.0	16.6	32.15	35.86
Levin	50.66	0.02	47.57	51.49	48.06	72.97	69.75	19.9	20.39	55.56	48.48
Feilding	16.91	0.01	19.99	19.14	20.55	33.41	48.09	12.41	17.8	22.29	36.71
Dannevirke	8.64	0.0	9.9	9.27	10.27	12.69	19.19	7.96	10.46	19.76	15.29
Marton	17.41	0.06	17.06	18.82	17.77	38.3	39.47	10.01	11.72	25.44	19.77
Taumarunui	27.7	0.65	26.65	28.53	34.0	18.31	29.11	8.14	11.86	28.41	37.29
Ashhurst	18.94	0.01	18.39	22.07	20.31	50.0	34.62	11.34	11.71	28.12	14.29
Pahiatua	26.65	0.01	24.53	32.62	34.55	41.38	17.86	11.21	15.24	36.84	20.63
Foxton	36.61	0.04	33.99	39.74	36.98	37.59	44.0	19.59	23.5	36.17	44.74
Taihape	2.53	0.2	3.1	3.11	5.96	2.33	8.33	0.81	2.53	2.75	4.08
Bulls	21.25	0.02	25.73	24.28	23.3	45.57	46.15	23.75	25.9	19.7	33.33
Bunnythorpe	6.71	0.0	10.07	5.87	7.67	18.75	11.11	9.78	14.29	19.57	20.0
Shannon	9.51	0.0	9.08	8.36	5.23	12.5	20.69	11.34	15.79	12.73	18.18
Foxton Beach	26.35	0.02	31.1	29.8	33.58	40.0	0.0	23.4	16.67	40.91	26.19
Woodville	65.23	2.47	57.91	62.87	66.19	61.76	78.79	48.87	51.75	34.55	20.45
Rongotea	18.03	0.02	16.08	17.21	14.92	14.29	11.11	13.14	20.5	7.14	35.29
Linton	5.5	0.0	11.39	7.89	6.18	9.52	0.0	7.59	14.01	22.03	29.91
Halcombe	4.04	0.0	4.93	5.52	8.29	5.56	45.45	3.0	5.39	0.0	0.0
Ohakune	25.44	0.11	22.64	24.51	26.08	25.69	16.33	11.23	19.61	13.51	28.57
Eketāhuna	7.57	0.0	7.72	4.72	11.17	0.0	12.5	7.17	9.17	5.36	5.71
Raetihi	17.66	0.01	14.16	19.14	18.04	14.93	12.12	7.9	10.18	7.32	7.14
Hunterville	18.14	0.02	12.05	21.09	18.9	47.37	56.0	4.2	6.48	16.0	25.71
Sanson	7.22	0.0	8.87	8.49	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	11.1	0.01	12.64	10.17	13.49	12.5	0.0	12.25	15.36	12.5	20.0
Tokomaru	6.96	0.01	7.2	5.39	6.92	0.0	11.11	8.61	9.5	0.0	10.0
Kairanga	49.75	0.11	42.55	44.04	44.29	38.46	0.0	43.89	40.19	35.29	38.89
Manakau	18.26	0.01	21.38	24.66	23.2	0.0	0.0	14.18	23.27	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	11.91	0.02	11.22	23.36	13.75	0.0	0.0	8.32	11.31	10.2	22.86
Waitārere Beach	26.55	0.05	30.5	25.7	31.5	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	6.01	6.63	7.3	0.0	0.0	4.01	6.54	4.76	10.0
Himatangi Beach	19.96	0.01	25.23	21.08	23.16	0.0	0.0	38.0	60.47	42.86	72.22
Longburn	23.12	0.04	30.4	25.94	33.33	39.39	33.87	26.4	32.8	26.67	33.33
Waiouru	4.11	0.0	9.08	9.95	9.72	5.88	11.76	8.82	8.24	33.33	0.0
Tangimoana	57.43	0.11	51.96	66.17	78.37	14.29	27.27	12.17	20.26	59.38	57.14
Ormondville	3.17	0.0	6.49	4.9	5.98	0.0	0.0	5.43	8.08	10.0	18.75
Hokio Beach	16.3	0.02	22.38	20.52	30.8	0.0	100.0	10.4	25.0	0.0	25.93
Norsewood	9.89	0.0	8.46	10.94	13.33	14.29	57.14	6.08	7.46	0.0	4.17
Kimbolton	7.1	0.01	5.1	4.26	5.84	0.0	0.0	3.59	8.03	0.0	8.0
Ōwhango	8.38	0.0	8.18	11.38	17.19	18.18	15.79	3.17	7.86	0.0	6.25
Rātana	23.1	0.02	19.0	21.34	20.41	0.0	0.0	7.55	18.75	22.22	40.0
Mangaweka	7.23	0.01	4.33	13.39	8.26	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	25.95	0.02	25.3	18.49	26.97	0.0	0.0	19.79	37.84	30.0	22.22
Pongaroa	14.13	0.27	9.4	13.93	21.79	8.33	28.57	6.72	7.48	6.35	11.76
Ōhura	10.36	0.01	12.38	12.88	21.47	20.0	16.67	5.53	9.95	16.0	12.5
National Park	6.22	0.0	7.78	7.8	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.44	6.88	11.59	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	17.71	1.34	29.6	22.58	22.99	4.76	4.35	40.0	31.21	42.86	37.5
Waikawa Beach	10.26	0.01	16.99	13.26	21.19	0.0	0.0	8.7	26.92	0.0	0.0
Mangamutu	21.29	0.01	26.76	28.57	37.14	66.67	88.89	16.94	19.0	25.0	20.0
Koitiata	36.57	0.06	32.45	30.5	34.69	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	7.2	0.0	9.9	5.49	13.1	0.0	0.0	11.76	10.92	0.0	0.0
Other	16.27	0.49	15.57	20.35	24.0	13.44	26.32	12.25	14.66	14.42	18.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.14: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +2°C and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	44.09	0.12	42.89	45.31	44.21	36.98	32.49	23.85	22.1	34.39	37.31
Whanganui	31.34	0.19	32.45	32.89	33.91	40.15	51.83	13.0	16.6	31.94	35.86
Levin	50.66	0.02	47.57	51.49	48.06	72.97	69.75	19.9	20.39	55.56	48.48
Feilding	23.84	0.01	27.32	26.03	29.32	52.94	59.54	13.37	18.27	35.54	49.37
Dannevirke	8.67	0.0	9.93	9.27	10.27	12.69	19.19	8.07	10.46	19.76	15.29
Marton	17.9	0.06	17.34	19.33	18.17	39.57	40.35	9.79	11.54	25.44	19.77
Taumarunui	28.67	0.65	27.91	30.04	36.12	18.31	29.11	8.14	11.86	27.27	35.59
Ashhurst	18.11	0.01	17.79	20.34	19.92	45.24	30.77	11.86	12.22	31.25	14.29
Pahiatua	26.94	0.01	24.28	32.76	34.64	41.38	17.86	10.8	14.13	36.84	20.63
Foxton	36.84	0.04	34.13	39.8	36.9	38.3	44.0	20.22	23.68	36.17	44.74
Taihape	2.53	0.2	3.1	3.11	5.96	2.33	8.33	0.81	2.53	2.75	4.08
Bulls	21.3	0.02	25.88	24.49	23.43	45.57	46.15	23.75	26.23	19.7	33.33
Bunnythorpe	6.71	0.0	10.0	5.87	7.67	18.75	11.11	9.78	14.13	17.39	20.0
Shannon	10.39	0.02	11.17	8.96	5.8	12.5	27.59	18.21	19.3	21.82	25.0
Foxton Beach	24.47	0.02	28.45	27.61	31.16	20.0	0.0	23.4	16.67	31.82	15.08
Woodville	66.0	2.48	58.61	64.56	66.48	61.76	78.79	49.05	52.36	34.55	18.18
Rongotea	20.42	0.02	19.08	19.29	17.13	14.29	11.11	17.43	24.27	7.14	35.29
Linton	6.38	0.0	12.29	9.66	6.18	9.52	0.0	8.82	14.73	22.03	29.91
Halcombe	4.04	0.0	4.93	5.52	8.29	5.56	45.45	3.0	5.39	0.0	0.0
Ohakune	25.44	0.11	22.64	24.51	26.08	25.69	16.33	11.23	19.61	13.51	28.57
Eketāhuna	7.57	0.0	7.72	4.72	11.17	0.0	12.5	7.17	9.17	5.36	5.71
Raetihi	17.66	0.01	14.16	19.14	18.04	14.93	12.12	7.9	10.18	7.32	7.14
Hunterville	18.87	0.02	12.59	22.27	20.06	47.37	56.0	4.71	6.48	16.0	25.71
Sanson	7.22	0.0	8.87	8.49	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	10.98	0.01	12.29	9.93	12.96	12.5	0.0	11.92	15.0	12.5	20.0
Tokomaru	7.08	0.01	7.57	5.39	6.92	0.0	11.11	9.84	10.06	0.0	10.0
Kairanga	54.44	0.14	48.22	48.74	49.52	38.46	0.0	49.61	46.97	47.06	38.89
Manakau	18.26	0.01	21.38	24.66	23.2	0.0	0.0	14.18	23.27	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	11.91	0.02	11.15	23.36	13.75	0.0	0.0	8.32	11.15	10.2	22.86
Waitārere Beach	26.55	0.05	30.5	25.7	31.5	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	6.01	6.63	7.3	0.0	0.0	4.01	6.54	4.76	10.0
Himatangi Beach	19.96	0.01	25.23	21.08	23.16	0.0	0.0	38.0	60.47	42.86	72.22
Longburn	22.35	0.05	30.5	26.32	32.77	39.39	33.87	25.84	34.4	26.67	33.33
Waiouru	4.11	0.0	9.08	9.95	9.72	5.88	11.76	8.82	8.24	33.33	0.0
Tangimoana	61.19	0.19	54.84	71.22	82.58	0.0	27.27	13.04	20.92	56.25	57.14
Ormondville	3.17	0.0	6.49	4.9	5.98	0.0	0.0	5.43	8.08	10.0	18.75
Hokio Beach	16.3	0.02	22.38	20.52	30.8	0.0	100.0	10.4	25.0	0.0	25.93
Norsewood	9.89	0.0	8.46	10.94	13.33	14.29	57.14	6.08	7.46	0.0	4.17
Kimbolton	7.1	0.01	5.1	4.26	5.84	0.0	0.0	3.59	8.03	0.0	8.0
Ōwhango	8.38	0.0	8.18	11.38	17.19	18.18	15.79	3.17	7.86	0.0	6.25
Rātana	23.1	0.02	19.0	21.34	20.41	0.0	0.0	7.55	18.75	22.22	40.0
Mangaweka	7.23	0.01	4.33	13.39	8.26	12.5	10.0	0.3	1.97	11.43	4.0
Ohakea	25.95	0.02	25.13	18.49	26.97	0.0	0.0	19.79	37.16	30.0	22.22
Pongaroa	14.13	0.27	9.4	13.93	21.79	8.33	28.57	6.72	7.48	6.35	11.76
Ōhura	10.36	0.01	12.38	12.88	21.47	20.0	16.67	5.53	9.95	16.0	12.5
National Park	6.22	0.0	7.78	7.8	6.25	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.44	6.88	11.59	0.0	0.0	4.21	12.5	0.0	0.0
Mangatainoka	18.86	1.34	29.95	23.66	24.14	4.76	4.35	40.0	31.21	42.86	37.5
Waikawa Beach	10.26	0.01	16.99	13.26	21.19	0.0	0.0	8.7	26.92	0.0	0.0
Mangamutu	27.1	0.01	28.53	50.0	40.0	58.33	77.78	16.13	19.0	25.0	20.0
Koitiata	36.57	0.06	32.45	30.5	34.69	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	12.0	0.0	10.66	5.49	13.1	0.0	0.0	11.76	13.45	0.0	0.0
Other	18.21	0.51	17.59	23.11	25.83	14.75	26.84	14.64	16.25	15.37	19.42

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.15: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +3°C and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	33.29	0.05	34.06	34.41	35.7	39.95	32.72	22.13	21.53	27.48	33.03
Whanganui	36.55	0.38	37.37	38.35	38.86	44.39	57.32	13.64	17.46	36.74	40.64
Levin	52.69	0.02	49.36	53.42	49.9	74.49	73.46	20.81	21.6	56.21	51.52
Feilding	17.92	0.01	21.3	20.29	21.72	37.88	55.73	13.01	18.89	23.49	40.51
Dannevirke	9.47	0.0	10.52	9.76	11.02	13.62	21.21	8.57	10.86	20.96	16.47
Marton	18.86	0.07	18.25	20.48	19.11	41.28	42.11	10.46	11.98	26.04	19.77
Taumarunui	32.27	0.79	31.65	34.32	40.17	22.07	34.18	9.95	12.79	35.23	37.29
Ashhurst	19.93	0.01	19.2	22.97	21.26	50.0	34.62	12.13	12.05	31.25	14.29
Pahiatua	28.34	0.01	26.42	33.89	36.94	44.83	25.0	13.24	16.97	36.84	25.4
Foxton	37.49	0.04	34.75	40.36	37.73	38.3	46.0	20.85	24.23	36.17	44.74
Taihape	2.53	0.27	3.16	3.21	5.96	2.33	8.33	0.81	2.74	2.75	4.08
Bulls	22.46	0.02	26.95	25.82	24.84	45.57	46.15	24.94	26.56	19.7	33.33
Bunnythorpe	7.53	0.0	10.34	5.87	8.58	18.75	11.11	10.11	14.29	19.57	20.0
Shannon	10.1	0.01	10.06	9.2	5.37	16.07	20.69	13.75	16.23	18.18	20.45
Foxton Beach	28.06	0.02	32.52	30.83	34.97	60.0	0.0	29.79	16.67	40.91	30.95
Woodville	61.08	2.96	55.31	59.03	62.62	51.47	72.73	48.35	51.33	32.73	20.45
Rongotea	18.78	0.02	17.34	18.4	16.21	14.29	11.11	14.61	21.55	10.71	35.29
Linton	5.65	0.0	12.02	7.69	7.27	14.29	0.0	8.05	14.73	23.73	30.77
Halcombe	4.04	0.0	5.14	5.8	8.29	5.56	45.45	3.23	5.55	0.0	2.63
Ohakune	26.44	0.11	24.16	25.88	27.68	30.28	20.41	11.78	21.54	13.51	28.57
Eketāhuna	8.62	0.18	8.96	5.15	11.69	2.44	12.5	8.47	11.35	5.36	5.71
Raetihi	18.04	0.01	14.74	19.7	18.72	14.93	12.12	8.17	11.2	7.32	7.14
Hunterville	18.97	0.02	12.88	22.75	20.93	47.37	56.0	4.71	6.63	16.0	27.14
Sanson	7.22	0.0	8.95	8.77	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	12.59	0.01	14.34	11.86	15.34	12.5	0.0	14.24	16.79	12.5	20.0
Tokomaru	6.96	0.01	7.29	5.39	7.31	0.0	11.11	8.61	9.5	0.0	10.0
Kairanga	52.41	0.16	46.85	47.29	47.62	53.85	0.0	48.07	45.76	41.18	38.89
Manakau	19.19	0.01	22.44	24.66	24.76	0.0	0.0	15.16	25.21	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	12.06	0.02	11.93	25.23	15.0	0.0	0.0	8.77	11.97	12.24	22.86
Waitārere Beach	28.26	0.06	31.62	27.05	32.48	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	6.11	6.63	8.03	0.0	0.0	4.01	6.54	4.76	10.0
Himatangi Beach	20.72	0.02	27.4	23.29	25.61	0.0	0.0	38.0	62.79	42.86	72.22
Longburn	22.35	0.05	30.72	26.32	33.33	39.39	33.87	26.4	34.4	26.67	33.33
Waiouru	4.7	0.0	9.9	11.31	9.72	5.88	11.76	9.48	9.36	33.33	0.0
Tangimoana	60.0	0.15	54.05	69.73	80.06	28.57	36.36	12.61	22.22	59.38	57.14
Ormondville	5.67	0.01	7.13	6.29	6.52	0.0	0.0	5.94	8.68	10.0	18.75
Hokio Beach	18.52	0.02	23.26	21.64	31.88	0.0	100.0	10.98	25.68	0.0	25.93
Norsewood	9.89	0.0	8.46	10.94	13.33	14.29	57.14	6.08	7.46	0.0	4.17
Kimbolton	7.1	0.01	5.1	4.26	5.84	0.0	0.0	3.59	8.03	0.0	8.0
Ōwhango	8.38	0.0	8.47	11.98	17.19	18.18	21.05	3.49	7.86	0.0	6.25
Rātana	23.1	0.02	18.73	21.34	20.41	0.0	0.0	7.55	16.67	22.22	40.0
Mangaweka	7.23	0.01	4.43	13.39	8.26	12.5	10.0	0.3	2.3	11.43	4.0
Ohakea	27.34	0.03	27.5	19.86	31.46	0.0	0.0	20.86	40.54	40.0	22.22
Pongaroa	15.9	0.37	9.99	15.57	24.36	8.33	28.57	7.28	7.48	6.35	11.76
Ōhura	10.36	0.01	13.18	13.64	22.03	20.0	16.67	5.53	12.04	16.0	12.5
National Park	6.22	0.0	7.95	7.8	6.77	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.85	6.88	12.32	0.0	0.0	5.26	12.5	0.0	0.0
Mangatainoka	25.71	3.19	36.14	40.86	33.33	4.76	39.13	38.92	33.76	57.14	50.0
Waikawa Beach	13.46	0.01	18.41	15.05	22.46	0.0	0.0	8.7	26.92	0.0	0.0
Mangamutu	26.45	0.02	31.47	57.14	51.43	75.0	88.89	16.13	18.0	25.0	20.0
Koitiata	36.57	0.06	33.44	31.91	35.37	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	12.0	0.0	11.42	5.49	14.29	0.0	40.0	11.76	13.45	0.0	0.0
Other	17.75	0.84	16.89	22.56	25.85	16.72	27.37	13.42	15.61	15.45	19.82

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.16: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +3°C and Defences Down

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	51.13	0.18	49.42	52.42	51.1	41.02	33.64	25.4	24.6	40.43	45.57
Whanganui	36.55	0.39	37.34	38.34	38.82	44.22	56.4	13.64	17.46	36.74	40.64
Levin	52.69	0.02	49.36	53.42	49.9	74.49	73.46	20.81	21.6	56.21	51.52
Feilding	24.89	0.01	28.66	27.35	30.74	55.29	63.36	13.61	19.2	37.35	51.9
Dannevirke	9.5	0.0	10.57	9.76	11.02	13.62	21.21	8.68	11.01	20.96	16.47
Marton	19.62	0.07	18.62	20.92	19.61	42.98	45.61	10.38	11.89	26.04	20.93
Taumarunui	32.95	0.8	32.04	34.76	40.9	22.07	34.18	9.95	12.79	34.09	37.29
Ashhurst	19.22	0.01	18.95	21.72	21.17	47.62	34.62	12.65	12.9	34.38	14.29
Pahiatua	28.37	0.01	26.25	33.89	37.22	44.83	21.43	12.51	16.87	36.84	23.81
Foxton	37.92	0.04	34.89	40.55	37.81	38.3	46.0	21.01	24.41	36.17	44.74
Taihape	2.53	0.27	3.16	3.21	5.96	2.33	8.33	0.81	2.74	2.75	4.08
Bulls	22.51	0.02	27.09	26.13	24.97	45.57	46.15	24.94	26.56	19.7	33.33
Bunnythorpe	7.53	0.0	10.26	5.87	8.58	18.75	11.11	10.11	14.13	17.39	20.0
Shannon	10.8	0.02	11.7	9.68	6.36	14.29	27.59	18.56	19.3	21.82	25.0
Foxton Beach	24.94	0.02	28.82	27.91	31.38	40.0	0.0	29.79	16.67	31.82	15.08
Woodville	69.14	3.19	62.19	69.19	69.47	85.29	96.97	50.78	53.39	36.36	22.73
Rongotea	21.04	0.03	19.94	20.33	18.23	14.29	11.11	18.1	24.9	10.71	35.29
Linton	6.38	0.0	12.69	9.47	6.55	14.29	0.0	9.13	14.96	23.73	30.77
Halcombe	4.04	0.0	5.1	5.8	8.29	5.56	45.45	3.23	5.55	0.0	0.0
Ohakune	26.44	0.11	24.16	25.88	27.68	30.28	20.41	11.78	21.54	13.51	28.57
Eketāhuna	7.75	0.0	8.52	4.94	11.69	2.44	12.5	7.67	10.94	5.36	5.71
Raetihi	18.04	0.01	14.74	19.7	18.72	14.93	12.12	8.17	11.2	7.32	7.14
Hunterville	19.38	0.03	13.0	22.99	21.22	47.37	56.0	4.97	6.63	16.0	25.71
Sanson	7.22	0.0	8.95	8.77	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	12.47	0.01	14.05	11.62	14.81	12.5	0.0	13.91	16.79	12.5	20.0
Tokomaru	7.08	0.01	8.04	5.69	7.31	0.0	11.11	10.66	10.61	0.0	10.0
Kairanga	55.58	0.15	50.16	49.82	50.0	53.85	0.0	51.93	49.39	47.06	38.89
Manakau	19.19	0.01	22.44	24.66	24.76	0.0	0.0	15.16	25.21	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	12.06	0.02	11.93	25.23	15.0	0.0	0.0	8.77	11.97	12.24	22.86
Waitārere Beach	28.26	0.06	31.62	27.05	32.48	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	6.11	6.63	8.03	0.0	0.0	4.01	6.54	4.76	10.0
Himatangi Beach	20.72	0.02	27.4	23.29	25.61	0.0	0.0	38.0	62.79	42.86	72.22
Longburn	23.12	0.06	30.72	26.32	32.77	39.39	33.87	26.4	35.2	26.67	33.33
Waiouru	4.7	0.0	9.9	11.31	9.72	5.88	11.76	9.48	9.36	33.33	0.0
Tangimoana	62.57	0.22	55.62	72.11	82.87	28.57	36.36	13.04	22.22	56.25	57.14
Ormondville	5.67	0.01	7.04	6.29	6.52	0.0	0.0	5.94	8.38	10.0	18.75
Hokio Beach	18.52	0.02	23.26	21.64	31.88	0.0	100.0	10.98	25.68	0.0	25.93
Norsewood	9.89	0.0	8.46	10.94	13.33	14.29	57.14	6.08	7.46	0.0	4.17
Kimbolton	7.1	0.01	5.1	4.26	5.84	0.0	0.0	3.59	8.03	0.0	8.0
Ōwhango	8.38	0.0	8.47	11.98	17.19	18.18	21.05	3.49	7.86	0.0	6.25
Rātana	23.1	0.02	18.73	21.34	20.41	0.0	0.0	7.55	16.67	22.22	40.0
Mangaweka	7.23	0.01	4.43	13.39	8.26	12.5	10.0	0.3	2.3	11.43	4.0
Ohakea	27.34	0.03	27.5	19.86	31.46	0.0	0.0	20.86	40.54	40.0	22.22
Pongaroa	15.9	0.37	9.99	15.57	24.36	8.33	28.57	7.28	7.48	6.35	11.76
Ōhura	10.36	0.01	13.18	13.64	22.03	20.0	16.67	5.53	12.04	16.0	12.5
National Park	6.22	0.0	7.95	7.8	6.77	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.85	6.88	12.32	0.0	0.0	5.26	12.5	0.0	0.0
Mangatainoka	26.29	3.21	38.21	39.78	33.33	9.52	34.78	41.08	39.49	57.14	50.0
Waikawa Beach	13.46	0.01	18.23	14.7	22.46	0.0	0.0	8.7	26.92	0.0	0.0
Mangamutu	28.39	0.03	35.0	57.14	57.14	66.67	88.89	18.55	26.0	25.0	20.0
Koitiata	36.57	0.06	33.44	31.91	35.37	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	12.0	0.01	11.42	5.49	14.29	0.0	40.0	11.76	13.45	0.0	0.0
Other	19.59	0.85	18.79	25.23	27.57	18.03	27.37	15.61	17.11	16.64	20.87

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.9.17: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each town/settlement- 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Palmerston North	33.29	0.05	34.06	34.41	35.7	39.95	32.72	22.13	21.53	27.48	33.03
Whanganui	36.88	0.39	37.82	38.64	39.53	45.64	58.84	13.72	17.56	36.95	41.43
Levin	52.69	0.02	49.36	53.42	49.9	74.49	73.46	20.81	21.6	56.21	51.52
Feilding	17.92	0.01	21.29	20.29	21.7	37.88	55.73	13.01	18.89	23.49	40.51
Dannevirke	9.47	0.0	10.52	9.76	11.02	13.62	21.21	8.57	10.86	20.96	16.47
Marton	18.86	0.07	18.25	20.48	19.11	41.28	42.11	10.46	11.98	26.04	19.77
Taumarunui	32.27	0.79	31.65	34.32	40.17	22.07	34.18	9.95	12.79	35.23	37.29
Ashhurst	19.93	0.01	19.2	22.97	21.26	50.0	34.62	12.13	12.05	31.25	14.29
Pahiatua	28.34	0.01	26.42	33.89	36.94	44.83	25.0	13.24	16.97	36.84	25.4
Foxton	37.36	0.04	34.63	40.36	37.73	38.3	46.0	20.06	24.23	36.17	44.74
Taihape	2.53	0.27	3.16	3.21	5.96	2.33	8.33	0.81	2.74	2.75	4.08
Bulls	22.46	0.02	26.95	25.82	24.84	45.57	46.15	24.94	26.56	19.7	33.33
Bunnythorpe	7.53	0.0	10.37	5.87	8.8	18.75	11.11	10.11	14.29	19.57	20.0
Shannon	9.92	0.01	10.01	9.2	5.23	16.07	20.69	13.75	16.23	18.18	20.45
Foxton Beach	30.76	0.03	35.42	34.37	37.24	60.0	0.0	29.79	16.67	40.91	34.92
Woodville	61.08	2.96	55.31	59.03	62.62	51.47	72.73	48.35	51.33	32.73	20.45
Rongotea	18.78	0.02	17.34	18.4	16.21	14.29	11.11	14.61	21.55	10.71	35.29
Linton	5.65	0.0	12.02	7.69	7.27	14.29	0.0	8.05	14.73	23.73	30.77
Halcombe	4.04	0.0	5.14	5.8	8.29	5.56	45.45	3.23	5.55	0.0	2.63
Ohakune	26.44	0.11	24.16	25.88	27.68	30.28	20.41	11.78	21.54	13.51	28.57
Eketāhuna	8.62	0.18	8.96	5.15	11.69	2.44	12.5	8.47	11.35	5.36	5.71
Raetihi	18.04	0.01	14.74	19.7	18.72	14.93	12.12	8.17	11.2	7.32	7.14
Hunterville	18.97	0.02	12.88	22.75	20.93	47.37	56.0	4.71	6.63	16.0	27.14
Sanson	7.22	0.0	8.95	8.77	9.84	24.49	42.31	4.48	7.14	0.0	12.5
Ōhau	12.59	0.01	14.34	11.86	15.34	12.5	0.0	14.24	16.79	12.5	20.0
Tokomaru	6.96	0.01	7.29	5.39	7.31	0.0	11.11	8.61	9.5	0.0	10.0
Kairanga	52.41	0.16	46.85	47.29	47.62	53.85	0.0	48.07	45.76	41.18	38.89
Manakau	19.19	0.01	22.51	24.93	24.76	0.0	0.0	15.16	25.21	25.93	40.0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	% of the resident population exposed to flooding	% of the resident population as fatalities	% of the total buildings exposed to flooding	% of residential (primary structures) exposed to flooding	% of residential (secondary structures) exposed to flooding	% of commercial/industrial buildings (primary structures) exposed to flooding	% of commercial/industrial (secondary structures) exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) exposed to flooding	% of other buildings (primary structures) exposed to flooding	% of other buildings (secondary structures) exposed to flooding
Pohangina	12.06	0.02	11.93	25.23	15.0	0.0	0.0	8.77	11.97	12.24	22.86
Waitārere Beach	26.86	0.06	31.38	25.95	33.09	75.0	100.0	0.0	0.0	80.0	75.93
Kai Iwi	3.89	0.0	6.11	6.63	8.03	0.0	0.0	4.01	6.54	4.76	10.0
Himatangi Beach	20.72	0.02	27.12	23.69	24.8	0.0	0.0	38.0	60.47	42.86	72.22
Longburn	22.35	0.05	30.72	26.32	33.33	39.39	33.87	26.4	34.4	26.67	33.33
Waiouru	4.7	0.0	9.9	11.31	9.72	5.88	11.76	9.48	9.36	33.33	0.0
Tangimoana	60.0	0.15	54.14	69.73	80.06	28.57	36.36	12.61	22.88	59.38	57.14
Ormondville	5.67	0.01	7.13	6.29	6.52	0.0	0.0	5.94	8.68	10.0	18.75
Hokio Beach	18.52	0.02	23.26	21.64	31.88	0.0	100.0	10.98	25.68	0.0	25.93
Norsewood	9.89	0.0	8.46	10.94	13.33	14.29	57.14	6.08	7.46	0.0	4.17
Kimbolton	7.1	0.01	5.1	4.26	5.84	0.0	0.0	3.59	8.03	0.0	8.0
Ōwhango	8.38	0.0	8.47	11.98	17.19	18.18	21.05	3.49	7.86	0.0	6.25
Rātana	23.1	0.02	18.73	21.34	20.41	0.0	0.0	7.55	16.67	22.22	40.0
Mangaweka	7.23	0.01	4.43	13.39	8.26	12.5	10.0	0.3	2.3	11.43	4.0
Ohakea	27.34	0.03	27.5	19.86	31.46	0.0	0.0	20.86	40.54	40.0	22.22
Pongaroa	15.9	0.37	9.99	15.57	24.36	8.33	28.57	7.28	7.48	6.35	11.76
Ōhura	10.36	0.01	13.18	13.64	22.03	20.0	16.67	5.53	12.04	16.0	12.5
National Park	6.22	0.0	7.95	7.8	6.77	17.39	0.0	8.57	0.0	11.76	15.0
Rangataua	9.94	0.01	8.85	6.88	12.32	0.0	0.0	5.26	12.5	0.0	0.0
Mangatainoka	25.71	3.19	36.14	40.86	33.33	4.76	39.13	38.92	33.76	57.14	50.0
Waikawa Beach	13.46	0.01	18.41	15.05	22.46	0.0	0.0	8.7	26.92	0.0	0.0
Mangamutu	26.45	0.02	31.47	57.14	51.43	75.0	88.89	16.13	18.0	25.0	20.0
Koitiata	35.82	0.07	37.42	34.75	40.82	0.0	0.0	60.0	25.0	0.0	0.0
Raurimu	12.0	0.0	11.42	5.49	14.29	0.0	40.0	11.76	13.45	0.0	0.0
Other	17.79	0.84	16.9	22.66	25.92	17.05	27.89	13.38	15.61	15.29	19.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.10.1: Total reinstatement cost of the buildings, by building type, for each town/settlement

Town/Settlement	Total reinstatement cost of buildings (000's NZD)	Total reinstatement cost of residential buildings (primary structures) (000's NZD)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total reinstatement cost of rural buildings (primary & secondary) (000's NZD)	Total reinstatement cost of other buildings (primary & secondary) (000's NZD)
Palmerston North	24,241,471	12,678,433	2,021,453	5,584,650	1,228,820	2,728,115
Whanganui	12,992,608	7,527,194	1,041,475	2,476,098	870,609	1,077,232
Levin	6,390,650	3,763,402	527,836	920,440	804,272	374,700
Feilding	4,850,634	2,649,826	516,167	778,930	517,433	388,279
Dannevirke	2,682,097	1,036,890	154,862	442,500	852,141	195,704
Marton	2,512,956	1,036,423	195,477	287,453	752,359	241,245
Taumarunui	1,598,288	855,387	96,687	225,686	241,784	178,744
Ashhurst	1,080,954	489,814	120,550	45,478	394,909	30,203
Pahiatua	1,604,935	556,818	89,608	152,673	702,089	103,748
Foxton	1,552,564	595,587	107,138	215,254	513,266	121,319
Taihape	1,401,542	430,945	59,476	146,639	618,028	146,455
Bulls	798,896	328,419	70,194	132,022	221,665	46,596
Bunnythorpe	809,705	220,040	54,203	20,950	441,610	72,904
Shannon	590,950	257,438	58,675	87,334	138,584	48,918
Foxton Beach	745,239	512,294	171,436	4,432	28,299	28,777
Woodville	759,651	284,821	59,443	58,790	304,544	52,054
Rongotea	731,177	230,735	68,876	27,887	368,976	34,704
Linton	956,763	206,625	22,296	31,132	359,954	336,756
Halcombe	767,985	145,401	58,667	41,044	475,520	47,353
Ohakune	982,145	556,856	121,084	87,365	193,802	23,038
Eketāhuna	815,568	157,778	31,324	29,669	563,090	33,707
Raetihi	496,227	186,025	29,807	44,384	198,306	37,705
Hunterville	834,670	184,215	30,386	71,875	489,620	58,575
Sanson	351,202	115,031	27,859	45,150	141,288	21,874
Ōhau	413,179	165,504	63,323	5,154	162,018	17,179
Tokomaru	305,404	112,547	32,240	15,666	125,072	19,878
Kairanga	521,775	106,972	17,959	8,920	371,618	16,307
Manakau	401,721	142,130	36,850	482	199,632	22,628
Pohangina	432,444	42,081	5,858	0	360,562	23,943

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total reinstatement cost of buildings (000's NZD)	Total reinstatement cost of residential buildings (primary structures) (000's NZD)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total reinstatement cost of rural buildings (primary & secondary) (000's NZD)	Total reinstatement cost of other buildings (primary & secondary) (000's NZD)
Waitārere Beach	327,826	241,631	71,688	2,166	1,762	10,580
Kai Iwi	271,227	61,062	14,312	3,533	156,477	35,844
Himatangi Beach	211,597	126,329	40,194	674	38,942	5,459
Longburn	762,119	276,803	10,819	301,608	159,351	13,537
Waiouru	471,643	200,482	11,851	26,891	221,164	11,254
Tangimoana	264,235	89,693	27,295	6,477	114,560	26,210
Ormondville	290,223	48,210	17,909	10,131	201,342	12,630
Hokio Beach	194,563	85,315	18,399	969	77,670	12,211
Norsewood	223,384	51,233	12,967	8,966	134,549	15,668
Kimbolton	210,695	69,934	12,253	3,152	107,505	17,850
Ōwhango	249,511	49,327	12,140	4,885	161,769	21,390
Rātana	123,470	60,398	8,992	407	30,727	22,946
Mangaweka	308,244	44,564	7,214	15,126	221,950	19,390
Ohakea	531,996	76,549	10,022	0	409,993	35,432
Pongaroa	435,724	55,654	6,152	6,599	224,819	142,501
Ōhura	219,060	46,700	21,046	2,503	128,052	20,759
National Park	234,414	117,387	16,425	26,163	57,213	17,226
Rangataua	117,648	55,158	10,862	0	51,628	0
Mangatainoka	201,922	36,000	9,427	64,602	88,059	3,833
Waikawa Beach	107,982	73,422	22,691	0	11,653	215
Mangamutu	198,908	12,946	4,846	113,959	65,589	1,568
Koitiata	46,211	34,884	7,681	0	3,014	632
Raurimu	81,781	31,267	6,286	461	40,350	3,417
Other	14,282,342	2,048,372	904,627	413,508	9,884,451	1,031,383

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.1: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 5% AEP with Current Climate and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	13,698	17,781,823	6,391	648,873	4,043	425,151.6	1,793	48,099	333	124,876.8	116	20,402.5	106	30,344	18,430,696.3
Whanganui	6,069	5,884,040	3,173	263,031	1,656	164,074	1,031	15,611	229	55,706.2	160	10,042.6	97	17,598.1	6,147,070.9
Levin	6,646	2,077,497	869	73,872	482	41,786.9	269	6,117	63	21,951.6	45	2,961.6	10	1,054.2	2,151,368.9
Feilding	1,633	531,335	300	38,432	114	8,859.6	47	1,523	63	19,693.6	57	3,757.8	19	4,598.6	569,767
Dannevirke	382	118,183	113	7,080	34	2,704.9	18	223	20	2,622.6	36	1,160.6	5	368.2	125,262.9
Marton	670	340,547	327	17,658	118	7,540.7	96	1,371	24	3,348.9	77	4,191	12	1,206	358,205.1
Taumarunui	334	5,259,533	246	14,024	110	7,612.2	92	1,306	8	1,267.3	22	1,108.1	14	2,730.1	5,273,556.9
Ashhurst	478	169,191	120	9,964	35	2,781.1	21	463	22	3,154.8	40	3,375.5	2	189.4	179,155.3
Pahiatua	657	365,324	371	24,852	163	11,774.7	110	1,404	21	3,532.8	61	4,240.5	16	3,899.5	390,175.8
Foxton	976	1,195,910	768	56,183	376	35,421.3	252	3,698	36	5,629.9	68	5,017.8	36	6,416.3	1,252,093
Taihape	46	200,020	41	2,177	14	1,197.7	15	193	1	23	9	391.3	2	372.1	202,196.6
Bulls	284	203,027	132	8,253	42	3,194.7	27	325	6	1,404.3	52	3,196.2	5	132.5	211,280.3
Bunnythorpe	92	69,910	59	2,826	8	472.1	4	100	0	0	43	2,020.1	4	232.6	72,735.6
Shannon	114	37,183	29	1,793	3	176.4	3	48	2	48.9	21	1,519.6	0	0	38,976.2
Foxton Beach	368	273,566	441	21,466	228	15,113.6	190	4,377	1	383.3	7	391.5	15	1,200.3	295,031.5
Woodville	518	2,533,993	608	60,980	97	10,525.3	105	2,658	21	2,930.8	380	44,283	5	583.1	2,594,973
Rongotea	169	107,629	102	5,157	36	2,854.7	27	510	1	62.7	38	1,729.1	0	0	112,786.1
Linton	45	13,142	38	8,171	3	148	0	0	1	427.3	31	1,010.9	3	6,585.2	21,313.5
Halcombe	40	42,817	36	2,655	4	179.2	10	411	0	0	22	2,064.9	0	0	45,471.6
Ohakune	189	164,573	211	14,377	94	7,459.6	54	2,041	21	2,901.3	37	1,676	5	299.7	178,949.8
Eketāhuna	55	31,737	57	3,456	6	347	8	256	0	0	43	2,853.5	0	0	35,193.2
Raetihi	120	91,926	97	5,064	38	2,776.3	31	343	3	289.4	25	1,655.2	0	0	96,990.3
Hunterville	101	86,311	92	5,232	25	1,666.2	17	288	19	1,776.3	18	483.4	13	1,016.7	91,543.1
Sanson	47	32,241	41	1,466	9	494.4	13	202	7	435.3	12	333.8	0	0	33,707.2
Ōhau	69	43,597	29	1,498	6	444.4	6	58	0	0	17	996.4	0	0	45,094.7
Tokomaru	53	62,890	20	1,898	4	188	0	0	0	0	16	1,710.2	0	0	64,788

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	137	50,417	86	6,957	22	1,705.8	9	100	1	1,283.1	53	3,847.4	1	20	57,374.2
Manakau	97	34,299	53	2,014	10	644.9	8	188	0	0	30	915.4	5	266.4	36,313.1
Pohangina	51	49,853	34	1,956	1	59.7	0	0	0	0	30	1,859.7	3	36	51,808.9
Waitārere Beach	108	161,828	239	9,724	100	6,641.8	114	2,256	1	135.8	0	0	24	690.2	171,552
Kai Iwi	23	24,234	35	1,242	5	367.5	5	61	0	0	21	767.9	4	46	25,476.2
Himatangi Beach	76	42,094	88	3,720	37	2,066.2	28	336	0	0	21	1,279.8	2	38	45,813.8
Longburn	74	41,575	52	7,886	12	1,119.1	5	53	14	5,171.5	19	1,256.7	2	285.1	49,461.2
Waiouru	20	12,287	22	1,691	3	1,176.7	6	122	1	23	11	321.6	1	48	13,978.4
Tangimoana	155	173,467	244	9,511	98	5,254.5	113	1,868	1	6	16	577.4	16	1,806	182,978.3
Ormondville	14	2,268	15	406	0	0	2	40	0	0	13	366.5	0	0	2,673.5
Hokio Beach	38	45,244	73	2,483	19	1,532.5	29	293	0	0	24	647.8	1	9	47,727.1
Norsewood	33	16,190	19	768	8	569.5	5	58	0	0	6	140.9	0	0	16,957.9
Kimbolton	21	38,012	10	610	3	302.3	2	145	0	0	5	163.1	0	0	38,621.7
Ōwhango	22	10,094	22	852	3	358.7	4	54	0	0	15	439.4	0	0	10,946.3
Rātana	66	70,879	37	1,783	14	1,173.6	14	273	0	0	9	336	0	0	72,661.9
Mangaweka	15	11,016	7	751	3	305	0	0	1	91.8	0	0	3	354.1	11,766.6
Ohakea	26	9,685	12	711	0	0	0	0	0	0	10	666.4	2	44.2	10,396.4
Pongaroa	19	15,206	32	2,122	4	453.3	4	74	1	110.6	17	1,053.4	6	430.7	17,327.8
Ōhura	11	11,855	30	2,265	7	574.5	15	950	1	80.4	6	620	1	39.8	14,120.4
National Park	12	1,934	9	1,650	3	143.5	4	98	1	1,338.8	1	69.7	0	0	3,583.9
Rangataua	15	9,995	11	275	1	43.1	4	54	0	0	6	178.1	0	0	10,270
Mangatainoka	23	231,969	109	15,810	13	1,433.3	9	209	1	90.8	85	14,048.3	1	29.1	247,778.8
Waikawa Beach	9	3,972	31	834	12	502.1	16	315	0	0	3	17	0	0	4,806.5
Mangamutu	10	5,186	15	12,798	1	98.5	0	0	5	12,431.3	9	267	0	0	17,984.2
Koitiata	45	88,874	81	3,033	39	2,558.2	40	424	0	0	2	50.7	0	0	91,906.9
Raurimu	8	3,016	10	260	0	0	1	4	0	0	9	256.1	0	0	3,275.7
Other	1,246	1,523,807	1,456	95,031	233	19,928.4	213	3,991	27	3,969.7	875	59,195.4	108	7,946.9	1,618,838.1

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.2: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 5% AEP with Current Climate and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	10,672	9,609,900	4,052	446,618	2,519	257,941.8	1,039	38,048	271	105,573.2	147	21,457.5	76	23,597.9	10,056,517.5
Whanganui	6,013	5,642,693	3,077	247,643	1,623	160,642.2	1,016	15,499	191	44,113.9	160	10,042.6	87	17,345.2	5,890,336.4
Levin	6,646	2,077,483	869	73,872	482	41,786.9	269	6,117	63	21,951.6	45	2,961.6	10	1,054.2	2,151,354.9
Feilding	2,339	843,400	526	70,729	227	26,967.3	98	3,254	111	28,254	68	5,374.3	22	6,879.4	914,128.6
Dannevirke	382	118,184	119	7,619	34	2,704.9	18	223	20	2,622.6	42	1,699.7	5	368.2	125,803
Marton	713	401,413	379	21,399	144	9,608.3	114	1,634	26	3,802.5	79	4,381.1	16	1,973.9	422,811.8
Taumarunui	331	5,252,060	239	13,652	109	7,320.8	86	1,227	8	1,267.3	22	1,107.1	14	2,730.1	5,265,711.9
Ashhurst	456	155,829	105	7,758	38	2,604.3	17	396	16	1,980.5	32	2,588.3	2	189.4	163,586.8
Pahiatua	656	366,183	375	25,315	166	12,063.1	110	1,399	22	3,739.3	61	4,203	16	3,910.6	391,497.7
Foxton	985	1,284,406	784	56,399	377	35,735.9	254	3,750	36	5,657.8	81	6,048.6	36	5,207.3	1,340,805.2
Taihape	46	200,050	41	2,176	14	1,197.3	15	193	1	23	9	391.3	2	372.1	202,226.5
Bulls	288	208,345	142	9,154	45	3,486	31	355	6	1,413.9	55	3,766.1	5	132.5	217,499.4
Bunnythorpe	92	69,516	58	2,771	8	472.1	4	100	0	0	43	2,017.1	3	181.4	72,287.2
Shannon	120	83,755	68	5,500	5	303.7	4	60	2	48.9	46	4,517.2	11	570.4	89,254.9
Foxton Beach	361	250,075	404	18,400	209	13,175.3	179	4,167	1	383.3	7	395.2	8	278.9	268,475.3
Woodville	531	2,540,228	604	60,805	92	10,145.8	104	2,616	21	2,914.6	382	44,545.2	5	583.1	2,601,032.5
Rongotea	227	292,895	208	13,191	58	4,942.9	42	666	1	62.7	99	6,896.3	8	622.9	306,086.3
Linton	49	16,966	57	9,819	10	901.3	0	0	1	427.3	43	1,904.8	3	6,585.2	26,785.3
Halcombe	40	42,818	36	2,655	4	179.2	10	411	0	0	22	2,064.9	0	0	45,473.4
Ohakune	189	164,573	211	14,377	94	7,459.6	54	2,041	21	2,901.3	37	1,676	5	299.7	178,949.8
Eketāhuna	55	31,743	58	3,502	6	347	8	256	0	0	44	2,900.2	0	0	35,245
Raetihi	120	91,926	97	5,064	38	2,776.3	31	343	3	289.4	25	1,655.2	0	0	96,990.3
Hunterville	117	113,347	118	6,635	39	2,617.1	23	329	22	1,959	21	714.8	13	1,014.9	119,981.8
Sanson	47	32,240	41	1,466	9	494.4	13	202	7	435.3	12	333.8	0	0	33,706.4
Ōhau	68	37,678	26	1,210	6	447.2	6	58	0	0	14	704.1	0	0	38,888
Tokomaru	57	86,865	24	2,407	0	0	0	0	0	0	23	2,351.9	1	55	89,271.7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	258	446,122	272	22,916	52	4,544.1	34	362	1	819.2	184	17,162.4	1	28	469,037.7
Manakau	97	34,298	53	2,014	10	644.9	8	188	0	0	30	915.4	5	266.4	36,312.5
Pohangina	51	49,855	34	1,956	1	59.7	0	0	0	0	30	1,859.7	3	36	51,811.1
Waitārere Beach	108	161,829	239	9,724	100	6,641.8	114	2,256	1	135.8	0	0	24	690.2	171,552.8
Kai Iwi	23	24,233	35	1,242	5	367.5	5	61	0	0	21	767.9	4	46	25,475.1
Himatangi Beach	76	42,092	88	3,720	37	2,066.2	28	336	0	0	21	1,279.8	2	38	45,812.3
Longburn	88	74,927	117	18,465	21	1,851.8	14	145	45	13,649.8	32	2,031.6	5	787.9	93,391.7
Waiouru	20	12,287	22	1,691	3	1,176.7	6	122	1	23	11	321.6	1	48	13,978.4
Tangimoana	135	145,461	192	7,521	80	4,259.8	84	1,223	1	6	16	655.3	11	1,377.7	152,982.1
Ormondville	14	2,268	15	406	0	0	2	40	0	0	13	366.5	0	0	2,674.2
Hokio Beach	38	45,245	73	2,483	19	1,532.5	29	293	0	0	24	647.8	1	9	47,727.6
Norsewood	33	16,190	19	768	8	569.5	5	58	0	0	6	140.9	0	0	16,957.9
Kimbolton	21	38,012	10	610	3	302.3	2	145	0	0	5	163.1	0	0	38,621.6
Ōwhango	22	10,094	22	852	3	358.7	4	54	0	0	15	439.4	0	0	10,946.2
Rātana	66	70,879	37	1,783	14	1,173.6	14	273	0	0	9	336	0	0	72,661.9
Mangaweka	15	11,016	7	751	3	305	0	0	1	91.8	0	0	3	354.1	11,766.5
Ohakea	26	8,726	12	681	0	0	0	0	0	0	10	636.6	2	44.2	9,406.9
Pongaroa	19	15,206	32	2,122	4	453.3	4	74	1	110.6	17	1,053.4	6	430.7	17,327.8
Ōhura	11	11,855	30	2,266	7	575.3	15	950	1	80.4	6	620	1	39.8	14,121.4
National Park	12	1,934	9	1,650	3	143.5	4	98	1	1,338.8	1	69.7	0	0	3,584.1
Rangataua	15	9,995	11	275	1	43.1	4	54	0	0	6	178.1	0	0	10,270
Mangatainoka	23	231,875	109	15,782	13	1,437.7	9	212	1	90.8	85	14,012.3	1	29.1	247,656.8
Waikawa Beach	9	3,972	31	834	12	502.1	16	315	0	0	3	17	0	0	4,806.5
Mangamutu	10	5,186	9	13,030	1	98.5	1	27	1	12,711.1	6	193.4	0	0	18,215.9
Koitiata	45	88,874	81	3,033	39	2,558.2	40	424	0	0	2	50.7	0	0	91,907.2
Raurimu	8	3,016	10	260	0	0	1	4	0	0	9	256.1	0	0	3,275.7
Other	1,532	3,066,893	2,240	186,732	377	46,133.1	316	5,508	30	6,245	1,402	120,290.9	115	8,554	3,253,625.1

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.3: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 2% AEP with Current Climate and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	14,892	20,984,204	7,195	745,580	4,497	485,586.2	2,050	51,980	390	153,856.5	138	20,018.2	120	34,139.9	21,729,784
Whanganui	6,498	6,577,969	3,491	301,077	1,822	182,543.6	1,134	17,846	253	64,538.5	164	10,351.6	118	25,798.1	6,879,046
Levin	7,019	2,308,440	1,087	88,660	614	50,336.5	334	7,260	73	26,343.8	54	3,617.3	12	1,102.3	2,397,100.5
Feilding	1,805	609,137	351	44,010	143	12,565.8	54	1,744	71	20,621	62	4,084.6	21	4,994.6	653,146.6
Dannevirke	404	130,563	130	8,098	40	3,043	19	257	23	3,079.2	42	1,341.8	6	377.1	138,661.1
Marton	756	446,574	402	23,712	151	10,297.8	118	1,710	26	3,753.8	89	5,175.7	18	2,774.7	470,286.4
Taumarunui	364	10,353,082	288	16,840	134	10,090.5	106	1,471	8	1,276.4	26	1,193.8	14	2,807	10,369,922.2
Ashhurst	524	193,378	144	10,627	47	3,548.3	32	591	22	3,151.7	40	2,966.5	3	369.2	204,005.2
Pahiatua	703	393,124	414	27,757	173	12,515.8	119	1,432	28	4,556.1	78	5,201.2	16	4,051.4	420,880.5
Foxton	1,011	1,265,829	810	58,143	397	36,505.1	267	3,850	40	6,027.7	67	5,162.1	39	6,598.3	1,323,971.7
Taihape	46	225,520	42	2,575	14	1,507.2	16	225	1	33	9	416.2	2	393.6	228,095.2
Bulls	315	244,321	165	10,238	50	3,901.3	35	408	8	1,225.3	66	4,548.5	6	155	254,559.2
Bunnythorpe	107	75,964	67	3,386	8	489.7	6	93	0	0	48	2,462.5	5	340.2	79,350.2
Shannon	122	48,142	43	2,655	3	176.1	3	48	2	48.9	30	2,221.5	5	161.1	50,796.7
Foxton Beach	384	299,834	472	22,594	248	16,357.7	201	4,220	1	414.3	7	386.4	15	1,216.1	322,428.3
Woodville	660	4,372,648	815	85,358	197	22,048	186	4,407	27	4,592.9	400	53,635.6	5	673.3	4,458,006.2
Rongotea	198	141,603	133	7,128	46	3,479	29	474	1	66.2	54	2,986.9	3	122.8	148,731.4
Linton	51	15,402	42	9,559	3	151.5	0	0	1	427.3	33	1,258	5	7,721.5	24,960.8
Halcombe	40	44,542	40	2,545	4	184.7	12	408	0	0	24	1,953	0	0	47,086.7
Ohakune	217	187,497	240	16,244	106	8,470.2	64	2,134	24	3,097.3	40	2,243.9	6	298.5	203,741
Eketāhuna	69	35,900	56	3,333	5	272.5	8	351	0	0	43	2,709.1	0	0	39,232.7
Raetihi	127	102,484	102	5,150	38	2,780.1	34	400	3	304.8	27	1,665.6	0	0	107,634
Hunterville	115	107,398	114	6,609	33	2,103.9	20	320	22	2,256.7	23	755.5	16	1,172.3	114,007.4
Sanson	49	35,560	44	1,884	10	542.2	13	211	8	686.7	13	444.8	0	0	37,443.8
Ōhau	76	52,303	40	2,094	9	786.8	8	77	0	0	23	1,229.8	0	0	54,397.3
Tokomaru	57	65,498	23	1,958	4	187	0	0	0	0	18	1,726.2	1	44	67,456.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	178	109,872	145	10,906	34	2,542.6	20	277	1	831.4	89	7,234.9	1	20	120,777.5
Manakau	101	37,588	66	2,869	14	947.1	9	174	0	0	38	1,454.1	5	293.1	40,457.4
Pohangina	53	59,849	39	2,220	1	54.4	0	0	0	0	35	2,129.4	3	36	62,069.4
Waitārere Beach	129	238,980	311	13,605	125	9,016.9	152	3,395	1	135.8	0	0	33	1,057.8	252,584.5
Kai Iwi	23	24,821	35	1,252	5	371.8	5	63	0	0	21	772.1	4	45	26,072.9
Himatangi Beach	79	46,622	103	4,278	43	2,252.7	32	386	0	0	26	1,605.7	2	34	50,900.4
Longburn	82	45,504	61	9,344	15	1,595.3	8	93	17	6,028.7	19	1,290.5	2	336.5	54,848.3
Waiouru	20	13,328	23	3,417	3	1,168.3	6	124	2	1,739.6	11	336.6	1	48	16,745.1
Tangimoana	167	202,824	271	10,684	108	6,263.1	129	1,954	1	7	17	694.6	16	1,764.9	213,507.6
Ormondville	14	2,663	16	434	0	0	2	43	0	0	14	390.7	0	0	3,096.7
Hokio Beach	49	54,090	89	3,032	26	1,892.5	35	401	1	6	25	715.7	2	18	57,121.7
Norsewood	37	16,968	20	812	8	569.5	5	58	0	0	7	184.6	0	0	17,779.5
Kimbolton	21	38,180	12	647	3	316.1	2	143	0	0	6	180	1	9	38,826.9
Ōwhango	26	11,080	22	923	3	431.6	4	61	0	0	15	430.1	0	0	12,003.2
Rātana	68	71,591	36	1,811	14	1,172.3	14	253	0	0	8	385.8	0	0	73,402.3
Mangaweka	16	19,158	9	887	5	416.2	0	0	1	118.5	0	0	3	352.7	20,044.7
Ohakea	26	15,812	13	623	0	0	0	0	0	0	11	585.7	2	36.9	16,435.1
Pongaroa	17	16,816	39	2,971	4	478	4	58	1	111.7	24	1,890.2	6	434	19,787.4
Ōhura	12	12,457	29	3,267	7	621.1	15	683	1	91.4	6	1,872	0	0	15,724
National Park	12	2,314	11	2,509	4	163.7	4	98	2	2,177.7	1	69.7	0	0	4,823
Rangataua	15	10,616	15	352	3	111.9	4	54	0	0	8	186.9	0	0	10,968
Mangatainoka	22	300,285	118	17,358	13	1,670.6	9	340	1	90.8	94	15,228.4	1	28.9	317,643.2
Waikawa Beach	9	4,702	39	1,087	17	675.6	19	397	0	0	3	15	0	0	5,789.1
Mangamutu	10	5,336	17	14,512	1	84.8	0	0	5	13,972.3	11	455	0	0	19,847.8
Koitiata	45	93,813	84	3,303	39	2,759	43	493	0	0	2	50.7	0	0	97,115.7
Raurimu	9	3,180	10	261	0	0	1	5	0	0	9	255.9	0	0	3,440.6
Other	1,355	7,797,516	1,762	120,942	289	26,394.8	277	4,888	31	4,446.3	1,044	76,059.7	121	9,152.9	7,918,458.5

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.4: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 2% AEP with Current Climate and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	12,217	13,633,370	5,011	534,946	3,075	330,767.9	1,279	20,613	318	122,058.4	248	30,720.6	91	30,786.9	14,168,315.6
Whanganui	6,478	6,540,643	3,434	285,964	1,813	181,545.1	1,131	17,850	218	51,196.4	164	10,351.6	108	25,021.4	6,826,606.9
Levin	7,019	2,308,458	1,087	88,660	614	50,336.5	334	7,260	73	26,343.8	54	3,617.3	12	1,102.3	2,397,118.1
Feilding	2,603	1,028,011	696	87,087	316	34,461.8	140	4,583	138	32,763.1	76	7,292.9	26	7,986.6	1,115,097.6
Dannevirke	404	130,562	135	8,649	40	3,043	19	257	23	3,079.2	47	1,893.1	6	377.1	139,211.5
Marton	801	479,571	452	28,874	172	12,228	138	2,008	30	4,137.1	91	5,211	21	5,289.9	508,445
Taumarunui	353	10,336,356	275	16,102	128	9,422.3	99	1,391	8	1,271.4	26	1,209.1	14	2,807	10,352,458
Ashhurst	501	174,796	115	8,498	40	2,797.4	19	413	16	2,170.4	37	2,750.5	3	367.9	183,293.8
Pahiatua	702	393,050	413	27,536	173	12,532.9	119	1,443	28	4,545.1	77	4,964.4	16	4,050.7	420,586.1
Foxton	1,027	1,376,004	833	58,702	399	36,760.2	269	3,878	40	6,026.2	85	6,394.7	40	5,642.7	1,434,705.8
Taihape	46	225,524	42	2,571	14	1,507.2	16	225	1	29.1	9	416.2	2	393.6	228,095
Bulls	315	246,784	167	10,167	50	3,994.3	35	419	8	1,215.9	68	4,383.6	6	155	256,950.7
Bunnythorpe	107	74,549	67	3,349	8	489.7	6	93	0	0	49	2,477.5	4	289	77,898
Shannon	130	118,297	77	8,345	5	324.8	4	57	3	1,774.2	52	5,197.8	13	991.1	126,641.7
Foxton Beach	377	271,114	435	19,557	227	14,349.5	192	4,149	1	414.3	7	369.3	8	274.6	290,671
Woodville	690	4,378,759	818	85,692	195	22,032.4	189	4,570	27	4,634.5	402	53,781.6	5	673.3	4,464,451
Rongotea	247	334,583	233	14,442	66	5,367.2	46	756	1	66.2	112	7,732.7	8	518.9	349,025.4
Linton	62	22,921	63	11,495	11	1,056.3	1	8	1	427.3	45	2,281.4	5	7,721.5	34,416.1
Halcombe	40	44,538	40	2,545	4	184.7	12	408	0	0	24	1,953	0	0	47,083.2
Ohakune	217	187,497	240	16,244	106	8,470.2	64	2,134	24	3,097.3	40	2,243.9	6	298.5	203,741
Eketāhuna	69	35,905	56	3,310	5	271.8	8	329	0	0	43	2,708.3	0	0	39,214.9
Raetihi	127	102,484	102	5,150	38	2,780.1	34	400	3	304.8	27	1,665.6	0	0	107,634
Hunterville	127	140,853	140	8,261	42	2,963.3	28	424	25	2,481.7	29	1,213.9	16	1,178.4	149,113.6
Sanson	49	35,560	44	1,884	10	542.2	13	211	8	686.7	13	444.8	0	0	37,443.5
Ōhau	76	46,908	33	1,860	9	787.7	6	59	0	0	18	1,013.7	0	0	48,768.1
Tokomaru	57	92,734	28	2,468	0	0	0	0	0	0	27	2,411.8	1	56	95,202.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	309	660,729	335	28,709	69	6,415.9	41	493	1	733.6	223	21,044.3	1	22	689,437.6
Manakau	101	37,588	66	2,869	14	947.1	9	174	0	0	38	1,454.1	5	293.1	40,457.4
Pohangina	53	59,849	39	2,219	1	54.4	0	0	0	0	35	2,129.4	3	36	62,067.9
Waitārere Beach	129	238,979	311	13,606	125	9,016.9	152	3,395	1	135.8	0	0	33	1,057.8	252,585.4
Kai Iwi	23	24,821	35	1,252	5	371.8	5	63	0	0	21	772.1	4	45	26,072.8
Himatangi Beach	79	46,626	103	4,278	43	2,252.7	32	386	0	0	26	1,605.7	2	34	50,904.3
Longburn	106	125,209	139	22,360	31	4,101.9	20	192	43	14,882.1	40	2,277.3	5	907.2	147,569
Waiouru	20	13,328	23	3,417	3	1,168.3	6	124	2	1,739.6	11	336.6	1	48	16,744.7
Tangimoana	208	311,571	369	14,155	152	8,881.3	181	2,659	1	7	19	735.5	16	1,872.6	325,726
Ormondville	14	2,664	16	435	0	0	2	43	0	0	14	391.8	0	0	3,098.7
Hokio Beach	49	54,090	89	3,032	26	1,892.5	35	401	1	6	25	715.7	2	18	57,121.9
Norsewood	37	16,967	20	812	8	569.5	5	58	0	0	7	184.6	0	0	17,779.3
Kimbolton	21	38,180	12	647	3	316.1	2	143	0	0	6	180	1	9	38,826.9
Ōwhango	26	11,080	22	923	3	431.6	4	61	0	0	15	430.1	0	0	12,003.2
Rātana	68	71,591	36	1,811	14	1,172.3	14	253	0	0	8	385.8	0	0	73,402.3
Mangaweka	16	19,158	9	887	5	416.2	0	0	1	118.5	0	0	3	352.7	20,044.7
Ohakea	26	14,668	13	636	0	0	0	0	0	0	11	599.4	2	36.9	15,304.4
Pongaroa	17	16,816	39	2,971	4	478	4	58	1	111.7	24	1,890.2	6	434	19,787.4
Ōhura	12	12,457	29	3,267	7	621.1	15	683	1	91.4	6	1,872	0	0	15,724
National Park	12	2,313	11	2,509	4	163.7	4	98	2	2,177.7	1	69.7	0	0	4,822
Rangataua	15	10,616	15	351	3	111.9	4	54	0	0	8	185.9	0	0	10,967
Mangatainoka	22	300,143	118	17,362	13	1,688.8	9	340	1	90.8	94	15,212.8	1	28.9	317,504.7
Waikawa Beach	9	4,702	39	1,087	17	675.6	19	397	0	0	3	15	0	0	5,789.1
Mangamutu	10	5,337	11	23,605	1	84.8	1	25	1	23,129.9	8	365	0	0	28,941.9
Koitiata	45	93,812	84	3,303	39	2,759	43	493	0	0	2	50.7	0	0	97,115.5
Raurimu	9	3,180	10	261	0	0	1	5	0	0	9	255.9	0	0	3,440.7
Other	1,716	9,859,393	2,684	233,941	452	55,381.7	383	6,727	35	6,128.2	1,685	155,281.7	129	10,421.4	10,093,333.9

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.5: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 1% AEP with Current Climate and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	15,617	22,742,135	7,667	762,190	4,791	513,693.2	2,173	32,204	416	157,668	162	23,742.8	125	34,881.7	23,504,325.2
Whanganui	7,003	7,786,788	3,839	337,106	2,020	205,335.6	1,233	19,522	284	73,456.5	167	10,522.9	135	28,269.6	8,123,894.2
Levin	7,253	2,463,883	1,241	99,993	700	58,279.5	383	8,436	78	27,888.2	65	4,009.2	15	1,379.2	2,563,875.9
Feilding	1,949	673,926	407	50,202	157	13,568.7	61	1,954	90	22,499.8	77	5,272	22	6,906.7	724,128.3
Dannevirke	436	142,801	146	9,331	44	3,248.4	20	268	23	3,147.6	49	1,891.8	10	775.8	152,132
Marton	840	509,247	453	28,574	174	12,357.8	133	1,930	27	4,001.3	95	5,408.4	24	4,877.3	537,820.6
Taumarunui	392	10,636,004	330	19,561	147	11,644.6	122	1,782	10	1,270.9	31	1,503.5	20	3,359.1	10,655,565.1
Ashhurst	556	208,233	164	11,898	55	4,038	35	646	22	3,160.2	49	3,694.4	3	359	220,131
Pahiatua	722	405,741	452	29,972	184	13,375.7	129	1,624	28	4,476.6	92	5,625.5	19	4,869.6	435,713.3
Foxton	1,042	1,331,119	848	61,156	413	38,101.3	271	3,978	44	6,604.9	79	5,984.5	41	6,487.9	1,392,274.7
Taihape	50	4,262,601	47	2,844	17	1,701.1	17	235	1	27.3	10	479.1	2	401.5	4,265,444.6
Bulls	339	284,626	198	12,825	58	4,707	39	499	19	2,296.4	75	5,177.9	7	144	297,451.2
Bunnythorpe	108	79,699	74	4,129	9	550.3	6	93	0	0	54	3,057	5	428.9	83,827.9
Shannon	122	58,518	56	3,175	3	191.1	3	48	2	48.9	40	2,558.6	8	328.9	61,693.3
Foxton Beach	394	316,172	491	23,514	259	17,162.6	208	4,275	1	411	7	373.4	16	1,290.9	339,685.8
Woodville	775	6,213,285	986	109,160	283	33,349	256	6,337	32	5,783.5	410	63,016.6	5	673.3	6,322,444.9
Rongotea	204	177,069	154	8,870	47	3,766.9	30	520	1	64	71	4,345.4	5	173	185,938.6
Linton	56	16,358	44	9,336	3	159.7	0	0	1	339.3	35	1,318.4	5	7,518.7	25,694.4
Halcombe	47	48,792	44	2,492	4	202.3	12	418	0	0	28	1,870.9	0	0	51,284.4
Ohakune	239	224,179	280	19,239	129	10,282.7	71	2,413	27	3,378.5	47	2,855.1	6	310.7	243,417.6
Eketāhuna	73	36,787	67	3,730	7	384.1	9	269	0	0	51	3,077.1	0	0	40,516.6
Raetihi	137	112,144	109	5,712	39	2,895.4	37	430	3	303.6	30	2,082.8	0	0	117,856.3
Hunterville	124	133,986	142	8,461	42	2,827.7	26	371	25	2,525	30	1,496.1	19	1,241.5	142,446.9
Sanson	56	37,701	45	2,102	10	578.2	13	223	9	830.8	13	470.2	0	0	39,803
Ōhau	76	63,699	45	2,343	10	954.1	10	111	0	0	25	1,277.2	0	0	66,042.4
Tokomaru	57	67,134	27	2,201	4	188.3	0	0	0	0	22	1,963.1	1	49	69,334.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	228	212,717	200	15,839	48	3,903.9	26	309	1	956.2	124	10,647.2	1	23	228,556
Manakau	108	39,929	80	3,595	16	1,035.9	10	177	0	0	47	1,753.7	7	629.1	43,523.6
Pohangina	57	67,272	43	2,256	2	113	0	0	0	0	37	2,075.8	4	67	69,528
Waitārere Beach	138	309,681	357	16,034	141	10,538.6	170	3,518	1	128.8	0	0	45	1,849.5	325,715.4
Kai Iwi	23	25,078	35	1,262	5	370.6	5	60	0	0	21	777	4	55	26,340
Himatangi Beach	85	54,446	113	4,672	48	2,471.5	36	452	0	0	27	1,717.1	2	32	59,117.9
Longburn	94	57,286	81	10,958	18	1,925.6	12	111	21	6,900.5	28	1,693.5	2	327.9	68,244.2
Waiouru	20	13,645	24	3,330	4	806.8	6	110	2	2,017.3	11	346.4	1	48	16,975.2
Tangimoana	184	236,207	304	11,886	122	7,103.4	147	2,235	1	7	17	731.3	17	1,809.9	248,093.4
Ormondville	14	2,857	17	437	0	0	2	49	0	0	15	388.6	0	0	3,293.6
Hokio Beach	51	62,422	97	3,274	29	2,072.9	40	442	1	6	25	736.4	2	17	65,696.1
Norsewood	37	17,104	20	790	8	557.7	5	58	0	0	7	174.6	0	0	17,893.8
Kimbolton	26	44,785	14	1,155	3	316.1	2	143	0	0	8	685.9	1	11	45,940
Ōwhango	26	11,537	23	971	3	467	4	58	0	0	16	446.8	0	0	12,507.6
Rātana	68	71,968	36	1,810	14	1,174.1	14	236	0	0	8	399.8	0	0	73,778.3
Mangaweka	16	19,523	11	925	5	422.8	0	0	1	119	2	31	3	352.5	20,447.6
Ohakea	26	19,415	15	638	0	0	0	0	0	0	13	600.7	2	36.9	20,052.9
Pongaroa	16	15,287	31	2,250	5	563.3	3	47	1	105.7	16	1,073.9	6	459.4	17,536.6
Ōhura	12	12,757	29	3,802	6	541.9	14	691	1	162.7	7	2,058.1	1	348.7	16,559
National Park	12	2,610	11	860	4	163.7	4	98	2	528.8	1	69.7	0	0	3,470.3
Rangataua	15	11,035	16	360	3	115.5	5	59	0	0	8	185.4	0	0	11,395.3
Mangatainoka	22	347,283	119	18,951	13	2,284.4	10	280	1	90.8	94	16,266.7	1	28.9	366,234.1
Waikawa Beach	13	6,543	45	1,324	19	762.3	22	484	0	0	4	76.6	0	0	7,867.3
Mangamutu	10	5,418	21	16,027	1	63.4	1	26	5	15,165.8	14	771.8	0	0	21,445.5
Koitiata	49	97,024	84	3,146	39	2,624.4	43	471	0	0	2	50.7	0	0	100,170.4
Raurimu	9	3,240	10	255	0	0	1	5	0	0	9	249.6	0	0	3,495.3
Other	1,579	11,335,436	2,188	154,687	361	35,309.5	348	6,474	34	4,967.8	1,311	97,639.3	134	10,295.9	11,490,122.5

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.6: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 1% AEP with Current Climate and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	14,433	20,514,387	6,459	715,300	3,989	449,191.8	1,672	48,444	361	132,604.3	324	40,495.4	113	44,565.9	21,229,686.7
Whanganui	6,991	7,794,150	3,786	323,374	2,015	205,394.3	1,232	19,514	247	60,341.5	167	10,522.9	125	27,600.8	8,117,523.8
Levin	7,253	2,463,900	1,241	99,993	700	58,279.5	383	8,436	78	27,888.2	65	4,009.2	15	1,379.2	2,563,893.3
Feilding	2,778	1,166,684	839	100,886	385	40,281	179	5,243	153	37,856.5	89	8,273	33	9,231.6	1,267,569.8
Dannevirke	436	142,814	152	9,700	44	3,248.4	20	268	23	3,147.6	55	2,260.9	10	775.8	152,513.5
Marton	858	530,515	495	31,060	188	13,699.9	150	2,099	35	4,471.3	97	5,433.1	25	5,356.5	561,574.9
Taumarunui	378	10,616,027	314	18,704	140	10,932.8	116	1,775	10	1,275	31	1,505.5	17	3,216.2	10,634,731
Ashhurst	521	189,197	139	9,777	45	3,197.6	25	463	16	2,234.6	50	3,522.1	3	359	198,974.1
Pahiatua	718	405,517	443	29,266	182	13,138.2	124	1,540	28	4,537.3	90	5,280.8	19	4,769.9	434,783.2
Foxton	1,058	1,458,726	869	61,865	415	38,292.4	273	4,011	44	6,612.6	95	7,359.1	42	5,588.6	1,520,591.5
Taihape	50	4,262,538	47	2,844	17	1,701.1	17	235	1	27.2	10	479.1	2	401.5	4,265,381.8
Bulls	339	286,020	199	12,946	58	4,714.4	39	502	19	2,301.7	76	5,285.6	7	143	298,966
Bunnythorpe	108	77,312	74	4,088	9	550.3	6	93	0	0	55	3,067	4	377.7	81,400.1
Shannon	133	166,048	87	11,490	6	435.8	4	58	3	3,706.2	56	6,100	18	1,190.5	177,538.3
Foxton Beach	386	285,045	450	20,050	236	14,805.9	198	4,161	1	411	7	382.4	8	288.9	305,095
Woodville	807	6,223,422	986	108,772	283	33,074.4	257	6,397	32	5,627.1	409	63,000	5	673.3	6,332,193.7
Rongotea	266	373,330	248	16,183	68	5,874.4	48	824	1	64	123	8,905.8	8	515.1	389,513.5
Linton	72	31,696	69	11,568	13	1,244.9	1	7	1	339.3	49	2,457.3	5	7,518.7	43,264.1
Halcombe	47	48,788	44	2,492	4	202.3	12	418	0	0	28	1,870.9	0	0	51,279.5
Ohakune	239	224,179	280	19,239	129	10,282.7	71	2,413	27	3,378.5	47	2,855.1	6	310.7	243,417.6
Eketāhuna	73	36,792	67	3,738	7	384.1	9	270	0	0	51	3,083.9	0	0	40,530.3
Raetihi	137	112,144	109	5,712	39	2,895.4	37	430	3	303.6	30	2,082.8	0	0	117,856.3
Hunterville	149	184,922	155	9,528	46	3,282.9	30	449	25	2,691.7	34	1,781.7	20	1,322.7	194,450.2
Sanson	56	37,701	45	2,096	10	578.2	13	223	9	830.8	13	464.6	0	0	39,797
Ōhau	76	51,214	39	2,137	10	954.2	8	93	0	0	21	1,089.8	0	0	53,350.9
Tokomaru	57	96,511	29	2,465	0	0	0	0	0	0	28	2,369.8	1	95	98,975.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	357	844,304	406	35,579	81	7,873.4	50	842	1	590.9	273	26,246.2	1	26	879,882.5
Manakau	108	39,928	80	3,595	16	1,035.9	10	177	0	0	47	1,753.7	7	629.1	43,523.3
Pohangina	57	67,272	43	2,256	2	113	0	0	0	0	37	2,075.8	4	67	69,527.8
Waitārere Beach	138	309,681	357	16,035	141	10,538.6	170	3,518	1	128.8	0	0	45	1,849.5	325,715.7
Kai Iwi	23	25,078	35	1,262	5	370.6	5	60	0	0	21	777	4	55	26,339.9
Himatangi Beach	85	54,446	113	4,672	48	2,471.5	36	452	0	0	27	1,717.1	2	32	59,118.1
Longburn	118	184,215	163	26,906	35	4,267.1	24	206	46	17,969.9	53	3,462.7	5	998.9	211,121.1
Waiouru	20	13,645	24	3,330	4	806.8	6	110	2	2,017.3	11	346.4	1	48	16,975.3
Tangimoana	261	507,555	457	17,988	190	12,192.9	229	3,153	1	7	20	813.1	17	1,822.6	525,543.2
Ormondville	14	2,856	17	439	0	0	2	49	0	0	15	389.5	0	0	3,295.4
Hokio Beach	51	62,422	97	3,274	29	2,072.9	40	442	1	6	25	736.4	2	17	65,696.4
Norsewood	37	17,104	20	790	8	557.7	5	58	0	0	7	174.6	0	0	17,893.8
Kimbolton	26	44,785	14	1,155	3	316.1	2	143	0	0	8	685.9	1	11	45,940
Ōwhango	26	11,536	23	971	3	467	4	58	0	0	16	446.8	0	0	12,507.4
Rātana	68	71,968	36	1,810	14	1,174.1	14	236	0	0	8	399.8	0	0	73,778.4
Mangaweka	16	19,523	11	925	5	422.8	0	0	1	119	2	31	3	352.5	20,447.6
Ohakea	26	17,578	15	634	0	0	0	0	0	0	13	596.3	2	36.9	18,211.9
Pongaroa	16	15,287	31	2,250	5	563.3	3	47	1	105.7	16	1,073.9	6	459.4	17,536.6
Ōhura	12	12,757	29	3,803	6	541.9	14	692	1	162.7	7	2,058.1	1	348.7	16,560
National Park	12	2,610	11	860	4	163.7	4	98	2	528.8	1	69.7	0	0	3,469.5
Rangataua	15	11,035	16	360	3	115.5	5	59	0	0	8	185.4	0	0	11,395.3
Mangatainoka	22	347,208	119	18,569	13	2,284.4	10	280	1	90.8	94	15,884.8	1	28.9	365,777.4
Waikawa Beach	13	6,543	45	1,324	19	762.3	22	484	0	0	4	76.6	0	0	7,867.4
Mangamutu	10	5,418	14	25,117	1	63.4	1	38	2	24,511.5	10	503.3	0	0	30,534.9
Koitiata	49	97,024	84	3,146	39	2,624.4	43	471	0	0	2	50.7	0	0	100,170.5
Raurimu	9	3,240	10	255	0	0	1	5	0	0	9	249.6	0	0	3,495.1
Other	1,901	13,693,047	3,085	271,525	521	65,447.6	448	8,436	39	6,968.4	1,929	177,975.4	148	12,698.1	13,964,571.7

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.7: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Current Climate and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	16,236	26,043,214	8,103	804,798	5,003	538,710.7	2,304	35,325	436	161,691.5	224	29,036.3	136	40,034.8	26,848,012.1
Whanganui	7,505	9,494,967	4,319	394,392	2,256	234,892.1	1,399	23,960	334	91,737.3	181	11,382.9	149	32,419.8	9,889,358.6
Levin	7,419	2,620,850	1,328	106,778	754	63,279.6	412	9,054	82	28,987.9	65	4,225	15	1,232.1	2,727,628.4
Feilding	2,052	746,053	443	56,206	173	14,724	70	2,142	94	24,303.2	83	7,099	23	7,938.1	802,258.9
Dannevirke	448	175,843	161	10,397	48	3,579.8	22	287	25	3,152.3	55	2,107.2	11	1,271.1	186,239.7
Marton	878	555,710	501	33,140	184	13,807.8	148	2,213	31	4,204.7	108	6,605.1	30	6,308.4	588,850.1
Taumarunui	423	11,062,936	381	22,813	173	13,873	137	1,765	13	1,602.1	36	1,828.8	22	3,744.9	11,085,749.4
Ashhurst	586	229,833	187	13,982	61	4,509.8	38	711	22	3,067.2	63	5,328.4	3	365.7	243,815
Pahiatua	760	436,060	488	34,660	191	13,633.9	135	1,713	31	6,044.8	108	6,821.8	23	6,446.5	470,719.6
Foxton	1,057	1,378,971	868	62,703	421	38,838	277	4,000	45	6,638.6	83	6,719.6	42	6,506.2	1,441,674.4
Taihape	55	4,191,638	50	3,325	17	2,033.2	17	244	1	31.7	12	580.6	3	434.7	4,194,963.4
Bulls	369	319,099	227	16,003	67	5,937.7	42	555	27	3,215.9	82	5,911.5	9	381.7	335,102.4
Bunnythorpe	109	83,164	84	4,674	10	573.7	6	97	0	0	63	3,565.7	5	436.9	87,837.6
Shannon	133	67,288	60	3,389	4	241.8	4	59	2	50.1	42	2,670.6	8	368	70,676.6
Foxton Beach	402	330,737	519	25,257	266	17,913.5	226	4,903	1	439.6	8	600.4	18	1,401	355,994.1
Woodville	906	8,535,343	1,143	135,400	359	42,548.2	304	8,223	40	7,722.9	431	76,104.9	9	799.9	8,670,743.2
Rongotea	222	218,740	175	10,137	49	4,075.1	34	597	1	64	86	5,197.6	5	204.3	228,877
Linton	58	17,974	49	10,304	3	159.7	0	0	1	339.3	39	2,043.3	6	7,762.3	28,277.5
Halcombe	57	57,603	59	3,110	5	278.4	18	590	0	0	36	2,241.8	0	0	60,713.2
Ohakune	249	251,466	309	21,684	143	11,890	80	2,777	28	3,527.6	52	3,133.7	6	356.1	273,150
Eketāhuna	71	37,694	65	3,633	7	379.6	9	286	0	0	49	2,967.5	0	0	41,327.3
Raetihi	150	126,995	119	6,350	42	3,069	39	442	3	317.8	34	2,353.8	1	167.3	133,345
Hunterville	137	148,027	158	9,660	47	3,407.3	28	426	25	2,538.3	37	2,001.3	21	1,288	157,687.2
Sanson	56	39,194	47	2,187	10	578.4	13	225	9	818.8	15	564.7	0	0	41,381.1
Ōhau	83	78,461	52	2,755	11	1,022.3	12	136	0	0	28	1,586.6	1	10	81,216.1
Tokomaru	57	68,301	32	2,668	4	188.9	0	0	0	0	27	2,413.2	1	66	70,969.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	287	396,528	282	22,042	63	5,008.5	39	604	1	956.5	178	15,450.7	1	22	418,569.9
Manakau	119	48,371	94	4,608	22	1,708.6	11	198	0	0	54	2,069.9	7	631.6	52,978.8
Pohangina	76	82,174	50	2,720	3	208	0	0	0	0	42	2,391.7	5	120.2	84,893.6
Waitārere Beach	147	369,064	391	17,825	155	11,750.2	186	3,816	2	420	0	0	48	1,839.1	386,888.5
Kai Iwi	23	25,340	37	1,282	5	384.2	5	55	0	0	23	791.6	4	51	26,622.5
Himatangi Beach	86	63,376	134	5,517	57	2,933.5	47	660	0	0	27	1,838.1	3	85.7	68,893.5
Longburn	102	106,363	131	20,863	29	3,550.5	19	182	40	13,714	38	2,537.8	5	877.9	127,226
Waiouru	20	13,899	24	3,810	4	905	6	114	2	2,404.3	11	341.8	1	44.7	17,708.9
Tangimoana	238	390,536	431	16,073	169	10,192.8	215	3,047	1	6	28	951.5	18	1,875.2	406,609.3
Ormondville	14	2,913	17	460	0	0	2	44	0	0	15	416.3	0	0	3,373.3
Hokio Beach	59	71,707	104	3,690	32	2,421.5	42	464	1	6	27	781	2	18	75,396.8
Norsewood	37	17,237	20	791	8	557.7	5	58	0	0	7	175.6	0	0	18,027.8
Kimbolton	26	45,361	14	1,348	3	316.1	2	143	0	0	8	880.5	1	9	46,709.2
Ōwhango	26	11,939	23	1,013	3	464.5	4	71	0	0	16	478	0	0	12,952
Rātana	68	72,354	35	1,785	14	1,163.5	14	231	0	0	7	389.8	0	0	74,138.9
Mangaweka	20	22,077	14	1,040	7	529.7	1	13	1	121.2	2	27	3	349	23,117.3
Ohakea	41	21,187	28	2,692	2	60	2	110	0	0	22	2,485.9	2	36.4	23,879
Pongaroa	16	10,325	33	2,197	5	539.7	3	49	2	147.4	17	1,023.9	6	436.5	12,522.1
Ōhura	12	12,964	33	4,069	6	532.8	18	972	1	181.9	7	2,080.6	1	301.9	17,033
National Park	12	2,913	11	1,050	4	163.7	4	98	2	718.9	1	69.7	0	0	3,963.4
Rangataua	15	11,425	16	460	3	123.8	5	68	0	0	8	268	0	0	11,884.8
Mangatainoka	22	391,950	129	26,240	13	2,309.6	10	538	1	90.8	104	23,273.3	1	28.9	418,190.3
Waikawa Beach	13	6,921	49	1,415	21	833.4	24	511	0	0	4	70	0	0	8,336.3
Mangamutu	10	5,487	21	20,065	1	63.4	1	27	5	19,171.5	14	802.7	0	0	25,552.2
Koitiata	49	99,428	83	3,220	39	2,729	43	491	0	0	1	0	0	0	102,647.8
Raurimu	9	3,295	10	266	0	0	1	8	0	0	9	257.9	0	0	3,561
Other	1,805	19,290,824	2,675	201,411	429	43,983.5	420	7,834	38	5,425.6	1,611	130,526	177	13,642.7	19,492,235.2

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.8: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Current Climate and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	17,091	33,419,590	8,292	943,890	5,178	611,539.2	2,164	73,967	399	141,737.9	400	46,595.7	151	70,050.3	34,363,480.5
Whanganui	7,507	9,528,264	4,297	389,702	2,255	235,357.6	1,399	23,995	313	86,558.2	181	11,382.9	149	32,408.6	9,917,966.2
Levin	7,419	2,620,828	1,328	106,778	754	63,279.6	412	9,054	82	28,987.9	65	4,225	15	1,232.1	2,727,606.5
Feilding	2,945	1,312,631	935	115,702	443	46,166.5	199	5,961	163	43,735.5	91	8,400.5	39	11,438.8	1,428,332.7
Dannevirke	448	175,836	165	10,698	48	3,585.2	22	289	25	3,152.3	59	2,383.7	11	1,288.7	186,533.8
Marton	891	574,117	535	35,002	198	14,728.6	158	2,206	36	4,674.6	110	6,661.2	33	6,732.6	609,119.4
Taumarunui	405	11,037,156	357	21,314	161	12,727.4	129	1,727	13	1,586.5	36	1,828.8	18	3,444	11,058,469.8
Ashhurst	551	212,668	162	12,291	49	3,662.9	27	538	17	2,152.1	66	5,572.4	3	365.7	224,958.7
Pahiatua	758	435,840	480	33,383	194	13,966	132	1,660	29	5,180.2	102	6,259	23	6,317.8	469,222.7
Foxton	1,075	1,508,858	887	63,229	424	39,035.3	276	3,989	45	6,633.9	99	7,995.9	43	5,573.7	1,572,087.2
Taihape	55	4,191,689	50	3,328	17	2,033.2	17	247	1	31.7	12	580.6	3	434.7	4,195,017.2
Bulls	369	319,826	231	16,400	68	6,085.3	42	546	27	3,268.9	85	6,120	9	379.7	336,226
Bunnythorpe	109	79,586	84	4,629	10	573.7	6	97	0	0	64	3,573.7	4	384.3	84,214.8
Shannon	143	201,264	99	11,407	7	518	4	58	5	2,476.3	65	7,120	18	1,233.8	212,671
Foxton Beach	393	297,860	469	21,510	243	15,418.1	208	4,678	1	439.6	8	602.8	9	371.1	319,369.8
Woodville	928	8,547,700	1,139	135,916	358	42,493.6	303	8,244	40	7,761.3	429	76,621.7	9	796.4	8,683,615.5
Rongotea	271	393,279	255	16,324	69	5,861.9	49	879	1	64	128	8,953.1	8	566.2	409,603
Linton	75	38,472	78	13,021	14	1,261.6	1	6	1	339.3	56	3,652	6	7,762.3	51,492.7
Halcombe	57	57,592	59	3,118	5	278.4	18	590	0	0	36	2,248.8	0	0	60,710.4
Ohakune	249	251,466	309	21,684	143	11,890	80	2,777	28	3,527.6	52	3,133.7	6	356.1	273,150
Eketāhuna	71	37,702	65	3,634	7	379.6	9	286	0	0	49	2,968.9	0	0	41,335.5
Raetihi	150	126,995	119	6,350	42	3,069	39	442	3	317.8	34	2,353.8	1	167.3	133,345
Hunterville	166	209,411	168	12,162	52	4,080.4	30	441	26	3,889.7	39	2,364.9	21	1,385.9	221,572.6
Sanson	56	39,194	47	2,187	10	578.4	13	225	9	818.8	15	564.7	0	0	41,380.8
Ōhau	82	56,335	43	2,252	10	961.9	9	110	0	0	23	1,170.5	1	10	58,586.9
Tokomaru	57	99,417	33	3,075	3	221	0	0	0	0	29	2,760.9	1	94	102,491.7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	395	1,016,019	482	43,820	86	8,948.6	59	947	1	600.6	333	32,973.8	3	350.1	1,059,839.3
Manakau	119	48,371	94	4,608	22	1,708.6	11	198	0	0	54	2,069.9	7	631.6	52,978.7
Pohangina	76	82,095	50	2,720	3	208	0	0	0	0	42	2,391.7	5	120.2	84,814.9
Waitārere Beach	147	369,061	391	17,818	155	11,750.2	186	3,808	2	420	0	0	48	1,839.1	386,879.2
Kai Iwi	23	25,340	37	1,282	5	384.2	5	55	0	0	23	791.6	4	51	26,622.5
Himatangi Beach	86	63,375	134	5,549	57	2,933.5	47	660	0	0	27	1,870.3	3	85.7	68,923.7
Longburn	116	236,556	164	33,608	35	5,269.2	24	242	46	23,380.2	54	3,590.2	5	1,124.9	270,164.3
Waiouru	20	13,899	24	3,810	4	905	6	114	2	2,404.3	11	341.8	1	44.7	17,708.9
Tangimoana	283	726,232	532	21,432	214	14,536.2	266	3,541	1	6	33	1,247.2	18	2,100.9	747,664.1
Ormondville	14	2,913	17	460	0	0	2	44	0	0	15	416.3	0	0	3,373.1
Hokio Beach	59	71,706	104	3,690	32	2,421.5	42	464	1	6	27	781	2	18	75,396.5
Norsewood	37	17,236	20	791	8	557.7	5	58	0	0	7	175.6	0	0	18,026.7
Kimbolton	26	45,362	14	1,348	3	316.1	2	143	0	0	8	880.5	1	9	46,709.8
Ōwhango	26	11,939	23	1,013	3	464.5	4	71	0	0	16	478	0	0	12,952
Rātana	68	72,354	35	1,785	14	1,163.5	14	231	0	0	7	389.8	0	0	74,138.9
Mangaweka	20	22,077	14	1,040	7	529.7	1	13	1	121.2	2	27	3	349	23,117.3
Ohakea	37	18,274	27	2,272	2	50.2	2	138	0	0	21	2,047.6	2	36.4	20,546.3
Pongaroa	16	10,325	33	2,197	5	539.7	3	49	2	147.4	17	1,023.9	6	436.5	12,522.1
Ōhura	12	12,964	33	4,069	6	532.8	18	972	1	181.9	7	2,080.6	1	301.9	17,033
National Park	12	2,918	11	1,050	4	163.7	4	98	2	718.9	1	69.7	0	0	3,968
Rangataua	15	11,425	16	460	3	123.8	5	68	0	0	8	268	0	0	11,884.8
Mangatainoka	22	391,888	129	26,240	13	2,309.7	10	539	1	90.8	104	23,272.3	1	28.9	418,127.7
Waikawa Beach	13	6,921	49	1,413	21	833.4	24	509	0	0	4	70	0	0	8,334.4
Mangamutu	10	5,486	17	14,925	2	104.3	1	24	4	14,283.8	10	512.7	0	0	20,410.6
Koitiata	49	99,428	83	3,220	39	2,729	43	491	0	0	1	0	0	0	102,647.8
Raurimu	9	3,295	10	266	0	0	1	8	0	0	9	257.9	0	0	3,561
Other	2,128	21,835,870	3,543	319,067	583	74,443.6	516	9,865	43	7,704.9	2,213	211,347.5	188	15,705.6	22,154,936.9

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.9: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.2% AEP with Current Climate and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	16,774	27,753,990	8,511	855,269	5,282	566,216.5	2,404	36,848	475	183,225.9	210	26,196.7	140	42,782.6	28,609,258.8
Whanganui	9,548	19,635,922	6,762	620,415	3,607	382,134.1	2,375	40,590	407	122,474.1	197	12,783.7	176	62,432.5	20,256,337.3
Levin	7,622	2,867,328	1,454	123,097	814	69,606.3	437	9,489	106	35,358.1	73	5,047.5	24	3,594.9	2,990,424.8
Feilding	2,196	822,710	516	61,866	219	17,919.3	78	1,507	100	26,431.6	94	7,600.6	25	8,407.4	884,576.3
Dannevirke	491	210,995	179	11,597	56	4,220.9	23	326	27	3,508.1	60	2,275.9	13	1,265.3	222,591.8
Marton	1,001	3,369,186	833	60,866	330	27,023.9	227	3,258	94	12,878.1	141	9,009.5	41	8,696.5	3,430,052.5
Taumarunui	557	26,765,635	541	37,246	259	24,752.3	183	2,737	21	2,679.1	46	2,374.1	32	4,703.8	26,802,880.7
Ashhurst	628	255,885	190	13,768	63	4,607.9	38	604	22	3,066.5	64	5,122.9	3	366.7	269,652.6
Pahiatua	801	462,063	532	38,533	204	14,859.2	143	1,851	36	7,164.7	125	7,961.1	24	6,696.9	500,595.8
Foxton	1,112	1,480,397	940	74,990	453	41,253.6	304	4,571	47	10,239.3	94	11,480.9	42	7,445.1	1,555,386.7
Taihape	84	6,080,750	79	4,146	25	2,406.8	29	435	4	100.7	17	783.5	4	420.5	6,084,896.2
Bulls	560	777,336	520	36,382	179	14,976.1	121	2,029	87	8,791.9	109	7,913.4	24	2,671.2	813,718.1
Bunnythorpe	102	81,817	87	5,112	11	634	6	107	1	4	63	3,886.6	6	480.8	86,929.4
Shannon	142	78,725	65	3,792	4	212.8	4	57	3	95.9	46	3,009.8	8	416.8	82,516.9
Foxton Beach	422	363,858	559	27,896	284	19,435.9	243	5,503	2	734.9	9	686.2	21	1,536.7	391,754
Woodville	1,014	25,081,952	1,341	162,869	438	52,731.4	360	10,013	46	13,341.6	480	83,772.3	17	3,011.5	25,244,821.1
Rongotea	219	258,740	222	13,381	59	4,725.2	46	710	3	235.6	105	7,231.9	9	477.9	272,120.9
Linton	61	19,006	55	11,363	5	466.9	0	0	1	339.3	42	1,774.9	7	8,782.3	30,368.5
Halcombe	98	132,154	90	4,680	11	751.7	25	686	4	251.2	50	2,990.7	0	0	136,834.3
Ohakune	283	300,555	337	24,854	159	14,052	85	2,700	29	3,978.3	57	3,754	7	370	325,408.9
Eketāhuna	73	39,286	71	3,949	8	428.8	9	269	0	0	54	3,251	0	0	43,235.3
Raetihi	168	143,719	124	6,794	44	3,367	42	501	3	326.1	34	2,456.2	1	143.6	150,512.8
Hunterville	163	189,325	183	11,997	56	3,795.5	33	441	27	3,532.3	45	2,862	22	1,368	201,322.3
Sanson	58	42,836	47	1,879	15	774.3	17	230	9	730.1	6	146.2	0	0	44,715.4
Ōhau	91	86,532	54	2,839	11	1,129	13	142	0	0	28	1,546.8	2	20	89,371.3
Tokomaru	57	69,466	32	2,590	4	206.6	0	0	0	0	27	2,337.5	1	45	72,055.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	293	376,622	303	24,515	68	5,574.2	38	654	1	802.3	191	16,806.2	5	678.4	401,136.8
Manakau	123	53,802	104	5,217	26	1,946.9	16	354	0	0	55	2,271.4	7	644.5	59,018.5
Pohangina	81	98,473	54	3,058	4	314.3	0	0	0	0	44	2,440.9	6	302.7	101,530.7
Waitārere Beach	171	445,068	442	19,838	176	13,568.4	213	3,921	4	515.9	0	0	49	1,832.9	464,905.7
Kai Iwi	21	25,945	37	1,265	5	384	5	54	0	0	23	786.5	4	41	27,210
Himatangi Beach	102	68,256	146	6,542	59	3,188.2	58	854	0	0	25	2,378.6	4	121	74,798.2
Longburn	120	82,766	147	20,310	33	3,718.4	22	192	32	12,352	55	3,172.4	5	875.5	103,075.9
Waiouru	25	20,767	40	4,981	16	2,233.7	9	171	0	0	13	758.4	2	1,817.7	25,748.4
Tangimoana	316	1,090,124	595	25,525	237	16,969.3	288	3,976	3	273.9	43	1,702.1	24	2,603.4	1,115,648.7
Ormondville	14	2,992	17	452	0	0	2	42	0	0	15	410.2	0	0	3,443.7
Hokio Beach	66	81,532	118	4,320	40	2,930.7	48	546	1	7	27	815.4	2	22	85,851.5
Norsewood	37	17,383	20	792	8	557.7	5	58	0	0	7	176.4	0	0	18,175.4
Kimbolton	26	46,698	14	1,490	3	316.1	2	143	0	0	8	1,021	1	10	48,187.6
Ōwhango	26	12,234	24	1,045	3	447.4	4	66	0	0	16	517	1	15	13,279.5
Rātana	76	69,755	36	1,531	16	1,179.3	14	230	0	0	6	121.5	0	0	71,285.7
Mangaweka	20	28,048	25	1,602	11	807.6	4	52	2	204.9	4	135.8	4	402	29,650.1
Ohakea	63	90,135	111	9,692	18	1,551.2	11	295	0	0	79	7,760	3	85.9	99,827.3
Pongaroa	33	584,221	51	3,179	11	1,057.4	10	169	3	170.7	20	1,295.8	7	485.9	587,400.3
Ōhura	20	15,448	40	4,430	8	671.6	21	898	1	205.3	9	2,236.1	1	418.8	19,877.9
National Park	12	3,366	11	1,248	4	178.7	4	102	2	897.7	1	69.7	0	0	4,614.4
Rangataua	18	12,101	16	474	3	138.5	5	53	0	0	8	282.3	0	0	12,575.4
Mangatainoka	24	454,023	134	27,877	13	2,663	11	723	1	90.8	107	24,341.9	2	58.7	481,899.6
Waikawa Beach	16	15,679	55	1,653	24	1,072	27	489	0	0	4	92.4	0	0	17,331.9
Mangamutu	10	5,536	29	14,082	1	65.6	1	30	9	13,059	18	927.4	0	0	19,617.7
Koitiata	45	102,253	84	3,190	41	2,688.7	43	501	0	0	0	0	0	0	105,442.9
Raurimu	9	3,393	11	258	0	0	1	7	0	0	10	250.6	0	0	3,651.2
Other	2,032	47,575,249	3,346	263,845	537	57,854.5	527	10,018	56	7,779	1,982	167,351.3	244	20,842.6	47,839,094.3

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.10: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.1% AEP with Current Climate and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	17,239	27,261,981	8,862	897,027	5,487	594,993.2	2,495	38,486	503	192,656.1	232	27,463.9	145	43,428.9	28,159,008.1
Whanganui	10,522	36,324,823	7,939	768,464	4,239	495,352.1	2,805	49,087	501	152,553.9	208	16,280.1	186	55,189.8	37,093,287.3
Levin	7,764	2,994,804	1,498	144,606	835	86,718.8	448	9,901	110	35,444.7	79	5,441.2	26	7,100.5	3,139,410.3
Feilding	2,298	881,142	570	70,224	248	21,430.7	88	1,584	109	30,620	98	7,968.4	27	8,620.5	951,366.4
Dannevirke	517	227,598	190	12,413	60	4,516.8	24	369	28	3,441.6	64	2,611.2	14	1,475.1	240,011.1
Marton	1,110	4,733,010	926	68,402	384	31,580.5	248	3,510	101	14,319.7	149	9,418.1	44	9,574	4,801,412.5
Taumarunui	882	28,476,248	914	61,684	460	45,128.5	335	4,682	27	2,672.9	56	2,926.6	36	6,273.5	28,537,932
Ashhurst	643	270,493	203	14,613	67	4,748.3	40	630	22	3,157.2	71	5,714.6	3	362.9	285,105.6
Pahiatua	828	495,571	567	41,152	214	15,573.2	148	2,040	37	7,203.9	144	9,480.6	24	6,854.5	536,722.6
Foxton	1,131	1,524,302	952	76,812	460	42,096	305	4,600	48	10,788.8	97	12,117.3	42	7,210.4	1,601,113.8
Taihape	84	7,777,054	82	5,726	25	3,828.8	29	432	5	116.1	19	946.2	4	402.7	7,782,779.7
Bulls	581	688,310	554	41,525	192	17,419.3	128	2,273	89	10,137.1	120	8,590.3	25	3,106.4	729,834.8
Bunnythorpe	109	85,166	93	5,293	11	651.3	6	104	1	5	67	3,909.9	8	623.9	90,459.5
Shannon	148	93,136	73	4,467	6	326.9	5	66	3	99.9	51	3,531	8	443.2	97,603
Foxton Beach	444	401,247	605	30,249	307	20,830.8	264	6,200	2	904.2	10	705.7	22	1,608.2	431,495.9
Woodville	1,095	35,634,661	1,457	191,242	489	68,158.7	400	12,619	56	16,030.7	493	90,806.7	19	3,626.5	35,825,902.7
Rongotea	221	288,043	236	14,350	65	5,428.8	48	767	3	235.6	111	7,367	9	551.6	302,393.3
Linton	68	20,161	56	11,277	5	388	0	0	1	339.3	43	1,795.8	7	8,752.9	31,438.1
Halcombe	113	143,310	102	5,432	16	918.2	26	701	4	246.9	55	3,556.4	1	10	148,742.3
Ohakune	302	1,577,187	375	27,600	176	16,020.8	96	2,899	29	4,060.3	65	3,984.8	9	634.6	1,604,787.2
Eketāhuna	73	40,114	75	4,230	9	478.2	10	279	0	0	56	3,473.1	0	0	44,344.2
Raetihi	179	156,716	130	7,094	46	3,596.2	42	494	3	305.5	36	2,430.9	3	267.9	163,810.4
Hunterville	192	241,422	215	15,523	70	5,183.1	43	695	29	4,913.5	50	3,327.7	23	1,403	256,944.6
Sanson	58	43,498	50	1,959	15	772.9	18	215	11	824.6	6	146.2	0	0	45,457.1
Ōhau	97	86,266	58	2,971	11	1,147.9	14	147	0	0	31	1,656.2	2	20	89,237.1
Tokomaru	57	70,237	32	2,705	4	206.5	0	0	0	0	27	2,437.7	1	61	72,942.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	321	521,266	361	30,164	81	7,047.5	54	787	1	747	218	20,162.8	7	1,419.6	551,430.5
Manakau	129	58,921	115	5,846	30	2,424.9	17	354	0	0	61	2,415.2	7	652.5	64,767
Pohangina	81	106,309	60	3,496	6	371.9	1	14	0	0	47	2,840.2	6	270.6	109,804.8
Waitārere Beach	171	458,357	450	20,123	180	13,801.8	217	3,964	4	561.6	0	0	49	1,795.1	478,479.8
Kai Iwi	21	28,190	37	1,247	5	384.8	5	54	0	0	23	767.6	4	41	29,436.9
Himatangi Beach	113	77,522	166	7,667	65	3,871.1	67	1,027	0	0	30	2,626.4	4	142.5	85,188.8
Longburn	120	102,313	169	23,817	35	3,695.4	24	226	46	15,561.9	59	3,548	5	786.6	126,130.2
Waiouru	26	21,189	40	4,710	16	2,221.4	9	187	0	0	13	767.6	2	1,533.7	25,898.6
Tangimoana	321	1,367,170	612	27,667	244	18,467.8	294	4,173	5	227.1	45	2,021.9	24	2,777.5	1,394,836.5
Ormondville	14	3,037	18	511	0	0	2	43	0	0	16	469.1	0	0	3,548
Hokio Beach	66	88,067	123	4,549	41	3,091.9	52	606	1	6	27	823.9	2	21	92,616.3
Norsewood	37	17,438	21	806	8	557.7	5	58	0	0	8	190.9	0	0	18,243.9
Kimbolton	26	47,414	15	1,475	3	316.1	2	143	0	0	9	1,006	1	10	48,888.7
Ōwhango	26	12,484	27	1,152	3	458	5	72	0	0	18	605.1	1	17	13,636.4
Rātana	76	70,026	36	1,549	16	1,179	14	232	0	0	6	137.9	0	0	71,575.4
Mangaweka	23	31,825	30	1,872	13	1,062.5	7	69	2	194.6	4	144.1	4	402.1	33,697.4
Ohakea	72	111,477	117	11,026	18	1,668.9	11	351	0	0	85	8,920.7	3	85.2	122,503.4
Pongaroa	40	926,445	56	3,764	11	1,119.3	11	186	3	168.5	24	1,699.3	7	591	930,209.2
Ōhura	23	18,888	46	4,632	10	768.2	22	859	1	201.3	9	2,321.3	4	482.1	23,520.2
National Park	12	3,615	11	1,209	4	179.1	4	102	2	858.9	1	69.7	0	0	4,824.1
Rangataua	18	12,457	16	474	3	136.1	5	53	0	0	8	285.3	0	0	12,930.7
Mangatainoka	25	493,544	145	30,050	14	3,538.3	13	749	1	90.8	114	25,604.2	3	68.4	523,593.5
Waikawa Beach	16	16,632	58	1,791	27	1,253.3	27	467	0	0	4	71.3	0	0	18,423.2
Mangamutu	23	15,470	43	29,451	1	66	1	26	14	27,531.2	26	1,775.2	1	51.6	44,921.4
Koitiata	45	104,070	87	3,276	42	2,791.2	45	485	0	0	0	0	0	0	107,346
Raurimu	9	3,467	12	296	0	0	1	9	0	0	11	287.8	0	0	3,762.6
Other	2,278	90,057,276	3,806	313,792	635	70,380.4	607	11,524	62	9,507.3	2,201	193,980.1	301	28,401	90,371,068.1

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.11: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +1°C and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	17,005	26,321,491	8,656	869,375	5,311	570,579.2	2,429	37,856	465	178,117.2	299	37,890.6	152	44,930.8	27,190,865.6
Whanganui	8,905	31,929,802	6,004	542,310	3,193	334,188.7	2,065	36,330	389	112,268.6	191	12,226.2	166	47,296.9	32,472,112
Levin	7,677	2,813,082	1,468	122,075	821	68,109	441	9,960	107	36,394.9	75	5,184.6	24	2,425.4	2,935,156.7
Feilding	2,211	831,963	506	61,541	210	17,297.1	79	2,274	96	25,641.6	97	8,252.3	24	8,076.1	893,503.9
Dannevirke	489	207,833	177	11,604	54	4,200	23	310	27	3,542.6	60	2,273.1	13	1,278.8	219,437
Marton	914	3,056,160	548	37,176	202	15,906.8	161	2,266	39	5,447.1	113	6,990.5	33	6,566.4	3,093,336.4
Taumarunui	628	26,945,169	616	40,886	305	27,656.5	210	3,170	21	2,632.3	48	2,615.4	32	4,811.3	26,986,055
Ashhurst	638	263,072	199	15,051	63	4,613.6	39	724	22	3,082.5	72	6,263.4	3	367.9	278,123
Pahiatua	809	465,938	538	38,956	206	15,031.1	146	1,907	36	7,234.8	126	8,145.1	24	6,637.5	504,894
Foxton	1,098	1,440,436	902	72,688	433	39,597.8	285	4,187	48	9,959.6	90	12,236.2	46	6,706.9	1,513,123.7
Taihape	55	932,823	56	3,971	20	2,581.5	18	275	1	50.3	14	628.7	3	434.7	936,794
Bulls	395	375,814	299	21,538	84	7,636.3	49	637	58	5,664.2	92	6,377.2	16	1,223.4	397,351.7
Bunnythorpe	109	86,787	90	5,205	12	674.4	6	108	0	0	65	3,821.1	7	602	91,992.4
Shannon	145	78,871	68	4,344	4	213.4	4	57	3	104.9	49	3,542.5	8	426.2	83,214.9
Foxton Beach	415	355,429	555	28,232	283	19,677.9	241	5,511	2	829.6	9	651.9	20	1,561.9	383,661.1
Woodville	847	17,994,232	1,075	118,858	320	36,992.2	287	7,404	38	6,245.8	425	67,507.4	5	708.7	18,113,090.3
Rongotea	234	247,503	193	11,307	53	4,297.4	37	639	1	64	97	6,079.1	5	228.3	258,810
Linton	70	20,035	59	11,849	6	525.8	0	0	1	339.3	45	2,200.8	7	8,782.3	31,884
Halcombe	54	66,343	63	3,511	7	397.6	19	590	0	0	37	2,524.5	0	0	69,854.1
Ohakune	278	304,273	335	24,879	158	14,119.9	85	2,713	29	4,023.9	56	3,649.2	7	373	329,151.6
Eketāhuna	83	59,223	84	5,100	10	716.4	10	298	0	0	64	4,085.9	0	0	64,323.3
Raetihi	168	142,893	124	6,574	44	3,366.1	42	497	3	326.1	34	2,241.1	1	143.6	149,467.4
Hunterville	162	184,922	171	11,084	51	3,744.3	33	490	26	3,266.4	39	2,207.6	22	1,376.1	196,006.1
Sanson	64	41,727	47	2,156	10	593.3	13	220	9	793.9	15	548	0	0	43,882.7
Ōhau	91	86,944	55	2,816	11	1,095.7	14	148	0	0	29	1,564.9	1	8	89,759.6
Tokomaru	57	69,468	33	2,648	4	206	0	0	0	0	28	2,378.8	1	62	72,116.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	338	691,446	348	30,625	76	7,164.2	48	739	1	949.7	222	21,745.3	1	26	722,071.1
Manakau	123	54,347	106	5,342	26	1,984.3	17	355	0	0	56	2,373.2	7	630	59,688.6
Pohangina	77	101,834	54	3,084	4	312.8	0	0	0	0	44	2,487.3	6	283.6	104,918.3
Waitārere Beach	164	399,557	425	19,107	171	12,928.4	203	3,832	3	478.4	0	0	48	1,868.4	418,664.1
Kai Iwi	25	26,120	37	1,246	5	380.6	5	55	0	0	23	767.3	4	42	27,365.8
Himatangi Beach	98	74,422	152	6,569	63	3,778.6	56	818	0	0	29	1,844.5	4	128.2	80,990.9
Longburn	120	174,692	152	26,163	33	4,073.6	23	203	44	17,935.4	47	3,009.9	5	940.6	200,854.5
Waiouru	21	14,194	27	4,403	6	792	7	140	2	3,078.2	11	349.1	1	44.7	18,596.8
Tangimoana	268	520,045	493	18,786	198	12,218.3	245	3,375	1	7	31	1,184.2	18	2,002.8	538,831.2
Ormondville	14	3,003	17	455	0	0	2	44	0	0	15	410.2	0	0	3,457.7
Hokio Beach	66	79,666	115	4,081	38	2,692.1	47	546	1	7	27	813.3	2	23	83,746.8
Norsewood	37	17,380	20	792	8	557.7	5	58	0	0	7	176.7	0	0	18,171.8
Kimbolton	26	46,103	14	1,365	3	316.1	2	143	0	0	8	895.9	1	10	47,468.4
Ōwhango	26	12,433	25	1,065	3	461.4	5	72	0	0	16	516.6	1	15	13,497.6
Rātana	76	69,712	37	1,536	16	1,179.3	14	230	0	0	7	126.5	0	0	71,248.4
Mangaweka	20	22,582	14	1,049	7	509.8	1	11	1	121.9	2	43	3	363.4	23,631.2
Ohakea	65	49,319	63	5,273	11	982.9	5	175	0	0	45	4,079.5	2	36.4	54,592
Pongaroa	33	528,365	51	3,126	11	1,049.5	10	170	3	170.7	20	1,267.9	7	467.9	531,490.8
Ōhura	16	14,964	40	4,499	8	678.2	21	941	1	208.5	9	2,246.2	1	424.9	19,462.6
National Park	12	3,317	11	1,200	4	178.7	4	102	2	849.6	1	69.7	0	0	4,517
Rangataua	18	12,052	16	457	3	114.9	5	53	0	0	8	289.8	0	0	12,509.3
Mangatainoka	22	2,777,477	123	18,879	13	1,989.1	11	207	1	90.8	96	16,540.1	2	51.7	2,796,355.7
Waikawa Beach	16	15,635	55	1,665	24	1,083.9	27	489	0	0	4	92.4	0	0	17,299.6
Mangamutu	10	5,549	26	14,049	1	65.6	1	26	9	13,049.8	15	906.9	0	0	19,597.6
Koitiata	49	101,320	82	3,219	39	2,723.2	43	496	0	0	0	0	0	0	104,539.3
Raurimu	9	3,408	11	257	0	0	1	7	0	0	10	249.7	0	0	3,664.8
Other	2,074	42,600,029	3,283	263,350	535	58,544.5	525	9,703	49	6,375.9	1,939	169,144.8	235	19,581.5	42,863,378.9

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.12: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +1°C and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	20,530	53,545,960	10,376	1,182,392	6,565	809,381.4	2,709	71,085	445	160,496	476	58,422	181	83,007.6	54,728,352
Whanganui	8,928	33,860,880	6,066	556,869	3,217	340,619.7	2,081	36,536	410	120,264.9	191	12,239	167	47,209.9	34,417,749.4
Levin	7,677	2,813,076	1,468	122,075	821	68,109	441	9,960	107	36,394.9	75	5,184.6	24	2,425.4	2,935,151.2
Feilding	3,133	1,450,653	1,081	130,662	523	54,952	240	6,593	177	47,700.8	100	10,646	41	10,770.2	1,581,314.8
Dannevirke	491	208,041	180	11,844	54	4,200	23	310	27	3,542.6	63	2,513.5	13	1,278.8	219,885.1
Marton	931	3,076,992	572	38,819	216	17,433	169	2,340	40	5,726.9	113	7,011.4	34	6,307.7	3,115,810.9
Taumarunui	727	27,145,097	711	46,412	359	32,486.1	249	3,651	23	2,469	48	2,609.9	32	5,197.3	27,191,509
Ashhurst	607	241,404	179	13,584	53	3,950.7	32	590	17	2,243	74	6,431.9	3	367.9	254,987.7
Pahiatua	795	458,747	521	37,532	205	14,880.1	144	1,882	34	6,797.4	114	7,357.2	24	6,615.3	496,278.9
Foxton	1,109	1,568,899	917	73,104	434	39,807.2	285	4,189	48	9,895.4	103	13,133.2	47	6,079.5	1,642,003.4
Taihape	55	932,799	56	3,971	20	2,581.8	18	275	1	51.3	14	627.7	3	434.7	936,770
Bulls	398	378,497	302	21,890	85	7,914.8	50	649	57	5,531.4	94	6,571.5	16	1,224.1	400,386.7
Bunnythorpe	109	81,976	90	5,152	12	674.4	6	108	0	0	66	3,824.1	6	545.4	87,127.9
Shannon	160	268,970	115	12,488	8	513.1	5	70	5	2,101.7	78	8,432.1	19	1,370.5	281,458.2
Foxton Beach	399	312,718	489	22,806	252	16,287.6	218	5,036	1	448.1	9	646.8	9	387.2	335,523.7
Woodville	1,013	21,879,182	1,295	155,868	421	50,851.7	348	9,247	45	10,699.1	466	82,799	15	2,271.2	22,035,049.9
Rongotea	289	412,826	263	17,059	71	6,153.7	50	902	1	64	133	9,357.6	8	580.5	429,884.7
Linton	85	42,624	84	14,464	16	1,599.8	1	7	1	339.3	59	3,736.1	7	8,782.3	57,088.2
Halcombe	54	66,288	64	3,519	7	400.3	20	596	0	0	37	2,522.6	0	0	69,807.5
Ohakune	278	304,273	335	24,879	158	14,119.9	85	2,713	29	4,023.9	56	3,649.2	7	373	329,151.6
Eketāhuna	73	39,513	71	4,033	8	435.5	9	276	0	0	54	3,321	0	0	43,545.9
Raetihi	168	142,893	124	6,574	44	3,366.1	42	497	3	326.1	34	2,241.1	1	143.6	149,467.4
Hunterville	174	237,493	186	12,958	61	4,709.3	34	508	27	3,749.1	42	2,501.3	22	1,489.6	250,451.2
Sanson	64	41,727	47	2,156	10	593.3	13	220	9	793.9	15	548	0	0	43,882.9
Ōhau	90	61,198	47	2,408	10	1,020	10	114	0	0	26	1,266.1	1	8	63,606.4
Tokomaru	57	103,907	35	3,314	4	353.9	0	0	0	0	30	2,831.5	1	128	107,220.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	411	1,173,740	529	49,278	97	10,318	66	975	1	604.6	362	37,010.2	3	370.6	1,223,017.7
Manakau	123	54,346	106	5,342	26	1,984.3	17	355	0	0	56	2,373.2	7	630	59,688.5
Pohangina	77	101,641	54	3,081	4	312.8	0	0	0	0	44	2,485.8	6	283.6	104,721.7
Waitārere Beach	164	399,558	425	19,107	171	12,928.4	203	3,832	3	478.4	0	0	48	1,868.4	418,665.1
Kai Iwi	25	26,120	37	1,245	5	380.6	5	55	0	0	23	766.3	4	42	27,364.9
Himatangi Beach	98	74,419	152	6,569	63	3,778.6	56	818	0	0	29	1,844.5	4	128.2	80,987.6
Longburn	116	287,748	168	27,453	35	5,197.4	24	250	46	16,935.2	58	4,059.6	5	1,012.2	315,201.5
Waiouru	21	14,194	27	4,403	6	792	7	140	2	3,078.2	11	349.1	1	44.7	18,596.7
Tangimoana	295	934,042	565	23,245	227	15,770.5	283	3,939	1	7	36	1,477.5	18	2,050.9	957,286.7
Ormondville	14	3,003	17	455	0	0	2	44	0	0	15	410.2	0	0	3,457.7
Hokio Beach	66	79,666	115	4,081	38	2,692.1	47	546	1	7	27	813.3	2	23	83,746.9
Norsewood	37	17,380	20	792	8	557.7	5	58	0	0	7	176.7	0	0	18,171.8
Kimbolton	26	46,121	14	1,365	3	316.1	2	143	0	0	8	895.9	1	10	47,486
Ōwhango	26	12,433	25	1,065	3	461.4	5	72	0	0	16	516.6	1	15	13,497.6
Rātana	76	69,712	37	1,536	16	1,179.3	14	230	0	0	7	126.5	0	0	71,248.1
Mangaweka	20	22,582	14	1,049	7	509.8	1	11	1	121.9	2	43	3	363.4	23,631.2
Ohakea	65	44,650	60	4,658	10	785.1	4	157	0	0	44	3,679.1	2	36.4	49,307.6
Pongaroa	33	528,365	51	3,126	11	1,049.5	10	170	3	170.7	20	1,267.9	7	467.9	531,490.8
Ōhura	16	14,964	40	4,499	8	678.2	21	941	1	208.5	9	2,246.2	1	424.9	19,462.7
National Park	12	3,317	11	1,200	4	178.7	4	102	2	849.6	1	69.7	0	0	4,516.8
Rangataua	18	12,052	16	457	3	114.9	5	53	0	0	8	289.8	0	0	12,509.3
Mangatainoka	24	2,847,807	134	27,862	13	2,808.8	11	726	1	90.8	107	24,188.5	2	47.7	2,875,669
Waikawa Beach	16	15,634	55	1,665	24	1,083.9	27	489	0	0	4	92.4	0	0	17,299.5
Mangamutu	10	5,548	19	23,850	2	109.8	1	24	4	23,065.2	11	605.8	1	44.8	29,398.3
Koitiata	49	101,320	82	3,219	39	2,723.2	43	496	0	0	0	0	0	0	104,539.2
Raurimu	9	3,408	11	257	0	0	1	7	0	0	10	249.7	0	0	3,664.8
Other	2,358	45,349,850	4,146	398,527	692	101,592.1	611	11,361	54	9,293.9	2,537	253,810.6	252	22,470.1	45,748,376.8

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.13: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +2°C and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	18,121	31,667,797	9,472	969,353	5,801	632,320.2	2,596	41,356	517	198,607.6	392	48,822.2	166	48,247.1	32,637,149.9
Whanganui	10,312	76,707,628	7,632	730,844	4,074	468,565	2,691	45,974	482	143,770.8	200	14,959.4	185	57,574.7	77,438,472.4
Levin	7,936	3,015,930	1,596	143,938	887	84,665.2	485	10,368	117	37,342.1	82	5,172.6	25	6,388.9	3,159,868
Feilding	2,350	905,854	561	68,752	243	19,919.1	87	2,332	103	29,694.4	102	8,584.5	26	8,222.5	974,606.2
Dannevirke	531	235,526	196	13,194	62	4,839.7	25	366	28	3,362.7	66	2,501.1	15	2,123.4	248,719.9
Marton	958	4,340,222	594	40,155	223	18,109.5	171	2,356	43	6,530.2	122	7,375.3	35	5,782.9	4,380,376.6
Taumarunui	1,029	30,038,935	1,087	75,865	551	55,837.2	401	5,724	31	3,119.5	65	3,527.5	39	7,655.7	30,114,800.4
Ashhurst	669	289,632	211	16,553	70	5,040.9	41	772	22	3,151.3	75	7,226.9	3	361.9	306,184.9
Pahiatua	838	508,608	585	42,815	218	16,040.3	154	2,106	37	7,309.4	152	10,180.9	24	7,178.1	551,422.5
Foxton	1,121	1,510,517	937	74,813	445	40,959.7	296	4,329	50	9,530	99	12,878.3	47	7,115.8	1,585,330
Taihape	55	5,474,807	58	4,218	20	2,702.4	20	291	1	53.7	14	676.3	3	495.3	5,479,025.3
Bulls	421	440,396	371	28,686	99	9,294.4	67	911	85	9,006.5	102	7,614.6	18	1,859.5	469,082.5
Bunnythorpe	115	90,743	94	5,437	12	677.5	6	104	0	0	69	4,039.5	7	615.4	96,179.8
Shannon	162	97,620	76	4,725	6	309.8	5	66	3	105.3	53	3,755.2	9	488.2	102,345.3
Foxton Beach	448	400,788	605	30,484	309	21,155.8	263	6,148	2	903.9	10	715.4	21	1,562.3	431,272
Woodville	1,101	51,782,724	1,450	186,412	488	64,453.9	400	12,418	56	16,411.6	488	89,652.1	18	3,476.5	51,969,136.4
Rongotea	263	289,089	213	13,067	59	4,761.9	40	694	1	64	106	7,078.1	7	469.2	302,155.7
Linton	75	26,884	68	12,378	8	519.3	1	6	1	339.3	51	2,759.7	7	8,753.4	39,262.4
Halcombe	54	73,798	67	3,704	7	453	22	654	0	0	38	2,597.8	0	0	77,501.7
Ohakune	304	1,583,882	379	27,773	177	16,090.3	96	2,856	29	4,124.7	68	4,045.7	9	656	1,611,655.3
Eketāhuna	87	51,713	79	4,686	10	562.3	12	333	0	0	57	3,789.8	0	0	56,398.8
Raetihi	184	157,560	130	7,080	46	3,604.5	42	492	3	305.5	36	2,426.8	3	250.5	164,640.3
Hunterville	176	218,021	179	12,620	55	4,267.2	34	482	26	3,626.8	42	2,764.6	22	1,480.8	230,641.2
Sanson	64	42,940	47	2,106	10	613.5	13	213	9	731.4	15	548.3	0	0	45,046
Ōhau	97	93,688	58	3,044	11	1,124.9	15	155	0	0	31	1,753.1	1	12	96,731.6
Tokomaru	57	70,632	33	2,753	4	205.7	0	0	0	0	28	2,493.6	1	54	73,385.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	392	1,109,881	467	43,629	92	9,513.6	58	905	1	1,039.9	315	32,154.8	1	16	1,153,510
Manakau	136	63,197	127	6,414	32	2,696.4	21	413	0	0	67	2,595.3	7	708.1	69,611.2
Pohangina	84	148,925	61	3,521	6	347.7	0	0	0	0	49	2,892.7	6	280.3	152,446
Waitārere Beach	171	436,295	448	19,905	177	13,612.4	219	3,938	4	611.8	0	0	48	1,742.8	456,199.6
Kai Iwi	21	26,157	37	1,292	5	421	5	54	0	0	23	776.2	4	41	27,448.6
Himatangi Beach	105	89,954	175	7,361	67	4,104.4	64	965	0	0	30	1,822.6	14	469.2	97,315.3
Longburn	120	242,524	166	27,638	35	5,317.9	24	243	46	17,183.4	56	3,866	5	1,027.1	270,161.7
Waiouru	21	14,399	29	5,166	7	1,247.5	7	144	2	3,359.4	12	371.5	1	44.7	19,564.8
Tangimoana	290	674,540	542	21,848	217	14,315.5	267	3,618	1	7	34	1,665.7	23	2,242.6	696,388.3
Ormondville	14	3,094	18	511	0	0	2	43	0	0	16	468.9	0	0	3,605.3
Hokio Beach	66	85,157	120	4,393	40	2,947.8	50	596	1	6	27	823.1	2	20	89,549.9
Norsewood	37	17,508	22	831	8	571.7	5	58	1	11	8	191.2	0	0	18,338.5
Kimbolton	26	46,850	15	1,427	3	316.1	2	143	0	0	9	958.5	1	10	48,277.5
Ōwhango	29	13,132	28	1,214	3	462.8	5	82	1	32.7	18	622.3	1	14	14,346.5
Rātana	76	70,116	37	1,556	16	1,179	14	232	0	0	7	144.9	0	0	71,671.9
Mangaweka	23	23,840	14	1,070	7	523	1	11	1	122.2	2	68	3	345.3	24,910.4
Ohakea	75	76,293	79	5,688	12	1,098.2	9	178	0	0	55	4,118.7	3	293.2	81,980.7
Pongaroa	40	931,453	56	3,795	11	1,112.9	11	185	3	172.2	24	1,737	7	587.5	935,248.2
Ōhura	23	19,213	49	4,684	10	783	24	898	1	201.3	10	2,296.1	4	506.3	23,896.6
National Park	12	3,662	11	1,125	4	179.1	4	102	2	774.8	1	69.7	0	0	4,787
Rangataua	18	12,499	16	505	3	136.1	5	53	0	0	8	316.5	0	0	13,003.6
Mangatainoka	31	2,897,082	145	29,673	15	3,064.9	13	749	1	90.8	112	25,635.3	4	133.4	2,926,755.3
Waikawa Beach	16	16,928	60	1,830	27	1,258.5	28	465	0	0	5	106.8	0	0	18,758.5
Mangamutu	33	20,260	45	14,914	2	126.1	1	29	15	12,944.6	26	1,765.7	1	49.7	35,174.2
Koitiata	49	102,871	85	3,206	40	2,701.9	45	504	0	0	0	0	0	0	106,076.6
Raurimu	9	3,534	12	292	0	0	1	8	0	0	11	284.1	0	0	3,826.5
Other	2,322	86,950,530	3,884	326,712	652	73,676.2	622	11,679	53	7,538.6	2,264	206,487.2	293	27,331.3	87,277,241.6

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.14: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +2°C and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	26,805	89,162,258	14,580	1,689,473	9,337	1,217,650.6	3,878	105,788	557	198,354.7	545	74,517.3	263	93,161.7	90,851,730.7
Whanganui	10,312	78,820,132	7,643	742,267	4,072	473,602	2,694	45,895	493	150,773.4	200	14,959.8	184	57,036.9	79,562,399.5
Levin	7,936	3,015,916	1,596	143,938	887	84,665.2	485	10,368	117	37,342.1	82	5,172.6	25	6,388.9	3,159,854.3
Feilding	3,312	1,604,508	1,231	149,125	606	61,310.5	283	7,084	190	56,405	107	12,299	45	12,026.4	1,753,632.9
Dannevirke	533	235,908	197	13,373	62	4,826.7	25	371	28	3,357.9	67	2,693.2	15	2,124.6	249,280.6
Marton	985	4,374,889	626	42,550	235	19,393.8	181	2,536	52	7,695.3	121	7,410.8	37	5,513.2	4,417,439
Taumarunui	1,065	30,148,254	1,151	79,277	585	58,891.2	431	6,003	33	3,165.3	65	3,523.1	37	7,694.5	30,227,531.4
Ashhurst	640	275,699	201	15,236	63	4,574.5	36	616	17	2,477.7	82	7,205.6	3	361.9	290,934.9
Pahiatua	847	511,146	581	42,548	218	16,113.6	154	2,093	37	7,252.1	148	9,933.3	24	7,155.9	553,694.1
Foxton	1,128	1,628,555	944	74,622	446	41,045.7	295	4,319	50	9,548.5	105	13,296.6	48	6,412.4	1,703,177.2
Taihape	55	5,474,852	58	4,209	20	2,696.8	20	291	1	52.1	14	674.3	3	495.3	5,479,061
Bulls	422	440,521	373	28,462	99	9,200.9	69	955	85	8,761.8	103	7,787.1	17	1,757.7	468,982.7
Bunnythorpe	115	84,734	94	5,385	12	677.5	6	104	0	0	70	4,044.5	6	558.8	90,118.8
Shannon	177	335,838	128	13,912	11	788.8	7	84	5	1,424.8	86	10,150.1	19	1,464.6	349,749.5
Foxton Beach	416	329,134	502	23,641	256	16,445.9	226	5,491	1	603.2	10	711.6	9	389.4	352,775.3
Woodville	1,114	51,823,858	1,442	186,462	484	64,622.2	397	12,376	56	16,393.2	487	89,594.5	18	3,476.5	52,010,320.4
Rongotea	298	432,261	269	17,586	72	6,242.4	50	1,003	1	64	138	9,660.9	8	614.8	449,847.4
Linton	87	46,730	92	15,159	18	1,661.2	2	13	1	339.3	64	4,392.3	7	8,753.4	61,889.3
Halcombe	54	73,788	67	3,702	7	453	22	654	0	0	38	2,595.4	0	0	77,490.5
Ohakune	304	1,583,882	379	27,773	177	16,090.3	96	2,856	29	4,124.7	68	4,045.7	9	656	1,611,655.3
Eketāhuna	87	51,727	79	4,685	10	562.3	12	329	0	0	57	3,792.9	0	0	56,412.2
Raetihi	184	157,560	130	7,086	46	3,604.5	42	492	3	305.5	36	2,432.8	3	250.5	164,646.3
Hunterville	183	277,037	191	13,766	64	5,192.3	35	507	27	3,758.3	43	2,741.4	22	1,567.1	290,802.8
Sanson	64	42,940	47	2,106	10	613.5	13	213	9	731.4	15	548.3	0	0	45,045.8
Ōhau	96	66,045	50	2,632	10	1,051.2	11	124	0	0	28	1,446	1	12	68,677
Tokomaru	58	111,396	37	3,650	4	403.1	0	0	0	0	32	3,118.2	1	129	115,045.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	429	1,327,894	578	53,313	103	10,603.6	72	1,108	1	612	399	40,494	3	495.6	1,381,207.5
Manakau	136	63,198	127	6,414	32	2,696.4	21	413	0	0	67	2,596.3	7	708.1	69,611.6
Pohangina	84	148,596	61	3,522	6	347.7	0	0	0	0	49	2,894	6	280.3	152,118
Waitārere Beach	171	436,294	448	19,905	177	13,612.4	219	3,938	4	611.8	0	0	48	1,742.8	456,199.1
Kai Iwi	21	26,156	37	1,292	5	421	5	54	0	0	23	776.2	4	41	27,448.2
Himatangi Beach	105	89,955	175	7,362	67	4,104.9	64	965	0	0	30	1,822.6	14	469.2	97,316.9
Longburn	116	333,959	168	27,303	35	5,838.8	24	261	46	15,919.3	58	4,300.3	5	984.3	361,262.1
Waiouru	21	14,399	29	5,166	7	1,247.5	7	144	2	3,359.4	12	371.5	1	44.7	19,564.8
Tangimoana	309	1,158,667	587	25,678	237	17,617.4	289	4,066	1	7	38	1,664.7	22	2,323.8	1,184,345.2
Ormondville	14	3,095	18	512	0	0	2	43	0	0	16	468.9	0	0	3,606.7
Hokio Beach	66	85,157	120	4,393	40	2,947.8	50	596	1	6	27	823.1	2	20	89,549.8
Norsewood	37	17,507	22	831	8	571.7	5	58	1	11	8	191.2	0	0	18,338.4
Kimbolton	26	46,849	15	1,427	3	316.1	2	143	0	0	9	958.5	1	10	48,276.3
Ōwhango	29	13,133	28	1,214	3	462.8	5	82	1	32.7	18	622.3	1	14	14,346.6
Rātana	76	70,116	37	1,556	16	1,179	14	232	0	0	7	144.9	0	0	71,671.6
Mangaweka	23	23,840	14	1,069	7	523	1	11	1	122.2	2	68	3	345.3	24,909.4
Ohakea	75	71,082	79	5,648	12	1,077.9	9	190	0	0	55	4,086.5	3	293.2	76,730
Pongaroa	40	931,453	56	3,795	11	1,112.9	11	185	3	172.2	24	1,737	7	587.5	935,248.2
Ōhura	23	19,212	49	4,684	10	783	24	898	1	201.3	10	2,296.1	4	506.3	23,896.5
National Park	12	3,662	11	1,125	4	179.1	4	102	2	774.8	1	69.7	0	0	4,786.5
Rangataua	18	12,499	16	505	3	136.1	5	53	0	0	8	316.5	0	0	13,003.6
Mangatainoka	33	2,899,181	146	29,761	16	3,151.2	13	748	1	90.8	112	25,635.3	4	136.3	2,928,941.7
Waikawa Beach	16	16,929	60	1,827	27	1,253.1	28	468	0	0	5	105.8	0	0	18,755.7
Mangamutu	42	27,385	45	13,489	7	418.1	1	37	9	11,031.9	27	1,936.2	1	65.8	40,874.4
Koitiata	49	102,870	85	3,206	40	2,701.9	45	504	0	0	0	0	0	0	106,076.5
Raurimu	15	4,049	12	294	0	0	1	6	0	0	11	287.4	0	0	4,342.8
Other	2,600	89,711,478	4,715	464,974	798	115,558	704	14,760	58	10,071.7	2,842	294,363.8	313	30,222.4	90,176,451.9

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.15: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +3°C and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	20,238	39,736,313	11,012	1,203,642	6,712	752,635.3	3,022	71,221	585	242,002.3	493	61,997.6	200	75,787.5	40,939,955.3
Whanganui	12,027	156,170,375	9,522	976,153	5,158	624,822	3,356	59,245	579	195,797.5	215	17,762.8	214	78,525.4	157,146,528.2
Levin	8,255	3,215,197	1,734	156,906	957	91,149.6	529	11,334	131	41,118.7	90	5,362.2	27	7,941.1	3,372,102.9
Feilding	2,489	979,159	624	81,410	259	23,614.7	101	2,996	124	35,934.6	110	9,977.6	30	8,887.8	1,060,568.7
Dannevirke	582	264,091	230	15,999	73	5,581.1	31	435	32	3,932	77	3,416	17	2,634.3	280,090
Marton	1,038	4,444,105	653	44,297	247	20,076.6	187	2,549	56	7,682.6	124	7,701.8	39	6,286.8	4,488,402.3
Taumarunui	1,199	36,551,113	1,380	97,112	688	70,606.1	519	7,333	45	5,671.5	84	5,024.7	44	8,476.7	36,648,224.6
Ashhurst	704	321,667	229	17,892	72	5,356.9	45	814	24	3,222.2	85	8,131.3	3	367.6	339,558.9
Pahiatua	891	561,711	640	46,059	226	16,960.2	165	2,267	41	7,801.7	184	12,238	24	6,791.9	607,770.2
Foxton	1,148	1,581,538	971	76,082	459	42,032.2	305	4,414	50	9,500.4	109	13,104.1	48	7,030.4	1,657,620.3
Taihape	55	7,244,204	61	4,389	21	2,680	21	321	1	52.1	15	709.1	3	627.4	7,248,592.8
Bulls	445	508,812	398	30,911	112	10,535.8	74	1,017	85	9,489.5	109	8,140.7	18	1,726.6	539,723.5
Bunnythorpe	129	95,663	96	5,472	12	698.3	8	136	0	0	69	4,037	7	600.4	101,135.1
Shannon	172	111,684	88	5,561	8	465.8	6	77	3	103.6	59	4,332.1	12	582.6	117,244.9
Foxton Beach	477	445,185	658	33,875	342	23,421.5	280	6,498	2	1,508.4	12	734.2	22	1,712.8	479,059.7
Woodville	1,031	61,939,482	1,341	161,626	441	52,129	363	9,726	45	12,916	476	84,129.3	16	2,725.4	62,101,107.9
Rongotea	274	324,826	231	13,939	66	5,234	43	738	1	64	113	7,392.6	8	509.5	338,764.7
Linton	77	25,353	74	12,784	8	510.5	3	36	1	339.3	55	3,017	7	8,881.2	38,137.3
Halcombe	54	71,576	70	4,012	7	443	23	703	0	0	40	2,866.7	0	0	75,587.7
Ohakune	316	1,630,120	420	31,690	198	18,958.5	105	2,979	32	4,532.7	76	4,493.6	9	725.5	1,661,809.8
Eketāhuna	99	2,556,505	107	6,183	12	1,111.9	13	350	0	0	81	4,712.3	1	9	2,562,687.7
Raetihi	188	167,752	134	7,258	47	3,754.2	44	528	3	311.8	37	2,431.9	3	232.3	175,010.3
Hunterville	184	267,978	194	13,874	64	5,158.2	36	548	27	3,656.7	44	2,884.2	23	1,628.1	281,852.2
Sanson	64	44,152	47	2,165	10	624.8	13	210	9	761.1	15	569.7	0	0	46,317
Ōhau	110	104,448	68	4,008	13	1,300.7	17	174	0	0	37	2,523.8	1	9	108,456.5
Tokomaru	57	72,471	33	2,966	4	203.9	0	0	0	0	28	2,701.3	1	61	75,437.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	413	1,563,431	546	53,391	100	10,901.3	68	1,080	1	1,173	375	40,139.2	2	96.7	1,616,822.4
Manakau	143	69,615	137	6,738	34	2,892	24	452	0	0	72	2,741.2	7	653.6	76,353
Pohangina	85	161,134	67	3,669	8	563.3	0	0	0	0	53	2,830.3	6	275.1	164,803.1
Waitārere Beach	182	459,524	453	20,363	181	13,903.1	220	3,992	4	635.3	0	0	48	1,831.6	479,886.7
Kai Iwi	21	28,381	38	1,261	5	387.6	6	66	0	0	23	766.6	4	41	29,642.3
Himatangi Beach	109	105,944	196	8,132	74	4,520.9	77	1,224	0	0	31	1,848.3	14	539.9	114,076.5
Longburn	116	320,424	166	30,203	35	5,883.1	24	264	46	18,916.5	56	4,116.9	5	1,023.1	350,626.5
Waiouru	24	14,815	31	5,812	9	1,912.4	7	138	2	3,359.4	12	357.1	1	44.7	20,627.4
Tangimoana	303	921,145	577	24,197	231	15,947.2	280	3,908	2	124.7	41	1,849.8	23	2,367.9	945,341.7
Ormondville	25	71,886	20	652	0	0	2	43	0	0	18	608.6	0	0	72,538.4
Hokio Beach	75	96,295	128	4,800	41	3,248.2	53	615	1	6	31	912.4	2	19	101,095.1
Norsewood	37	17,654	22	826	8	565.9	5	55	1	11	8	194.4	0	0	18,480.3
Kimbolton	26	47,829	15	1,478	3	316.1	2	143	0	0	9	1,009.2	1	10	49,306.6
Ōwhango	29	13,577	29	1,256	3	464.4	5	81	1	38	19	657.3	1	15	14,832.9
Rātana	76	70,503	36	1,554	16	1,182	14	231	0	0	6	141	0	0	72,057.3
Mangaweka	23	25,010	15	1,146	7	557.7	1	11	2	170.9	2	65	3	341.2	26,155.7
Ohakea	79	98,620	85	6,723	12	1,161.5	9	249	0	0	61	5,052.4	3	259.8	105,342.6
Pongaroa	45	1,302,700	62	4,092	13	1,154.9	12	167	3	175.2	27	1,919.9	7	674.4	1,306,791.9
Ōhura	23	20,456	52	4,892	10	881.4	25	941	1	202.7	12	2,331.3	4	535.3	25,348
National Park	12	4,018	11	935	4	169.8	4	100	2	595.6	1	69.7	0	0	4,952.7
Rangataua	18	13,003	16	493	3	136.1	5	52	0	0	8	304.2	0	0	13,496.3
Mangatainoka	45	6,928,157	181	30,669	33	4,672.3	25	900	2	109.7	113	24,603.4	8	383.7	6,958,826.1
Waikawa Beach	21	26,889	71	2,466	31	1,670.1	35	694	0	0	5	102.4	0	0	29,354.6
Mangamutu	41	30,221	69	15,044	15	883.4	6	301	19	12,042.6	28	1,761.9	1	54.6	45,264.7
Koitiata	49	104,412	88	3,357	41	2,829.8	46	520	0	0	1	8	0	0	107,769.5
Raurimu	15	7,671	16	312	0	0	1	6	1	2	14	302.7	0	0	7,982.6
Other	2,534	147,857,835	4,375	395,137	748	86,108.8	696	13,146	64	9,360.9	2,545	251,547.5	322	34,973.7	148,252,971.6

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.16: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +3°C and Defences Down

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	31,087	133,596,770	18,243	2,154,759	11,693	1,555,314.4	4,987	127,238	623	252,252.6	609	82,849.3	331	137,104.9	135,751,528.5
Whanganui	12,027	157,277,019	9,524	981,132	5,162	630,208.3	3,354	58,998	579	196,614.1	215	17,752.1	214	77,560.2	158,258,151.4
Levin	8,255	3,215,189	1,734	156,906	957	91,149.6	529	11,334	131	41,118.7	90	5,362.2	27	7,941.1	3,372,095
Feilding	3,458	1,767,829	1,354	154,286	675	66,522.4	320	7,615	201	56,542.3	112	11,181.6	46	12,424.2	1,922,115
Dannevirke	584	264,659	230	16,053	73	5,581.1	31	435	32	3,932	77	3,470.3	17	2,634.3	280,712
Marton	1,080	4,474,922	681	46,452	260	21,273.7	197	2,670	61	8,384.1	124	7,795.5	39	6,328.1	4,521,374.5
Taumarunui	1,224	36,893,333	1,405	100,164	704	73,888.2	530	7,310	45	5,178.3	83	5,085.7	43	8,701.6	36,993,497.3
Ashhurst	679	318,611	226	17,238	71	5,215.8	39	731	19	2,917.6	94	8,006	3	367.6	335,848.7
Pahiatua	892	557,710	628	45,510	225	16,703	163	2,244	41	7,720.9	175	11,778.9	24	7,064.2	603,219.6
Foxton	1,161	1,683,840	970	75,664	459	42,130.7	304	4,396	50	9,625	109	13,130.4	48	6,381.6	1,759,504.5
Taihape	55	7,244,240	61	4,375	21	2,665.3	21	321	1	52.1	15	709.1	3	627.4	7,248,615
Bulls	446	509,189	401	31,058	113	10,808.5	74	1,005	85	9,401.4	111	8,151.9	18	1,690.9	540,246.8
Bunnythorpe	129	88,390	96	5,432	12	700.7	8	139	0	0	70	4,048	6	543.9	93,822.2
Shannon	184	385,819	135	16,411	13	1,031.3	10	150	6	3,010.1	87	10,760.1	19	1,459.3	402,230.3
Foxton Beach	424	343,123	517	24,684	264	17,235.5	231	5,749	1	603.2	12	712.9	9	383.1	367,807.3
Woodville	1,167	66,814,640	1,556	213,612	528	78,792.3	428	14,660	76	17,137.9	502	98,062.9	22	4,959.4	67,028,251.7
Rongotea	307	454,845	280	18,334	77	6,479.3	52	1,048	1	64	142	10,132.1	8	610.8	473,179.2
Linton	87	44,815	97	15,577	18	1,633.4	2	13	1	339.3	69	4,710.4	7	8,881.2	60,391.7
Halcombe	54	71,562	70	4,014	7	443.7	23	707	0	0	40	2,863.9	0	0	75,575.8
Ohakune	316	1,630,120	420	31,690	198	18,958.5	105	2,979	32	4,532.7	76	4,493.6	9	725.5	1,661,809.8
Eketāhuna	89	62,306	97	5,249	11	748.6	13	356	0	0	72	4,135.8	1	9	67,555.2
Raetihi	188	167,752	134	7,258	47	3,754.2	44	528	3	311.8	37	2,431.9	3	232.3	175,010.3
Hunterville	188	304,983	195	15,242	65	5,462.4	36	520	28	4,769.4	44	2,817.6	22	1,672.4	320,225.1
Sanson	64	44,152	47	2,165	10	624.8	13	210	9	761.1	15	569.7	0	0	46,316.9
Ōhau	109	75,947	62	3,674	12	1,241.3	14	148	0	0	35	2,275.2	1	9	79,621
Tokomaru	58	118,594	41	4,303	4	401.9	0	0	0	0	36	3,759	1	141	122,897.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	438	1,475,848	609	57,902	106	11,191.6	77	1,165	1	544.2	422	44,496.7	3	504.7	1,533,750
Manakau	143	69,615	137	6,737	34	2,892	24	452	0	0	72	2,740.2	7	653.6	76,352.4
Pohangina	85	160,713	67	3,671	8	563.3	0	0	0	0	53	2,831.9	6	275.1	164,383.7
Waitārere Beach	182	459,524	453	20,377	181	13,909.2	220	4,001	4	635.3	0	0	48	1,830.6	479,900.9
Kai Iwi	21	28,382	38	1,261	5	387.6	6	66	0	0	23	766.6	4	41	29,642.9
Himatangi Beach	109	105,943	196	8,126	74	4,520.9	77	1,218	0	0	31	1,848.3	14	539.9	114,069.2
Longburn	120	375,837	168	29,294	35	6,566.9	24	262	46	17,123.2	58	4,342.1	5	998.4	405,130.9
Waiouru	24	14,816	31	5,812	9	1,912.4	7	138	2	3,359.4	12	357.1	1	44.7	20,628.3
Tangimoana	316	1,386,620	594	26,642	240	17,977.5	291	4,140	2	271.5	39	1,746.2	22	2,507.4	1,413,262
Ormondville	25	71,886	20	656	0	0	2	43	0	0	18	612.3	0	0	72,542.3
Hokio Beach	75	96,293	128	4,800	41	3,248.2	53	615	1	6	31	912.4	2	19	101,093.3
Norsewood	37	17,654	22	826	8	565.9	5	55	1	11	8	194.4	0	0	18,480.4
Kimbolton	26	47,829	15	1,478	3	316.1	2	143	0	0	9	1,009.2	1	10	49,306.6
Ōwhango	29	13,577	29	1,256	3	464.4	5	81	1	38	19	657.3	1	15	14,833.4
Rātana	76	70,503	36	1,554	16	1,182	14	231	0	0	6	141	0	0	72,056.7
Mangaweka	23	25,009	15	1,142	7	557.7	1	11	2	170.9	2	61	3	341.2	26,151
Ohakea	79	93,404	84	6,694	12	1,177.1	9	265	0	0	60	4,991.1	3	259.8	100,098.4
Pongaroa	45	1,302,700	62	4,092	13	1,154.9	12	167	3	175.2	27	1,919.9	7	674.4	1,306,791.9
Ōhura	23	20,456	52	4,892	10	881.4	25	941	1	202.7	12	2,331.3	4	535.3	25,348
National Park	12	4,019	11	935	4	169.8	4	100	2	595.6	1	69.7	0	0	4,954.3
Rangataua	18	13,003	16	493	3	136.1	5	52	0	0	8	304.2	0	0	13,496.3
Mangatainoka	46	6,976,419	190	34,934	29	5,523.7	24	907	3	1,588.2	126	26,568.1	8	347.5	7,011,353.2
Waikawa Beach	21	26,582	69	2,386	30	1,608.2	34	676	0	0	5	101.4	0	0	28,968
Mangamutu	44	48,432	84	12,530	17	1,113.2	10	326	18	8,524.5	37	2,489.6	2	75.5	60,961.5
Koitiata	49	104,412	88	3,357	41	2,829.8	46	520	0	0	1	8	0	0	107,769.4
Raurimu	15	7,850	16	315	0	0	1	6	1	2	14	305.7	0	0	8,164.9
Other	2,796	150,796,588	5,190	530,010	895	131,810.4	779	16,282	69	11,825.4	3,103	331,343.9	344	38,749.6	151,326,598

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.11.17: Estimated population impacted, and cost to reinstate the proportion of building which were modelled to be affected by flooding, by building type, for each town/settlement - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Palmerston North	20,238	39,733,719	11,012	1,203,694	6,712	752,672.7	3,022	71,224	585	242,007.3	493	62,002.8	200	75,787.5	40,937,413.4
Whanganui	12,135	158,863,280	9,696	992,159	5,220	632,717.8	3,433	58,317	607	205,690.8	214	17,611.7	222	77,821.2	159,855,439.5
Levin	8,255	3,215,180	1,734	156,906	957	91,149.6	529	11,334	131	41,118.7	90	5,362.2	27	7,941.1	3,372,086.1
Feilding	2,489	979,115	624	81,547	259	23,583.4	101	2,996	124	36,100.3	110	9,980.9	30	8,887.8	1,060,661.7
Dannevirke	582	264,091	230	15,999	73	5,581.1	31	435	32	3,932	77	3,416	17	2,634.3	280,090
Marton	1,038	4,444,101	653	44,297	247	20,076.6	187	2,549	56	7,682.6	124	7,701.8	39	6,286.8	4,488,397.8
Taumarunui	1,199	36,551,113	1,380	97,112	688	70,606.1	519	7,333	45	5,671.5	84	5,024.7	44	8,476.7	36,648,224.6
Ashhurst	704	321,670	229	17,892	72	5,356.9	45	814	24	3,222.2	85	8,131.3	3	367.6	339,562.2
Pahiatua	891	561,711	640	46,059	226	16,960.2	165	2,267	41	7,801.7	184	12,238	24	6,791.9	607,770.2
Foxton	1,144	1,556,633	963	75,272	459	42,040.3	306	4,420	50	9,543.6	100	12,268.5	48	6,999.5	1,631,905.3
Taihape	55	7,243,962	61	4,389	21	2,680	21	321	1	52.1	15	709.1	3	627.4	7,248,351.1
Bulls	445	508,804	398	30,911	112	10,535.8	74	1,017	85	9,489.5	109	8,140.7	18	1,726.6	539,714.8
Bunnythorpe	129	95,661	96	5,471	12	698.3	8	138	0	0	69	4,035	7	600.4	101,132
Shannon	169	111,808	89	5,690	8	450.8	6	77	3	103.6	60	4,488.4	12	570.8	117,498.5
Foxton Beach	523	575,863	774	45,274	414	34,068	319	7,072	2	1,510.2	12	847.2	27	1,777.4	621,137.2
Woodville	1,031	61,939,482	1,341	161,626	441	52,129	363	9,726	45	12,916	476	84,129.3	16	2,725.4	62,101,108
Rongotea	274	324,821	231	13,934	66	5,234	43	738	1	64	113	7,388.1	8	509.5	338,754.6
Linton	77	25,354	74	12,784	8	510.5	3	36	1	339.3	55	3,017	7	8,881.2	38,138.1
Halcombe	54	71,576	70	4,013	7	443.9	23	703	0	0	40	2,866.7	0	0	75,588.8
Ohakune	316	1,630,120	420	31,690	198	18,958.5	105	2,979	32	4,532.7	76	4,493.6	9	725.5	1,661,809.8
Eketāhuna	99	2,556,505	107	6,183	12	1,111.9	13	350	0	0	81	4,712.3	1	9	2,562,687.7
Raetihi	188	167,752	134	7,258	47	3,754.2	44	528	3	311.8	37	2,431.9	3	232.3	175,010.3
Hunterville	184	267,973	194	13,873	64	5,157	36	548	27	3,656.7	44	2,884.2	23	1,628.1	281,845.7
Sanson	64	44,152	47	2,165	10	624.8	13	210	9	761.1	15	569.7	0	0	46,316.8
Ōhau	110	104,449	68	4,008	13	1,300.7	17	174	0	0	37	2,523.8	1	9	108,456.7
Tokomaru	57	72,472	33	2,966	4	203.9	0	0	0	0	28	2,701.3	1	61	75,438.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total usual resident population exposed to flooding	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost for residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary & secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (fatality + total reinstatement cost for buildings) (000's NZD)
Kairanga	413	1,563,407	546	53,338	100	10,862.8	68	1,080	1	1,173	375	40,124.3	2	96.7	1,616,745.4
Manakau	143	69,611	137	6,739	34	2,892	24	452	0	0	72	2,741.8	7	653.6	76,350.4
Pohangina	85	161,117	67	3,669	8	563.3	0	0	0	0	53	2,830.3	6	275.1	164,786.2
Waitārere Beach	173	453,973	461	20,426	182	13,939.6	227	4,024	4	635.3	0	0	48	1,826.6	474,399.4
Kai Iwi	21	28,382	39	1,410	6	533.9	6	68	0	0	23	766.6	4	41	29,791.7
Himatangi Beach	109	105,230	194	9,005	74	5,408.1	75	1,185	0	0	31	1,866.3	14	545.9	114,234.8
Longburn	116	320,409	166	29,918	35	5,883.1	24	264	46	18,632	56	4,116.9	5	1,023.1	350,327.3
Waiouru	24	14,815	31	5,812	9	1,912.4	7	138	2	3,359.4	12	357.1	1	44.7	20,627.3
Tangimoana	303	923,711	577	24,238	231	15,985.5	280	3,889	2	128.9	41	1,844.7	23	2,389.9	947,948.9
Ormondville	25	71,886	20	652	0	0	2	43	0	0	18	608.6	0	0	72,538.4
Hokio Beach	75	96,290	128	4,801	41	3,249.1	53	615	1	6	31	912.4	2	19	101,091
Norsewood	37	17,654	22	826	8	565.9	5	55	1	11	8	194.4	0	0	18,480.3
Kimbolton	26	47,830	15	1,478	3	316.1	2	143	0	0	9	1,009.2	1	10	49,307.8
Ōwhango	29	13,577	29	1,256	3	464.4	5	81	1	38	19	657.3	1	15	14,832.9
Rātana	76	70,504	36	1,554	16	1,182	14	231	0	0	6	141	0	0	72,057.6
Mangaweka	23	25,008	15	1,142	7	557.7	1	11	2	170.9	2	61	3	341.2	26,149.5
Ohakea	79	98,618	85	6,723	12	1,161.5	9	249	0	0	61	5,052.4	3	259.8	105,340.6
Pongaroa	45	1,302,700	62	4,092	13	1,154.9	12	167	3	175.2	27	1,919.9	7	674.4	1,306,792.1
Ōhura	23	20,456	52	4,892	10	881.4	25	941	1	202.7	12	2,331.3	4	535.3	25,348
National Park	12	4,018	11	935	4	169.8	4	100	2	595.6	1	69.7	0	0	4,952.7
Rangataua	18	13,003	16	493	3	136.1	5	52	0	0	8	304.2	0	0	13,496.3
Mangatainoka	45	6,928,154	181	30,669	33	4,672.3	25	900	2	109.7	113	24,603.4	8	383.7	6,958,822.9
Waikawa Beach	21	27,342	72	2,498	31	1,675.6	36	721	0	0	5	101.4	0	0	29,839.6
Mangamutu	41	30,221	69	15,044	15	883.4	6	301	19	12,042.6	28	1,761.9	1	54.6	45,264.7
Koitiata	48	120,963	98	3,646	46	3,117.1	51	521	0	0	1	8	0	0	124,608.9
Raurimu	15	7,671	16	312	0	0	1	6	1	2	14	302.7	0	0	7,982.6
Other	2,539	148,094,541	4,383	394,358	751	86,187.9	701	13,177	68	9,547.9	2,541	250,866.8	322	34,578.4	148,488,899.4

*Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.12.1: Total count of resident population and number of buildings by building type, for each District in the Horizons Region

District	Usual resident population	Total number of buildings	Total number of residential buildings (primary structures)	Total number residential buildings (secondary structures)	Total number of commercial/industrial buildings (primary structures)	Total number of commercial/industrial buildings (secondary structures)	Total number of rural buildings (primary structures)	Total number of rural buildings (secondary structures)	Total number of other buildings (primary structures)	Total number of other buildings (secondary structures)
Buildings inside towns/settlements										
Palmerston North City	66,586	55,246	30,451	15,130	2,136	544	3,310	2,191	1,002	482
Whanganui District	33,444	35,020	17,963	11,790	1,205	331	1,545	1,354	521	311
Horowhenua District	25,770	33,924	15,083	10,949	817	256	3,335	2,630	405	449
Manawatū District	22,106	28,013	9,696	6,607	561	199	5,851	4,364	436	299
Tararua District	13,563	23,114	6,249	4,607	637	233	5,973	4,608	473	334
Rangitīkei District	11,386	19,037	5,662	4,611	624	247	3,833	3,276	464	320
Ruapehu District	7,534	14,317	5,207	3,623	446	211	2,245	2,160	243	182
Buildings outside towns/settlements										
Palmerston North City	0	1	0	0	0	0	0	1	0	0
Whanganui District	2,791	6,893	647	525	13	10	2,606	2,573	248	271
Horowhenua District	1,552	3,626	704	644	25	10	1,267	866	56	54
Manawatū District	4,018	9,448	1,321	1,063	62	33	3,841	2,712	216	200
Tararua District	1,770	5,634	469	400	35	38	2,382	2,009	178	123
Rangitīkei District	1,577	4,565	556	476	40	25	1,723	1,386	181	178
Ruapehu District	2,568	9,076	1,055	1,012	130	74	2,977	3,035	383	410
Total buildings										
Palmerston North City	66,586	55,247	30,451	15,130	2,136	544	3,310	2,192	1,002	482
Whanganui District	36,235	41,913	18,610	12,315	1,218	341	4,151	3,927	769	582
Horowhenua District	27,322	37,550	15,787	11,593	842	266	4,602	3,496	461	503
Manawatū District	26,124	37,461	11,017	7,670	623	232	9,692	7,076	652	499
Tararua District	15,333	28,748	6,718	5,007	672	271	8,355	6,617	651	457
Rangitīkei District	12,963	23,602	6,218	5,087	664	272	5,556	4,662	645	498
Ruapehu District	10,102	23,393	6,262	4,635	576	285	5,222	5,195	626	592

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.1: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 5% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	14,336	15	11,703	6,774	3,472	549	124	269	233	174	108
Whanganui District	6,092	5	6,533	3,380	2,313	265	114	128	155	104	74
Horowhenua District	8,478	3	9,811	4,941	3,268	430	123	380	413	130	126
Manawatū District	2,408	0 to 1	3,347	1,250	975	116	69	387	445	54	51
Tararua District	1,709	3	2,971	885	730	110	49	566	533	62	36
Rangitīkei District	1,227	0 to 1	1,904	672	601	85	57	182	211	58	38
Ruapehu District	731	4	1,467	558	498	56	21	114	181	20	19
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	109	0 to 1	372	26	33	0	1	112	169	14	17
Horowhenua District	188	0 to 1	446	74	89	1	2	126	134	12	8
Manawatū District	466	0 to 1	1,063	179	164	17	4	331	301	29	38
Tararua District	180	0 to 1	439	42	51	3	8	130	186	11	8
Rangitīkei District	175	0 to 1	486	101	107	2	2	126	123	11	14
Ruapehu District	128	0 to 1	528	80	103	10	12	90	188	16	29
Total buildings											
Palmerston North City	14,336	15	11,703	6,774	3,472	549	124	269	233	174	108
Whanganui District	6,201	5	6,905	3,406	2,346	265	115	240	324	118	91
Horowhenua District	8,666	3	10,257	5,015	3,357	431	125	506	547	142	134
Manawatū District	2,874	1	4,410	1,429	1,139	133	73	718	746	83	89
Tararua District	1,889	3	3,410	927	781	113	57	696	719	73	44
Rangitīkei District	1,402	0 to 1	2,390	773	708	87	59	308	334	69	52
Ruapehu District	859	5	1,995	638	601	66	33	204	369	36	48

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.2: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 5% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	11,311	8	9,521	5,343	2,763	507	113	295	254	148	98
Whanganui District	6,036	5	6,456	3,352	2,296	255	102	128	155	102	66
Horowhenua District	8,489	3	9,839	4,932	3,261	430	123	405	429	134	125
Manawatū District	3,268	2	4,385	1,656	1,277	187	81	529	523	68	64
Tararua District	1,721	3	2,978	893	741	109	39	568	531	61	36
Rangitīkei District	1,290	0 to 1	1,976	706	618	90	58	187	218	58	41
Ruapehu District	728	4	1,458	554	493	56	21	114	181	20	19
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	109	0 to 1	370	26	31	0	1	112	169	14	17
Horowhenua District	339	0 to 1	810	157	140	2	2	291	198	11	9
Manawatū District	576	0 to 1	1,415	232	201	18	4	474	416	32	38
Tararua District	180	0 to 1	437	42	51	3	8	129	185	11	8
Rangitīkei District	200	0 to 1	584	112	118	2	2	173	146	14	17
Ruapehu District	128	0 to 1	528	80	103	10	12	90	188	16	29
Total buildings											
Palmerston North City	11,311	8	9,521	5,343	2,763	507	113	295	254	148	98
Whanganui District	6,145	5	6,826	3,378	2,327	255	103	240	324	116	83
Horowhenua District	8,828	4	10,649	5,089	3,401	432	125	696	627	145	134
Manawatū District	3,844	2	5,800	1,888	1,478	205	85	1,003	939	100	102
Tararua District	1,901	3	3,415	935	792	112	47	697	716	72	44
Rangitīkei District	1,490	1	2,560	818	736	92	60	360	364	72	58
Ruapehu District	856	5	1,986	634	596	66	33	204	369	36	48

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.3: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 2% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	15,599	17	12,779	7,372	3,792	622	132	292	254	195	120
Whanganui District	6,521	5	7,003	3,641	2,461	284	117	139	167	116	78
Horowhenua District	8,957	4	10,403	5,219	3,454	454	132	421	452	134	137
Manawatū District	2,675	1	3,748	1,404	1,079	121	74	456	497	59	58
Tararua District	1,934	4	3,321	1,019	843	118	57	607	571	68	38
Rangitīkei District	1,361	0 to 1	2,110	753	649	96	59	212	238	59	44
Ruapehu District	802	9	1,608	622	547	62	24	123	190	20	20
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	125	0 to 1	434	33	44	0	1	132	190	17	17
Horowhenua District	210	0 to 1	534	90	104	1	2	157	157	12	11
Manawatū District	518	0 to 1	1,207	204	189	17	4	378	339	33	43
Tararua District	170	0 to 1	463	44	54	3	8	137	197	12	8
Rangitīkei District	195	0 to 1	527	106	115	2	2	138	136	13	15
Ruapehu District	137	5	595	86	120	11	14	103	212	19	30
Total buildings											
Palmerston North City	15,599	17	12,779	7,372	3,792	622	132	292	254	195	120
Whanganui District	6,646	5	7,437	3,674	2,505	284	118	271	357	133	95
Horowhenua District	9,167	4	10,937	5,309	3,558	455	134	578	609	146	148
Manawatū District	3,193	1	4,955	1,608	1,268	138	78	834	836	92	101
Tararua District	2,104	5	3,784	1,063	897	121	65	744	768	80	46
Rangitīkei District	1,556	1	2,637	859	764	98	61	350	374	72	59
Ruapehu District	939	14	2,203	708	667	73	38	226	402	39	50

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.4: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 2% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	12,945	11	10,890	6,082	3,141	573	131	379	305	171	108
Whanganui District	6,501	5	6,957	3,633	2,457	270	106	140	167	113	71
Horowhenua District	8,974	4	10,428	5,210	3,448	456	132	444	463	140	135
Manawatū District	3,685	2	4,981	1,890	1,475	207	87	598	575	79	70
Tararua District	1,963	4	3,327	1,039	840	118	50	605	569	68	38
Rangitīkei District	1,418	1	2,164	783	658	111	60	214	238	58	42
Ruapehu District	791	9	1,590	612	539	62	24	123	190	20	20
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	125	0 to 1	431	33	42	0	1	132	189	17	17
Horowhenua District	382	1	927	187	158	2	2	327	226	11	14
Manawatū District	673	0 to 1	1,628	269	228	20	4	566	460	38	43
Tararua District	169	0 to 1	458	44	54	3	8	134	196	11	8
Rangitīkei District	230	0 to 1	660	119	125	2	2	208	169	18	17
Ruapehu District	137	5	595	86	120	11	14	103	212	19	30
Total buildings											
Palmerston North City	12,945	11	10,890	6,082	3,141	573	131	379	305	171	108
Whanganui District	6,626	5	7,388	3,666	2,499	270	107	272	356	130	88
Horowhenua District	9,356	5	11,355	5,397	3,606	458	134	771	689	151	149
Manawatū District	4,358	3	6,609	2,159	1,703	227	91	1,164	1,035	117	113
Tararua District	2,132	5	3,785	1,083	894	121	58	739	765	79	46
Rangitīkei District	1,648	1	2,824	902	783	113	62	422	407	76	59
Ruapehu District	928	14	2,185	698	659	73	38	226	402	39	50

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.5: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 1% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	16,382	19	13,485	7,750	3,997	661	139	333	275	204	126
Whanganui District	7,026	6	7,512	3,924	2,630	306	121	152	171	124	84
Horowhenua District	9,254	4	10,829	5,418	3,601	464	136	454	469	141	146
Manawatū District	2,913	1	4,108	1,529	1,181	132	76	522	539	65	64
Tararua District	2,103	6	3,559	1,106	924	120	63	636	592	76	42
Rangitīkei District	1,486	4	2,262	812	683	113	66	223	253	66	46
Ruapehu District	862	9	1,721	668	579	66	28	134	200	24	22
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	169	1	495	46	53	0	1	152	206	18	19
Horowhenua District	256	0 to 1	602	101	114	1	2	192	168	12	12
Manawatū District	578	0 to 1	1,359	227	204	17	4	439	392	32	44
Tararua District	182	0 to 1	496	50	64	3	8	147	202	13	9
Rangitīkei District	234	0 to 1	633	127	136	2	2	173	160	16	17
Ruapehu District	160	6	659	98	142	11	15	111	228	21	33
Total buildings											
Palmerston North City	16,382	19	13,485	7,750	3,997	661	139	333	275	204	126
Whanganui District	7,195	8	8,007	3,970	2,683	306	122	304	377	142	103
Horowhenua District	9,510	4	11,431	5,519	3,715	465	138	646	637	153	158
Manawatū District	3,491	2	5,467	1,756	1,385	149	80	961	931	97	108
Tararua District	2,285	6	4,055	1,156	988	123	71	783	794	89	51
Rangitīkei District	1,720	5	2,895	939	819	115	68	396	413	82	63
Ruapehu District	1,022	15	2,380	766	721	77	43	245	428	45	55

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.6: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 1% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	15,209	17	12,693	7,167	3,676	611	141	440	342	192	124
Whanganui District	7,014	6	7,475	3,922	2,628	293	110	152	171	122	77
Horowhenua District	9,273	4	10,847	5,410	3,592	465	136	474	483	146	141
Manawatū District	4,004	3	5,383	2,042	1,581	220	92	663	624	85	76
Tararua District	2,131	6	3,565	1,127	926	122	55	626	590	77	42
Rangitīkei District	1,529	4	2,301	831	691	121	68	222	254	69	45
Ruapehu District	848	9	1,696	656	568	66	27	134	200	23	22
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	167	1	491	46	51	0	1	151	205	18	19
Horowhenua District	415	1	1,017	203	170	2	2	362	250	12	16
Manawatū District	720	1	1,752	287	239	20	5	615	505	37	44
Tararua District	178	0 to 1	490	50	64	3	8	142	201	13	9
Rangitīkei District	261	0 to 1	761	136	139	2	2	245	193	23	21
Ruapehu District	160	6	659	98	142	11	15	111	228	21	33
Total buildings											
Palmerston North City	15,209	17	12,693	7,167	3,676	611	141	440	342	192	124
Whanganui District	7,181	8	7,966	3,968	2,679	293	111	303	376	140	96
Horowhenua District	9,688	5	11,864	5,613	3,762	467	138	836	733	158	157
Manawatū District	4,724	4	7,135	2,329	1,820	240	97	1,278	1,129	122	120
Tararua District	2,309	6	4,055	1,177	990	125	63	768	791	90	51
Rangitīkei District	1,790	5	3,062	967	830	123	70	467	447	92	66
Ruapehu District	1,008	15	2,355	754	710	77	42	245	428	44	55

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.7: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	17,039	21	14,120	8,084	4,160	691	147	387	310	209	132
Whanganui District	7,528	8	8,075	4,222	2,808	356	133	159	177	131	89
Horowhenua District	9,489	4	11,173	5,586	3,707	477	137	483	483	147	153
Manawatū District	3,195	2	4,537	1,664	1,299	139	77	607	607	74	70
Tararua District	2,282	8	3,816	1,199	995	128	68	673	630	77	46
Rangitīkei District	1,576	4	2,397	859	715	134	70	241	259	70	49
Ruapehu District	916	9	1,841	721	615	69	31	142	213	24	26
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	248	4	638	58	68	2	3	198	262	22	25
Horowhenua District	289	0 to 1	660	120	117	1	2	216	177	14	13
Manawatū District	627	0 to 1	1,516	257	224	17	4	490	443	34	47
Tararua District	184	0 to 1	516	56	68	3	8	152	204	15	10
Rangitīkei District	264	0 to 1	718	138	149	2	2	200	185	19	23
Ruapehu District	193	9	753	109	159	11	15	133	252	28	46
Total buildings											
Palmerston North City	17,039	21	14,120	8,084	4,160	691	147	387	310	209	132
Whanganui District	7,776	12	8,713	4,280	2,876	358	136	357	439	153	114
Horowhenua District	9,778	4	11,833	5,706	3,824	478	139	699	660	161	166
Manawatū District	3,822	2	6,053	1,921	1,523	156	81	1,097	1,050	108	117
Tararua District	2,466	8	4,332	1,255	1,063	131	76	825	834	92	56
Rangitīkei District	1,840	5	3,115	997	864	136	72	441	444	89	72
Ruapehu District	1,109	18	2,594	830	774	80	46	275	465	52	72

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.8: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	17,901	27	14,666	8,434	4,190	644	152	513	389	209	135
Whanganui District	7,530	8	8,065	4,223	2,807	351	128	159	177	131	89
Horowhenua District	9,507	4	11,187	5,579	3,697	478	139	505	492	151	146
Manawatū District	4,275	3	5,760	2,161	1,676	233	93	741	682	95	79
Tararua District	2,302	8	3,817	1,214	1,001	127	58	667	626	78	46
Rangitīkei District	1,618	4	2,438	878	722	141	73	241	262	72	49
Ruapehu District	898	9	1,811	706	603	69	30	142	213	23	25
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	246	4	634	58	66	2	3	197	261	22	25
Horowhenua District	435	2	1,065	211	176	2	2	379	263	13	19
Manawatū District	774	1	1,868	303	247	20	5	659	548	39	47
Tararua District	183	0 to 1	512	57	68	3	8	148	203	15	10
Rangitīkei District	297	0 to 1	850	149	153	2	2	277	215	26	26
Ruapehu District	193	9	753	109	159	11	15	133	252	28	46
Total buildings											
Palmerston North City	17,901	27	14,666	8,434	4,190	644	152	513	389	209	135
Whanganui District	7,776	12	8,699	4,281	2,873	353	131	356	438	153	114
Horowhenua District	9,942	6	12,252	5,790	3,873	480	141	884	755	164	165
Manawatū District	5,049	4	7,628	2,464	1,923	253	98	1,400	1,230	134	126
Tararua District	2,485	8	4,329	1,271	1,069	130	66	815	829	93	56
Rangitīkei District	1,915	5	3,288	1,027	875	143	75	518	477	98	75
Ruapehu District	1,091	18	2,564	815	762	80	45	275	465	51	71

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.9: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.2% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	17,645	23	14,681	8,405	4,359	707	152	390	317	217	134
Whanganui District	9,569	16	10,246	5,418	3,645	434	147	169	190	149	94
Horowhenua District	9,822	4	11,684	5,808	3,930	484	141	497	508	149	167
Manawatū District	3,494	2	5,085	1,844	1,461	157	83	673	705	81	81
Tararua District	2,495	22	4,162	1,314	1,081	140	70	731	690	88	48
Rangitīkei District	1,949	9	3,010	1,101	898	202	105	268	298	78	60
Ruapehu District	1,118	22	2,120	868	699	76	34	153	230	29	31
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	362	24	940	100	117	4	8	281	340	38	52
Horowhenua District	282	0 to 1	674	116	120	1	2	225	185	12	13
Manawatū District	647	0 to 1	1,607	271	243	18	8	507	479	36	45
Tararua District	195	0 to 1	530	56	74	3	8	158	207	14	10
Rangitīkei District	297	0 to 1	835	155	162	3	2	245	216	25	27
Ruapehu District	249	12	872	136	184	14	19	152	284	32	51
Total buildings											
Palmerston North City	17,645	23	14,681	8,405	4,359	707	152	390	317	217	134
Whanganui District	9,931	40	11,186	5,518	3,762	438	155	450	530	187	146
Horowhenua District	10,104	5	12,358	5,924	4,050	485	143	722	693	161	180
Manawatū District	4,141	3	6,692	2,115	1,704	175	91	1,180	1,184	117	126
Tararua District	2,690	22	4,692	1,370	1,155	143	78	889	897	102	58
Rangitīkei District	2,246	9	3,845	1,256	1,060	205	107	513	514	103	87
Ruapehu District	1,367	34	2,992	1,004	883	90	53	305	514	61	82

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.10: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.1% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	18,133	22	15,150	8,660	4,490	742	158	415	324	225	136
Whanganui District	10,543	29	11,317	5,995	4,034	485	168	178	199	160	98
Horowhenua District	10,023	5	11,972	5,940	4,032	491	143	521	524	151	170
Manawatū District	3,672	3	5,379	1,941	1,528	175	92	722	744	86	91
Tararua District	2,650	31	4,403	1,386	1,135	155	75	779	732	90	51
Rangitīkei District	2,111	11	3,235	1,190	966	214	108	292	317	83	65
Ruapehu District	1,477	24	2,531	1,084	850	79	39	164	242	35	38
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	466	51	1,158	160	161	5	9	325	373	59	66
Horowhenua District	302	0 to 1	727	127	124	1	2	247	199	14	13
Manawatū District	722	0 to 1	1,697	287	250	18	8	547	504	36	47
Tararua District	210	4	551	59	77	3	8	170	209	14	11
Rangitīkei District	309	1	888	159	163	5	4	270	232	26	29
Ruapehu District	269	15	947	153	200	14	20	169	299	37	55
Total buildings											
Palmerston North City	18,133	22	15,150	8,660	4,490	742	158	415	324	225	136
Whanganui District	11,009	80	12,475	6,155	4,195	490	177	503	572	219	164
Horowhenua District	10,325	5	12,699	6,067	4,156	492	145	768	723	165	183
Manawatū District	4,394	4	7,076	2,228	1,778	193	100	1,269	1,248	122	138
Tararua District	2,860	35	4,954	1,445	1,212	158	83	949	941	104	62
Rangitīkei District	2,420	12	4,123	1,349	1,129	219	112	562	549	109	94
Ruapehu District	1,746	39	3,478	1,237	1,050	93	59	333	541	72	93

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.11: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	17,884	22	14,919	8,518	4,369	716	153	451	352	223	137
Whanganui District	8,930	26	9,607	5,061	3,402	421	141	164	187	141	90
Horowhenua District	9,852	4	11,679	5,829	3,897	486	143	509	504	149	162
Manawatū District	3,495	2	4,918	1,815	1,399	150	78	670	656	76	74
Tararua District	2,342	18	3,917	1,207	1,011	134	68	708	661	82	46
Rangitīkei District	1,671	4	2,578	921	749	169	84	259	273	73	50
Ruapehu District	1,176	22	2,167	892	725	77	35	152	226	29	31
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	334	16	865	90	100	4	8	263	320	32	48
Horowhenua District	310	0 to 1	732	132	128	1	2	245	196	14	14
Manawatū District	692	0 to 1	1,640	275	243	17	6	538	477	36	48
Tararua District	199	4	532	57	74	3	8	159	206	15	10
Rangitīkei District	290	0 to 1	790	153	156	2	2	222	207	23	25
Ruapehu District	249	12	888	136	189	14	19	155	289	35	51
Total buildings											
Palmerston North City	17,884	22	14,919	8,518	4,369	716	153	451	352	223	137
Whanganui District	9,264	42	10,472	5,151	3,502	425	149	427	507	173	138
Horowhenua District	10,162	5	12,411	5,961	4,025	487	145	754	700	163	176
Manawatū District	4,187	3	6,558	2,090	1,642	167	84	1,208	1,133	112	122
Tararua District	2,541	22	4,449	1,264	1,085	137	76	867	867	97	56
Rangitīkei District	1,961	5	3,368	1,074	905	171	86	481	480	96	75
Ruapehu District	1,425	34	3,055	1,028	914	91	54	307	515	64	82

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.12: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	21,400	44	17,174	10,064	4,863	692	157	587	421	243	147
Whanganui District	8,953	27	9,649	5,079	3,413	431	143	164	187	142	90
Horowhenua District	9,861	5	11,676	5,811	3,878	485	145	536	514	153	154
Manawatū District	4,561	4	6,105	2,301	1,771	244	95	789	724	96	85
Tararua District	2,488	21	4,119	1,311	1,073	136	63	722	678	88	48
Rangitīkei District	1,703	4	2,620	940	757	178	86	262	274	73	50
Ruapehu District	1,275	22	2,272	948	768	77	38	152	225	29	35
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	334	16	861	89	97	4	8	263	320	32	48
Horowhenua District	450	2	1,125	222	183	2	2	401	276	17	22
Manawatū District	806	1	1,953	313	258	20	7	688	579	40	48
Tararua District	196	4	529	57	74	3	8	158	204	15	10
Rangitīkei District	323	0 to 1	923	165	161	2	2	298	238	29	28
Ruapehu District	249	12	888	136	189	14	19	155	289	35	51
Total buildings											
Palmerston North City	21,400	44	17,174	10,064	4,863	692	157	587	421	243	147
Whanganui District	9,287	44	10,510	5,168	3,510	435	151	427	507	174	138
Horowhenua District	10,311	7	12,801	6,033	4,061	487	147	937	790	170	176
Manawatū District	5,367	5	8,058	2,614	2,029	264	102	1,477	1,303	136	133
Tararua District	2,684	25	4,648	1,368	1,147	139	71	880	882	103	58
Rangitīkei District	2,026	5	3,543	1,105	918	180	88	560	512	102	78
Ruapehu District	1,524	34	3,160	1,084	957	91	57	307	514	64	86

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.13: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	19,039	26	15,950	9,056	4,657	767	167	529	387	240	147
Whanganui District	10,333	62	11,096	5,863	3,961	482	170	174	194	156	96
Horowhenua District	10,210	5	12,136	6,037	4,065	498	144	545	527	152	168
Manawatū District	3,766	3	5,320	1,943	1,474	168	85	758	726	81	85
Tararua District	2,710	46	4,460	1,405	1,147	154	75	795	739	94	51
Rangitīkei District	1,758	9	2,721	976	776	187	88	280	285	77	52
Ruapehu District	1,629	26	2,707	1,169	917	85	41	173	244	40	38
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	435	47	1,113	151	154	4	9	317	360	53	65
Horowhenua District	341	0 to 1	828	150	141	1	2	292	213	15	14
Manawatū District	751	1	1,767	288	249	17	6	602	518	37	50
Tararua District	213	4	561	60	77	3	8	174	213	15	11
Rangitīkei District	305	1	857	158	161	2	4	249	230	25	28
Ruapehu District	277	16	985	160	207	14	21	178	311	37	57
Total buildings											
Palmerston North City	19,039	26	15,950	9,056	4,657	767	167	529	387	240	147
Whanganui District	10,768	109	12,209	6,014	4,115	486	179	491	554	209	161
Horowhenua District	10,551	5	12,964	6,187	4,206	499	146	837	740	167	182
Manawatū District	4,517	4	7,087	2,231	1,723	185	91	1,360	1,244	118	135
Tararua District	2,923	50	5,021	1,465	1,224	157	83	969	952	109	62
Rangitīkei District	2,063	10	3,578	1,134	937	189	92	529	515	102	80
Ruapehu District	1,906	41	3,692	1,329	1,124	99	62	351	555	77	95

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.14: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	27,713	72	21,833	13,078	6,225	785	169	651	450	307	168
Whanganui District	10,333	64	11,097	5,864	3,961	483	170	174	194	155	96
Horowhenua District	10,200	5	12,102	6,006	4,033	498	146	571	536	155	157
Manawatū District	4,808	4	6,413	2,431	1,842	250	100	829	763	103	95
Tararua District	2,745	46	4,477	1,432	1,152	153	73	792	731	94	50
Rangitīkei District	1,793	9	2,760	997	790	190	89	281	284	77	52
Ruapehu District	1,671	26	2,774	1,203	949	85	41	173	247	39	37
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	433	47	1,107	150	152	4	9	316	359	52	65
Horowhenua District	481	2	1,222	235	195	2	2	445	298	19	26
Manawatū District	860	2	2,038	321	268	20	7	730	601	41	50
Tararua District	208	4	556	60	77	3	8	170	212	15	11
Rangitīkei District	341	1	995	172	165	2	4	327	264	30	31
Ruapehu District	277	16	985	160	207	14	21	178	311	37	57
Total buildings											
Palmerston North City	27,713	72	21,833	13,078	6,225	785	169	651	450	307	168
Whanganui District	10,766	111	12,204	6,014	4,113	487	179	490	553	207	161
Horowhenua District	10,681	7	13,324	6,241	4,228	500	148	1,016	834	174	183
Manawatū District	5,668	6	8,451	2,752	2,110	270	107	1,559	1,364	144	145
Tararua District	2,953	50	5,033	1,492	1,229	156	81	962	943	109	61
Rangitīkei District	2,134	10	3,755	1,169	955	192	93	608	548	107	83
Ruapehu District	1,948	41	3,759	1,363	1,156	99	62	351	558	76	94

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.15: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	21,192	33	17,644	10,058	5,099	848	171	615	434	264	155
Whanganui District	12,048	126	12,768	6,836	4,539	534	188	182	203	178	108
Horowhenua District	10,640	5	12,615	6,261	4,220	511	151	585	554	156	177
Manawatū District	3,970	4	5,659	2,064	1,558	188	96	806	772	86	89
Tararua District	2,794	59	4,636	1,439	1,181	157	85	842	780	96	56
Rangitīkei District	1,870	10	2,877	1,047	826	194	91	295	293	78	53
Ruapehu District	1,824	31	3,044	1,326	1,030	98	50	188	268	46	38
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	505	84	1,255	185	177	6	9	350	392	64	72
Horowhenua District	362	0 to 1	901	166	151	1	2	322	226	16	17
Manawatū District	799	2	1,869	306	260	18	7	646	548	35	49
Tararua District	237	12	639	73	94	7	8	195	233	15	14
Rangitīkei District	320	2	907	161	163	5	5	278	239	26	30
Ruapehu District	311	19	1,058	181	220	14	21	194	326	39	63
Total buildings											
Palmerston North City	21,192	33	17,644	10,058	5,099	848	171	615	434	264	155
Whanganui District	12,553	210	14,023	7,021	4,716	540	197	532	595	242	180
Horowhenua District	11,002	6	13,516	6,427	4,371	512	153	907	780	172	194
Manawatū District	4,769	5	7,528	2,370	1,818	206	103	1,452	1,320	121	138
Tararua District	3,031	72	5,275	1,512	1,275	164	93	1,037	1,013	111	70
Rangitīkei District	2,190	12	3,784	1,208	989	199	96	573	532	104	83
Ruapehu District	2,135	50	4,102	1,507	1,250	112	71	382	594	85	101

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.16: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Down

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	32,038	108	25,015	15,082	7,163	868	175	692	485	354	196
Whanganui District	12,048	127	12,758	6,835	4,535	532	185	182	203	178	108
Horowhenua District	10,612	5	12,541	6,219	4,177	509	153	604	564	156	159
Manawatū District	5,002	5	6,699	2,546	1,923	262	106	858	798	109	97
Tararua District	2,927	61	4,838	1,527	1,234	180	91	848	804	98	56
Rangitīkei District	1,917	10	2,914	1,063	839	198	95	296	292	78	53
Ruapehu District	1,849	31	3,064	1,336	1,041	98	50	188	268	45	38
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	503	84	1,254	185	175	6	9	350	393	64	72
Horowhenua District	512	2	1,300	251	206	2	2	475	315	22	27
Manawatū District	881	2	2,089	332	275	21	7	752	614	39	49
Tararua District	231	12	634	74	94	7	8	189	233	15	14
Rangitīkei District	358	2	1,037	176	166	5	5	349	272	31	33
Ruapehu District	311	19	1,058	181	220	14	21	194	326	39	63
Total buildings											
Palmerston North City	32,038	108	25,015	15,082	7,163	868	175	692	485	354	196
Whanganui District	12,551	211	14,012	7,020	4,710	538	194	532	596	242	180
Horowhenua District	11,124	8	13,841	6,470	4,383	511	155	1,079	879	178	186
Manawatū District	5,883	6	8,788	2,878	2,198	283	113	1,610	1,412	148	146
Tararua District	3,158	74	5,472	1,601	1,328	187	99	1,037	1,037	113	70
Rangitīkei District	2,275	13	3,951	1,239	1,005	203	100	645	564	109	86
Ruapehu District	2,160	50	4,122	1,517	1,261	112	71	382	594	84	101

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.13.17: Total counts of population exposed, number of fatalities, and buildings affected by flooding, by buidling type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

District	Total number of resident population exposed to flooding	Total number of estimated fatalities from flooding	Total number of buildings exposed to flooding	Total number of residential buildings (primary structures) exposed to flooding	Total number residential buildings (secondary structures) exposed to flooding	Total number of commercial/industrial buildings (primary structures) exposed to flooding	Total number of commercial/industrial buildings (secondary structures) exposed to flooding	Total number of rural buildings (primary structures) exposed to flooding	Total number of rural buildings (secondary structures) exposed to flooding	Total number of other buildings (primary structures) exposed to flooding	Total number of other buildings (secondary structures) exposed to flooding
Buildings inside town/settlements											
Palmerston North City	21,192	33	17,645	10,058	5,100	848	171	615	434	264	155
Whanganui District	12,156	128	12,923	6,888	4,617	549	193	183	204	179	110
Horowhenua District	10,670	5	12,700	6,311	4,255	511	151	580	554	156	182
Manawatū District	3,970	4	5,656	2,066	1,553	188	96	806	772	86	89
Tararua District	2,794	59	4,636	1,439	1,181	157	85	842	780	96	56
Rangitīkei District	1,869	10	2,889	1,051	834	194	91	295	293	78	53
Ruapehu District	1,824	31	3,044	1,326	1,030	98	50	188	268	46	38
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	505	84	1,257	185	177	6	9	351	393	64	72
Horowhenua District	362	0 to 1	892	165	150	1	2	317	226	15	16
Manawatū District	799	2	1,869	306	260	18	7	646	548	35	49
Tararua District	242	12	651	79	99	8	9	194	232	14	16
Rangitīkei District	320	2	906	161	162	5	5	278	239	26	30
Ruapehu District	311	19	1,058	181	220	14	21	194	326	39	63
Total buildings											
Palmerston North City	21,192	33	17,645	10,058	5,100	848	171	615	434	264	155
Whanganui District	12,661	212	14,180	7,073	4,794	555	202	534	597	243	182
Horowhenua District	11,032	6	13,592	6,476	4,405	512	153	897	780	171	198
Manawatū District	4,769	5	7,525	2,372	1,813	206	103	1,452	1,320	121	138
Tararua District	3,036	72	5,287	1,518	1,280	165	94	1,036	1,012	110	72
Rangitīkei District	2,189	12	3,795	1,212	996	199	96	573	532	104	83
Ruapehu District	2,135	50	4,102	1,507	1,250	112	71	382	594	85	101

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.1: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 5% AEP with Current Climate and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	21.5	0	21.2	22.2	22.9	25.7	22.8	8.1	10.6	17.4	22.4
Whanganui District	18.2	0	15.6	18.2	18.8	21.8	33.4	3.1	4	13.5	12.7
Horowhenua District	32.9	0	26.1	31.3	28.2	51.1	46.2	8.3	11.8	28.2	25.1
Manawatū District	10.9	0	8.9	11.3	12.7	18.6	29.7	4	6.3	8.3	10.2
Tararua District	12.6	0	10.3	13.2	14.6	16.4	18.1	6.8	8.1	9.5	7.9
Rangitīkei District	10.8	0	8.1	10.8	11.8	12.8	21	3.3	4.5	9	7.6
Ruapehu District	9.7	0.1	6.3	8.9	10.7	9.7	7.4	2.2	3.5	3.2	3.2
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	3.9	0	0.9	0.1	0.3	0	0.3	2.7	4.3	1.8	2.9
Horowhenua District	12.1	0	1.2	0.5	0.8	0.1	0.8	2.7	3.8	2.6	1.6
Manawatū District	11.6	0	2.8	1.6	2.1	2.7	1.7	3.4	4.2	4.5	7.6
Tararua District	10.2	0	1.5	0.6	1	0.5	3	1.6	2.8	1.7	1.8
Rangitīkei District	11.1	0	2.1	1.6	2.1	0.3	0.7	2.3	2.6	1.7	2.8
Ruapehu District	5	0	2.3	1.3	2.2	1.7	4.2	1.7	3.6	2.6	4.9
Total buildings											
Palmerston North City	21.5	0	21.2	22.2	22.9	25.7	22.8	8.1	10.6	17.4	22.4
Whanganui District	17.1	0	16.5	18.3	19.1	21.8	33.7	5.8	8.2	15.3	15.6
Horowhenua District	31.7	0	27.3	31.8	29	51.2	47	11	15.7	30.8	26.6
Manawatū District	11	0	11.8	13	14.8	21.4	31.5	7.4	10.5	12.7	17.8
Tararua District	12.3	0	11.9	13.8	15.6	16.8	21	8.3	10.9	11.2	9.6
Rangitīkei District	10.8	0	10.1	12.4	13.9	13.1	21.7	5.5	7.2	10.7	10.4
Ruapehu District	8.5	0.1	8.5	10.2	13	11.5	11.6	3.9	7.1	5.8	8.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.2: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 5% AEP with Current Climate and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	17	0	17.2	17.6	18.3	23.7	20.8	8.9	11.6	14.8	20.3
Whanganui District	18.1	0	15.4	18	18.6	20.9	29.9	3.1	4	13.3	11.3
Horowhenua District	32.9	0	26.2	31.2	28.1	51.1	46.2	8.8	12.3	29.1	24.9
Manawatū District	14.8	0	11.7	15	16.6	30	34.9	5.5	7.4	10.4	12.8
Tararua District	12.7	0	10.4	13.3	14.8	16.2	14.4	6.8	8	9.4	7.9
Rangitīkei District	11.3	0	8.4	11.3	12.2	13.6	21.3	3.4	4.7	9	8.2
Ruapehu District	9.7	0.1	6.2	8.8	10.6	9.7	7.4	2.2	3.5	3.2	3.2
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	3.9	0	0.9	0.1	0.2	0	0.3	2.7	4.3	1.8	2.9
Horowhenua District	21.8	0.1	2.2	1	1.2	0.2	0.8	6.3	5.7	2.4	1.8
Manawatū District	14.3	0	3.8	2.1	2.6	2.9	1.7	4.9	5.9	4.9	7.6
Tararua District	10.2	0	1.5	0.6	1	0.5	3	1.5	2.8	1.7	1.8
Rangitīkei District	12.7	0	2.5	1.8	2.3	0.3	0.7	3.1	3.1	2.2	3.4
Ruapehu District	5	0	2.3	1.3	2.2	1.7	4.2	1.7	3.6	2.6	4.9
Total buildings											
Palmerston North City	17	0	17.2	17.6	18.3	23.7	20.8	8.9	11.6	14.8	20.3
Whanganui District	17	0	16.3	18.1	18.9	20.9	30.2	5.8	8.2	15.1	14.3
Horowhenua District	32.3	0	28.4	32.2	29.3	51.3	47	15.1	17.9	31.4	26.6
Manawatū District	14.7	0	15.5	17.1	19.3	32.9	36.6	10.3	13.3	15.3	20.4
Tararua District	12.4	0	11.9	13.9	15.8	16.7	17.3	8.3	10.8	11.1	9.6
Rangitīkei District	11.5	0	10.8	13.2	14.5	13.9	22.1	6.5	7.8	11.2	11.7
Ruapehu District	8.5	0.1	8.5	10.1	12.9	11.5	11.6	3.9	7.1	5.8	8.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.3: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 2% AEP with Current Climate and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	23.4	0	23.1	24.2	25.1	29.1	24.3	8.8	11.6	19.5	24.9
Whanganui District	19.5	0	16.7	19.6	20	23.3	34.3	3.4	4.2	15.1	13.4
Horowhenua District	34.8	0	27.7	33.1	29.8	53.9	49.6	9.2	12.9	29.1	27.2
Manawatū District	12.1	0	10	12.7	14.1	19.4	31.9	4.7	7	9.1	11.6
Tararua District	14.3	0	11.6	15.2	16.8	17.6	21	7.3	8.6	10.4	8.3
Rangitīkei District	11.9	0	8.9	12.1	12.8	14.5	21.7	3.8	5.1	9.2	8.8
Ruapehu District	10.7	0.1	6.9	9.9	11.8	10.8	8.4	2.4	3.7	3.2	3.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	4.5	0	1	0.2	0.4	0	0.3	3.2	4.8	2.2	2.9
Horowhenua District	13.5	0	1.4	0.6	0.9	0.1	0.8	3.4	4.5	2.6	2.2
Manawatū District	12.9	0	3.2	1.9	2.5	2.7	1.7	3.9	4.8	5.1	8.6
Tararua District	9.6	0	1.6	0.7	1.1	0.5	3	1.6	3	1.8	1.8
Rangitīkei District	12.4	0	2.2	1.7	2.3	0.3	0.7	2.5	2.9	2	3
Ruapehu District	5.3	0.2	2.5	1.4	2.6	1.9	4.9	2	4.1	3	5.1
Total buildings											
Palmerston North City	23.4	0	23.1	24.2	25.1	29.1	24.3	8.8	11.6	19.5	24.9
Whanganui District	18.3	0	17.7	19.7	20.3	23.3	34.6	6.5	9.1	17.3	16.3
Horowhenua District	33.5	0	29.1	33.6	30.7	54	50.4	12.6	17.4	31.7	29.4
Manawatū District	12.2	0	13.2	14.6	16.5	22.1	33.6	8.6	11.8	14.1	20.2
Tararua District	13.7	0	13.2	15.8	17.9	18	24	8.9	11.6	12.3	10.1
Rangitīkei District	12	0	11.2	13.8	15	14.8	22.4	6.3	8	11.2	11.8
Ruapehu District	9.3	0.1	9.4	11.3	14.4	12.7	13.3	4.3	7.7	6.2	8.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.4: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 2% AEP with Current Climate and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	19.4	0	19.7	20	20.8	26.8	24.1	11.4	13.9	17.1	22.4
Whanganui District	19.4	0	16.6	19.5	19.9	22.2	31.1	3.4	4.2	14.7	12.2
Horowhenua District	34.8	0	27.8	33	29.7	54.2	49.6	9.7	13.2	30.4	26.8
Manawatū District	16.7	0	13.3	17.2	19.2	33.2	37.5	6.2	8.1	12.1	14
Tararua District	14.5	0	11.6	15.5	16.8	17.6	18.4	7.2	8.6	10.4	8.3
Rangitīkei District	12.4	0	9.2	12.6	12.9	16.7	22.1	3.9	5.1	9	8.4
Ruapehu District	10.5	0.1	6.8	9.8	11.6	10.8	8.4	2.4	3.7	3.2	3.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	4.5	0	1	0.2	0.3	0	0.3	3.2	4.8	2.2	2.9
Horowhenua District	24.6	0.1	2.5	1.2	1.4	0.2	0.8	7.1	6.5	2.4	2.8
Manawatū District	16.8	0	4.3	2.4	3	3.2	1.7	5.8	6.5	5.8	8.6
Tararua District	9.6	0	1.6	0.7	1.1	0.5	3	1.6	3	1.7	1.8
Rangitīkei District	14.6	0	2.8	1.9	2.5	0.3	0.7	3.7	3.6	2.8	3.4
Ruapehu District	5.3	0.2	2.5	1.4	2.6	1.9	4.9	2	4.1	3	5.1
Total buildings											
Palmerston North City	19.4	0	19.7	20	20.8	26.8	24.1	11.4	13.9	17.1	22.4
Whanganui District	18.3	0	17.6	19.7	20.3	22.2	31.4	6.5	9.1	16.9	15.1
Horowhenua District	34.2	0	30.2	34.2	31.1	54.4	50.4	16.8	19.7	32.8	29.6
Manawatū District	16.7	0	17.6	19.6	22.2	36.4	39.2	12	14.6	17.9	22.6
Tararua District	13.9	0	13.2	16.1	17.9	18	21.4	8.8	11.6	12.1	10.1
Rangitīkei District	12.7	0	12	14.5	15.4	17	22.8	7.6	8.7	11.8	11.8
Ruapehu District	9.2	0.1	9.3	11.2	14.2	12.7	13.3	4.3	7.7	6.2	8.4

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.5: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 1% AEP with Current Climate and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	24.6	0	24.4	25.4	26.4	30.9	25.6	10.1	12.6	20.4	26.1
Whanganui District	21	0	17.9	21.1	21.4	25.1	35.5	3.7	4.3	16.1	14.4
Horowhenua District	35.9	0	28.8	34.3	31.1	55.1	51.1	9.9	13.4	30.6	29
Manawatū District	13.2	0	11	13.9	15.4	21.2	32.8	5.4	7.6	10	12.8
Tararua District	15.5	0	12.4	16.5	18.4	17.9	23.2	7.6	8.9	11.7	9.2
Rangitīkei District	13.1	0	9.6	13.1	13.4	17	24.3	4	5.4	10.2	9.2
Ruapehu District	11.4	0.1	7.4	10.7	12.5	11.5	9.8	2.6	3.9	3.8	3.7
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	6.1	0.1	1.2	0.2	0.4	0	0.3	3.7	5.2	2.3	3.3
Horowhenua District	16.5	0	1.6	0.6	1	0.1	0.8	4.2	4.8	2.6	2.4
Manawatū District	14.4	0	3.6	2.1	2.7	2.7	1.7	4.5	5.5	4.9	8.8
Tararua District	10.3	0	1.7	0.7	1.3	0.5	3	1.8	3	2	2
Rangitīkei District	14.8	0	2.7	2	2.7	0.3	0.7	3.1	3.4	2.5	3.4
Ruapehu District	6.2	0.2	2.8	1.6	3.1	1.9	5.3	2.1	4.4	3.4	5.6
Total buildings											
Palmerston North City	24.6	0	24.4	25.4	26.4	30.9	25.6	10.1	12.6	20.4	26.1
Whanganui District	19.9	0	19.1	21.3	21.8	25.1	35.8	7.3	9.6	18.5	17.7
Horowhenua District	34.8	0	30.4	35	32	55.2	51.9	14	18.2	33.2	31.4
Manawatū District	13.4	0	14.6	15.9	18.1	23.9	34.5	9.9	13.2	14.9	21.6
Tararua District	14.9	0	14.1	17.2	19.7	18.3	26.2	9.4	12	13.7	11.2
Rangitīkei District	13.3	0	12.3	15.1	16.1	17.3	25	7.1	8.9	12.7	12.7
Ruapehu District	10.1	0.1	10.2	12.2	15.6	13.4	15.1	4.7	8.2	7.2	9.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.6: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 1% AEP with Current Climate and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	22.8	0	23	23.5	24.3	28.6	25.9	13.3	15.6	19.2	25.7
Whanganui District	21	0	17.8	21.1	21.3	24.1	32.3	3.7	4.3	15.9	13.2
Horowhenua District	36	0	28.9	34.3	31	55.2	51.1	10.3	13.8	31.7	28
Manawatū District	18.1	0	14.4	18.5	20.6	35.3	39.7	6.8	8.8	13	15.2
Tararua District	15.7	0	12.4	16.8	18.5	18.1	20.3	7.5	8.9	11.8	9.2
Rangitīkei District	13.4	0	9.8	13.4	13.6	18.2	25	4	5.5	10.7	9
Ruapehu District	11.3	0.1	7.2	10.5	12.2	11.5	9.5	2.6	3.9	3.7	3.7
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	6	0.1	1.2	0.2	0.4	0	0.3	3.6	5.2	2.3	3.3
Horowhenua District	26.7	0.1	2.7	1.3	1.5	0.2	0.8	7.9	7.2	2.6	3.2
Manawatū District	17.9	0	4.7	2.6	3.1	3.2	2.2	6.3	7.1	5.7	8.8
Tararua District	10.1	0	1.7	0.7	1.3	0.5	3	1.7	3	2	2
Rangitīkei District	16.6	0	3.2	2.2	2.7	0.3	0.7	4.4	4.1	3.6	4.2
Ruapehu District	6.2	0.2	2.8	1.6	3.1	1.9	5.3	2.1	4.4	3.4	5.6
Total buildings											
Palmerston North City	22.8	0	23	23.5	24.3	28.6	25.9	13.3	15.6	19.2	25.7
Whanganui District	19.8	0	19	21.3	21.8	24.1	32.5	7.3	9.6	18.2	16.5
Horowhenua District	35.5	0	31.6	35.5	32.5	55.5	51.9	18.2	21	34.3	31.2
Manawatū District	18.1	0	19.1	21.1	23.7	38.5	41.8	13.2	16	18.7	24.1
Tararua District	15.1	0	14.1	17.5	19.8	18.6	23.2	9.2	11.9	13.8	11.2
Rangitīkei District	13.8	0	13	15.6	16.3	18.5	25.7	8.4	9.6	14.3	13.2
Ruapehu District	10	0.1	10.1	12	15.3	13.4	14.7	4.7	8.2	7	9.3

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.7: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Current Climate and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	25.6	0	25.6	26.6	27.5	32.4	27	11.7	14.1	20.9	27.4
Whanganui District	22.5	0	19.3	22.7	22.8	29.2	39	3.8	4.5	17	15.3
Horowhenua District	36.8	0	29.8	35.4	32	56.6	51.5	10.5	13.8	31.9	30.4
Manawatū District	14.4	0	12.1	15.1	16.9	22.3	33.2	6.3	8.6	11.3	14
Tararua District	16.8	0.1	13.3	17.9	19.9	19.1	25.1	8.1	9.5	11.8	10.1
Rangitīkei District	13.8	0	10.2	13.8	14.1	20.2	25.7	4.3	5.6	10.8	9.8
Ruapehu District	12.2	0.1	7.9	11.5	13.3	12	10.9	2.7	4.1	3.8	4.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	8.9	0.2	1.5	0.3	0.6	0.2	0.9	4.8	6.7	2.9	4.3
Horowhenua District	18.6	0	1.8	0.8	1	0.1	0.8	4.7	5.1	3	2.6
Manawatū District	15.6	0	4	2.3	2.9	2.7	1.7	5.1	6.3	5.2	9.4
Tararua District	10.4	0	1.8	0.8	1.4	0.5	3	1.8	3.1	2.3	2.2
Rangitīkei District	16.7	0	3	2.2	2.9	0.3	0.7	3.6	4	3	4.6
Ruapehu District	7.5	0.3	3.2	1.7	3.4	1.9	5.3	2.5	4.8	4.5	7.8
Total buildings											
Palmerston North City	25.6	0	25.6	26.6	27.5	32.4	27	11.7	14.1	20.9	27.4
Whanganui District	21.5	0	20.8	23	23.4	29.4	39.9	8.6	11.2	19.9	19.6
Horowhenua District	35.8	0	31.5	36.1	33	56.8	52.3	15.2	18.9	34.9	33
Manawatū District	14.6	0	16.2	17.4	19.9	25	34.9	11.3	14.8	16.6	23.4
Tararua District	16.1	0.1	15.1	18.7	21.2	19.5	28	9.9	12.6	14.1	12.2
Rangitīkei District	14.2	0	13.2	16	17	20.5	26.5	7.9	9.5	13.8	14.5
Ruapehu District	11	0.2	11.1	13.2	16.7	13.9	16.1	5.3	8.9	8.3	12.2

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.8: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Current Climate and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	26.9	0	26.6	27.7	27.7	30.1	27.9	15.5	17.8	20.9	28
Whanganui District	22.5	0	19.2	22.7	22.8	28.8	37.5	3.8	4.5	17	15.3
Horowhenua District	36.9	0	29.8	35.3	31.9	56.8	52.3	11	14.1	32.8	29
Manawatū District	19.3	0	15.4	19.6	21.9	37.4	40.1	7.7	9.6	14.6	15.8
Tararua District	17	0.1	13.3	18.1	20	18.9	21.4	8	9.5	12	10.1
Rangitīkei District	14.2	0	10.3	14.1	14.2	21.2	26.8	4.3	5.6	11.2	9.8
Ruapehu District	11.9	0.1	7.7	11.3	13	12	10.5	2.7	4.1	3.7	4.2
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	8.8	0.2	1.5	0.3	0.5	0.2	0.9	4.8	6.7	2.9	4.3
Horowhenua District	28	0.1	2.8	1.3	1.5	0.2	0.8	8.2	7.5	2.8	3.8
Manawatū District	19.3	0	5	2.8	3.2	3.2	2.2	6.8	7.7	6	9.4
Tararua District	10.3	0	1.8	0.8	1.4	0.5	3	1.8	3.1	2.3	2.2
Rangitīkei District	18.8	0	3.6	2.4	3	0.3	0.7	5	4.6	4	5.2
Ruapehu District	7.5	0.3	3.2	1.7	3.4	1.9	5.3	2.5	4.8	4.5	7.8
Total buildings											
Palmerston North City	26.9	0	26.6	27.7	27.7	30.1	27.9	15.5	17.8	20.9	28
Whanganui District	21.5	0	20.8	23	23.3	29	38.4	8.6	11.2	19.9	19.6
Horowhenua District	36.4	0	32.6	36.7	33.4	57	53	19.2	21.6	35.6	32.8
Manawatū District	19.3	0	20.4	22.4	25.1	40.6	42.2	14.4	17.4	20.6	25.2
Tararua District	16.2	0.1	15.1	18.9	21.4	19.4	24.4	9.8	12.5	14.3	12.2
Rangitīkei District	14.8	0	13.9	16.5	17.2	21.5	27.6	9.3	10.2	15.2	15.1
Ruapehu District	10.8	0.2	11	13	16.4	13.9	15.8	5.3	8.9	8.2	12

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.9: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.2% AEP with Current Climate and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	26.5	0	26.6	27.6	28.8	33.1	27.9	11.8	14.5	21.7	27.8
Whanganui District	28.6	0.1	24.4	29.1	29.6	35.6	43.1	4.1	4.8	19.4	16.1
Horowhenua District	38.1	0	31.1	36.8	33.9	57.5	53	10.8	14.5	32.3	33.2
Manawatū District	15.8	0	13.6	16.7	19.1	25.2	35.8	6.9	10	12.4	16.2
Tararua District	18.4	0.2	14.5	19.6	21.6	20.8	25.8	8.8	10.4	13.5	10.5
Rangitīkei District	17.1	0.1	12.8	17.7	17.6	30.4	38.6	4.8	6.4	12.1	12.1
Ruapehu District	14.8	0.3	9.1	13.9	15.1	13.2	11.9	2.9	4.4	4.6	5.2
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	13	0.9	2.2	0.5	0.9	0.3	2.4	6.8	8.7	4.9	8.9
Horowhenua District	18.2	0	1.8	0.7	1	0.1	0.8	4.9	5.3	2.6	2.6
Manawatū District	16.1	0	4.3	2.5	3.2	2.9	3.5	5.2	6.8	5.5	9
Tararua District	11	0	1.8	0.8	1.5	0.5	3	1.9	3.1	2.1	2.2
Rangitīkei District	18.8	0.1	3.5	2.5	3.2	0.5	0.7	4.4	4.6	3.9	5.4
Ruapehu District	9.7	0.5	3.7	2.2	4	2.4	6.7	2.9	5.5	5.1	8.6
Total buildings											
Palmerston North City	26.5	0	26.6	27.6	28.8	33.1	27.9	11.8	14.5	21.7	27.8
Whanganui District	27.4	0.1	26.7	29.6	30.6	36	45.5	10.8	13.5	24.3	25.1
Horowhenua District	37	0	32.9	37.5	34.9	57.6	53.8	15.7	19.8	34.9	35.8
Manawatū District	15.8	0	17.9	19.2	22.2	28.1	39.2	12.2	16.7	17.9	25.2
Tararua District	17.5	0.1	16.3	20.4	23.1	21.3	28.8	10.6	13.6	15.7	12.7
Rangitīkei District	17.3	0.1	16.3	20.2	20.8	30.9	39.3	9.2	11	16	17.5
Ruapehu District	13.5	0.3	12.8	16	19.1	15.6	18.6	5.8	9.9	9.7	13.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.10: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.1% AEP with Current Climate and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	27.2	0	27.4	28.4	29.7	34.7	29	12.5	14.8	22.5	28.2
Whanganui District	31.5	0.1	27	32.2	32.8	39.8	49.3	4.3	5.1	20.8	16.8
Horowhenua District	38.9	0	31.9	37.6	34.8	58.3	53.8	11.3	15	32.8	33.8
Manawatū District	16.6	0	14.4	17.6	19.9	28.1	39.7	7.5	10.5	13.2	18.2
Tararua District	19.5	0.2	15.3	20.6	22.7	23.1	27.7	9.3	11.1	13.8	11.2
Rangitīkei District	18.5	0.1	13.7	19.1	19	32.2	39.7	5.3	6.8	12.9	13.1
Ruapehu District	19.6	0.3	10.8	17.3	18.3	13.7	13.7	3.1	4.7	5.6	6.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	16.7	1.8	2.8	0.9	1.3	0.4	2.6	7.8	9.5	7.7	11.3
Horowhenua District	19.5	0	1.9	0.8	1.1	0.1	0.8	5.4	5.7	3	2.6
Manawatū District	18	0	4.5	2.6	3.3	2.9	3.5	5.6	7.1	5.5	9.4
Tararua District	11.9	0.2	1.9	0.9	1.5	0.5	3	2	3.2	2.1	2.4
Rangitīkei District	19.6	0.1	3.8	2.6	3.2	0.8	1.5	4.9	5	4	5.8
Ruapehu District	10.5	0.6	4	2.4	4.3	2.4	7	3.2	5.8	5.9	9.3
Total buildings											
Palmerston North City	27.2	0	27.4	28.4	29.7	34.7	29	12.5	14.8	22.5	28.2
Whanganui District	30.4	0.2	29.8	33.1	34.1	40.2	51.9	12.1	14.6	28.5	28.2
Horowhenua District	37.8	0	33.8	38.4	35.9	58.4	54.5	16.7	20.7	35.8	36.4
Manawatū District	16.8	0	18.9	20.2	23.2	31	43.1	13.1	17.6	18.7	27.7
Tararua District	18.6	0.2	17.2	21.5	24.2	23.5	30.6	11.4	14.2	16	13.6
Rangitīkei District	18.7	0.1	17.5	21.7	22.2	33	41.2	10.1	11.8	16.9	18.9
Ruapehu District	17.3	0.4	14.9	19.8	22.6	16.1	20.7	6.4	10.4	11.5	15.7

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.11: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +1°C and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	26.9	0	27	28	28.9	33.5	28.1	13.6	16.1	22.3	28.4
Whanganui District	26.7	0.1	22.9	27.2	27.6	34.6	41.4	4	4.8	18.3	15.5
Horowhenua District	38.2	0	31.1	36.9	33.6	57.7	53.8	11.1	14.4	32.3	32.2
Manawatū District	15.8	0	13.1	16.5	18.2	24.1	33.6	6.9	9.3	11.7	14.8
Tararua District	17.3	0.1	13.6	18	20.2	19.9	25.1	8.5	10	12.6	10.1
Rangitīkei District	14.7	0	10.9	14.8	14.7	25.4	30.9	4.7	5.9	11.3	10
Ruapehu District	15.6	0.3	9.3	14.2	15.6	13.4	12.3	2.9	4.3	4.6	5.2
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	12	0.6	2.1	0.5	0.8	0.3	2.4	6.3	8.2	4.2	8.2
Horowhenua District	20	0	1.9	0.8	1.1	0.1	0.8	5.3	5.6	3	2.8
Manawatū District	17.2	0	4.4	2.5	3.2	2.7	2.6	5.5	6.7	5.5	9.6
Tararua District	11.2	0.2	1.9	0.8	1.5	0.5	3	1.9	3.1	2.3	2.2
Rangitīkei District	18.4	0.1	3.4	2.5	3.1	0.3	0.7	4	4.4	3.6	5
Ruapehu District	9.7	0.5	3.8	2.2	4.1	2.4	6.7	3	5.6	5.6	8.6
Total buildings											
Palmerston North City	26.9	0	27	28	28.9	33.5	28.1	13.6	16.1	22.3	28.4
Whanganui District	25.6	0.1	25	27.7	28.4	34.9	43.7	10.3	12.9	22.5	23.7
Horowhenua District	37.2	0	33	37.8	34.7	57.8	54.5	16.4	20	35.4	35
Manawatū District	16	0	17.5	19	21.4	26.8	36.2	12.5	16	17.2	24.4
Tararua District	16.6	0.1	15.5	18.8	21.7	20.4	28	10.4	13.1	14.9	12.2
Rangitīkei District	15.1	0	14.3	17.3	17.8	25.8	31.6	8.7	10.3	14.9	15.1
Ruapehu District	14.1	0.3	13.1	16.4	19.7	15.8	18.9	5.9	9.9	10.2	13.8

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.12: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +1°C and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	32.1	0.1	31.1	33	32.1	32.4	28.9	17.7	19.2	24.2	30.5
Whanganui District	26.8	0.1	23	27.3	27.7	35.4	41.9	4	4.8	18.5	15.5
Horowhenua District	38.3	0	31.1	36.8	33.5	57.6	54.5	11.7	14.7	33.2	30.6
Manawatū District	20.6	0	16.3	20.9	23.1	39.2	41	8.1	10.2	14.7	17
Tararua District	18.3	0.1	14.3	19.5	21.4	20.2	23.2	8.6	10.2	13.5	10.5
Rangitīkei District	15	0	11.1	15.1	14.9	26.8	31.6	4.7	5.9	11.3	10
Ruapehu District	16.9	0.3	9.7	15.1	16.6	13.4	13.3	2.9	4.3	4.6	5.9
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	12	0.6	2	0.5	0.8	0.3	2.4	6.3	8.2	4.2	8.2
Horowhenua District	29	0.1	3	1.4	1.6	0.2	0.8	8.7	7.9	3.7	4.4
Manawatū District	20.1	0	5.2	2.8	3.4	3.2	3	7.1	8.2	6.1	9.6
Tararua District	11.1	0.2	1.8	0.8	1.5	0.5	3	1.9	3.1	2.3	2.2
Rangitīkei District	20.5	0.1	3.9	2.6	3.2	0.3	0.7	5.4	5.1	4.5	5.6
Ruapehu District	9.7	0.5	3.8	2.2	4.1	2.4	6.7	3	5.6	5.6	8.6
Total buildings											
Palmerston North City	32.1	0.1	31.1	33	32.1	32.4	28.9	17.7	19.2	24.2	30.5
Whanganui District	25.6	0.1	25.1	27.8	28.5	35.7	44.3	10.3	12.9	22.6	23.7
Horowhenua District	37.7	0	34.1	38.2	35	57.8	55.3	20.4	22.6	36.9	35
Manawatū District	20.5	0	21.5	23.7	26.4	42.4	44	15.2	18.4	20.9	26.6
Tararua District	17.5	0.2	16.2	20.4	22.9	20.7	26.2	10.5	13.3	15.8	12.7
Rangitīkei District	15.6	0	15	17.8	18.1	27.1	32.4	10.1	11	15.8	15.7
Ruapehu District	15.1	0.3	13.5	17.3	20.6	15.8	20	5.9	9.9	10.2	14.5

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.13: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +2°C and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	28.6	0	28.9	29.7	30.8	35.9	30.7	16	17.7	23.9	30.5
Whanganui District	30.9	0.2	26.5	31.5	32.2	39.6	49.9	4.2	4.9	20.3	16.5
Horowhenua District	39.6	0	32.3	38.2	35.1	59.1	54.1	11.8	15.1	33	33.4
Manawatū District	17	0	14.2	17.6	19.2	27	36.6	7.8	10.3	12.4	17
Tararua District	20	0.3	15.5	20.9	22.9	22.9	27.7	9.5	11.2	14.4	11.2
Rangitīkei District	15.4	0.1	11.5	15.7	15.2	28.2	32.4	5	6.1	11.9	10.4
Ruapehu District	21.6	0.3	11.6	18.7	19.8	14.8	14.4	3.3	4.7	6.4	6.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	15.6	1.7	2.7	0.8	1.2	0.3	2.6	7.6	9.2	6.9	11.2
Horowhenua District	22	0	2.2	0.9	1.2	0.1	0.8	6.3	6.1	3.2	2.8
Manawatū District	18.7	0	4.7	2.6	3.2	2.7	2.6	6.2	7.3	5.7	10
Tararua District	12	0.2	1.9	0.9	1.5	0.5	3	2.1	3.2	2.3	2.4
Rangitīkei District	19.3	0.1	3.6	2.5	3.2	0.3	1.5	4.5	4.9	3.9	5.6
Ruapehu District	10.8	0.6	4.2	2.6	4.5	2.4	7.4	3.4	6	5.9	9.6
Total buildings											
Palmerston North City	28.6	0	28.9	29.7	30.8	35.9	30.7	16	17.7	23.9	30.5
Whanganui District	29.7	0.3	29.1	32.3	33.4	39.9	52.5	11.8	14.1	27.2	27.7
Horowhenua District	38.6	0	34.5	39.2	36.3	59.3	54.9	18.2	21.2	36.2	36.2
Manawatū District	17.3	0	18.9	20.2	22.5	29.7	39.2	14	17.6	18.1	27.1
Tararua District	19.1	0.3	17.5	21.8	24.4	23.4	30.6	11.6	14.4	16.7	13.6
Rangitīkei District	15.9	0.1	15.2	18.2	18.4	28.5	33.8	9.5	11.1	15.8	16.1
Ruapehu District	18.9	0.4	15.8	21.2	24.2	17.2	21.8	6.7	10.7	12.3	16.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.14: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +2°C and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	41.6	0.1	39.5	43	41.1	36.8	31.1	19.7	20.5	30.6	34.9
Whanganui District	30.9	0.2	26.5	31.5	32.2	39.7	49.9	4.2	4.9	20.2	16.5
Horowhenua District	39.6	0	32.2	38	34.8	59.1	54.9	12.4	15.3	33.6	31.2
Manawatū District	21.8	0	17.1	22.1	24	40.1	43.1	8.6	10.8	15.8	19
Tararua District	20.2	0.3	15.6	21.3	23	22.8	26.9	9.5	11.1	14.4	10.9
Rangitīkei District	15.8	0.1	11.7	16	15.5	28.6	32.7	5.1	6.1	11.9	10.4
Ruapehu District	22.2	0.3	11.9	19.2	20.5	14.8	14.4	3.3	4.8	6.2	6.2
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	15.5	1.7	2.6	0.8	1.2	0.3	2.6	7.6	9.1	6.8	11.2
Horowhenua District	31	0.1	3.2	1.5	1.7	0.2	0.8	9.7	8.5	4.1	5.2
Manawatū District	21.4	0	5.4	2.9	3.5	3.2	3	7.5	8.5	6.3	10
Tararua District	11.8	0.2	1.9	0.9	1.5	0.5	3	2	3.2	2.3	2.4
Rangitīkei District	21.6	0.1	4.2	2.8	3.2	0.3	1.5	5.9	5.7	4.7	6.2
Ruapehu District	10.8	0.6	4.2	2.6	4.5	2.4	7.4	3.4	6	5.9	9.6
Total buildings											
Palmerston North City	41.6	0.1	39.5	43	41.1	36.8	31.1	19.7	20.5	30.6	34.9
Whanganui District	29.7	0.3	29.1	32.3	33.4	40	52.5	11.8	14.1	26.9	27.7
Horowhenua District	39.1	0	35.5	39.5	36.5	59.4	55.6	22.1	23.9	37.7	36.4
Manawatū District	21.7	0	22.6	25	27.5	43.3	46.1	16.1	19.3	22.1	29.1
Tararua District	19.3	0.3	17.5	22.2	24.6	23.2	29.9	11.5	14.2	16.7	13.3
Rangitīkei District	16.5	0.1	15.9	18.8	18.8	28.9	34.2	10.9	11.8	16.6	16.7
Ruapehu District	19.3	0.4	16.1	21.8	24.9	17.2	21.8	6.7	10.7	12.1	15.9

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.15: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +3°C and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	31.8	0.1	31.9	33	33.7	39.7	31.4	18.6	19.8	26.4	32.2
Whanganui District	36	0.4	30.5	36.7	36.9	43.8	55.1	4.4	5.2	23.1	18.6
Horowhenua District	41.3	0	33.6	39.7	36.4	60.7	56.8	12.7	15.8	33.8	35.2
Manawatū District	18	0	15.1	18.7	20.3	30.2	41.4	8.3	10.9	13.2	17.8
Tararua District	20.6	0.4	16.1	21.4	23.6	23.4	31.4	10.1	11.8	14.8	12.2
Rangitīkei District	16.4	0.1	12.2	16.8	16.2	29.2	33.5	5.3	6.3	12.1	10.6
Ruapehu District	24.2	0.4	13	21.2	22.2	17	17.5	3.6	5.2	7.3	6.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	18.1	3	3	1	1.4	0.5	2.6	8.4	10	8.3	12.4
Horowhenua District	23.3	0	2.4	1.1	1.3	0.1	0.8	7	6.5	3.5	3.4
Manawatū District	19.9	0	5	2.8	3.4	2.9	3	6.7	7.7	5.4	9.8
Tararua District	13.4	0.7	2.2	1.1	1.9	1	3	2.3	3.5	2.3	3.1
Rangitīkei District	20.3	0.1	3.8	2.6	3.2	0.8	1.8	5	5.1	4	6
Ruapehu District	12.1	0.7	4.5	2.9	4.8	2.4	7.4	3.7	6.3	6.2	10.6
Total buildings											
Palmerston North City	31.8	0.1	31.9	33	33.7	39.7	31.4	18.6	19.8	26.4	32.2
Whanganui District	34.6	0.6	33.5	37.7	38.3	44.3	57.8	12.8	15.2	31.5	30.9
Horowhenua District	40.3	0	36	40.7	37.7	60.8	57.5	19.7	22.3	37.3	38.6
Manawatū District	18.3	0	20.1	21.5	23.7	33.1	44.4	15	18.6	18.6	27.7
Tararua District	19.8	0.5	18.4	22.5	25.5	24.4	34.3	12.4	15.3	17.1	15.3
Rangitīkei District	16.9	0.1	16	19.4	19.4	30	35.3	10.3	11.4	16.1	16.7
Ruapehu District	21.1	0.5	17.5	24.1	27	19.4	24.9	7.3	11.4	13.6	17.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.16: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +3°C and Defences Down

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	48.1	0.2	45.3	49.5	47.3	40.6	32.2	20.9	22.1	35.3	40.7
Whanganui District	36	0.4	30.4	36.7	36.8	43.7	54.2	4.4	5.2	23.1	18.6
Horowhenua District	41.2	0	33.4	39.4	36	60.5	57.5	13.1	16.1	33.8	31.6
Manawatū District	22.6	0	17.9	23.1	25.1	42	45.7	8.8	11.3	16.7	19.4
Tararua District	21.6	0.5	16.8	22.7	24.6	26.8	33.6	10.2	12.2	15.1	12.2
Rangitīkei District	16.8	0.1	12.3	17.1	16.5	29.8	34.9	5.3	6.3	12.1	10.6
Ruapehu District	24.5	0.4	13.1	21.3	22.5	17	17.5	3.6	5.2	7.2	6.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	18	3	3	1	1.4	0.5	2.6	8.4	10	8.3	12.4
Horowhenua District	33	0.2	3.5	1.6	1.8	0.2	0.8	10.3	9	4.8	5.4
Manawatū District	21.9	0	5.6	3	3.6	3.4	3	7.8	8.7	6	9.8
Tararua District	13.1	0.7	2.2	1.1	1.9	1	3	2.3	3.5	2.3	3.1
Rangitīkei District	22.7	0.1	4.4	2.8	3.3	0.8	1.8	6.3	5.8	4.8	6.6
Ruapehu District	12.1	0.7	4.5	2.9	4.8	2.4	7.4	3.7	6.3	6.2	10.6
Total buildings											
Palmerston North City	48.1	0.2	45.3	49.5	47.3	40.6	32.2	20.9	22.1	35.3	40.7
Whanganui District	34.6	0.6	33.4	37.7	38.2	44.2	56.9	12.8	15.2	31.5	30.9
Horowhenua District	40.7	0	36.9	41	37.8	60.7	58.3	23.4	25.1	38.6	37
Manawatū District	22.5	0	23.5	26.1	28.7	45.4	48.7	16.6	19.9	22.7	29.3
Tararua District	20.6	0.5	19	23.8	26.5	27.8	36.5	12.4	15.7	17.4	15.3
Rangitīkei District	17.6	0.1	16.7	19.9	19.8	30.6	36.8	11.6	12.1	16.9	17.3
Ruapehu District	21.4	0.5	17.6	24.2	27.2	19.4	24.9	7.3	11.4	13.4	17.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.14.17: Percentage of population exposed, fatalities, and buildings affected by flooding, by building type, for each District - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

District	% of the resident population exposed to flooding	% of the resident population as fatalities by flooding	% of the total buildings that are exposed to flooding	% of residential buildings (primary structures) that are exposed to flooding	% of residential buildings (secondary structures) that are exposed to flooding	% of commercial/industrial buildings (primary structures) that are exposed to flooding	% of commercial/industrial buildings (secondary structures) that are exposed to flooding	% of rural buildings (primary structures) that are exposed to flooding	% of rural buildings (secondary structures) that are exposed to flooding	% of other buildings (primary structures) that are exposed to flooding	% of other buildings (secondary structures) that are exposed to flooding
Buildings inside town/settlements											
Palmerston North City	31.8	0.1	31.9	33	33.7	39.7	31.4	18.6	19.8	26.4	32.2
Whanganui District	36.4	0.4	30.8	37	37.5	45.1	56.6	4.4	5.2	23.3	18.9
Horowhenua District	41.4	0	33.8	40	36.7	60.7	56.8	12.6	15.8	33.8	36.2
Manawatū District	18	0	15.1	18.8	20.2	30.2	41.4	8.3	10.9	13.2	17.8
Tararua District	20.6	0.4	16.1	21.4	23.6	23.4	31.4	10.1	11.8	14.8	12.2
Rangitīkei District	16.4	0.1	12.2	16.9	16.4	29.2	33.5	5.3	6.3	12.1	10.6
Ruapehu District	24.2	0.4	13	21.2	22.2	17	17.5	3.6	5.2	7.3	6.4
Buildings outside town/settlements											
Palmerston North City	0	0	0	0	0	0	0	0	0	0	0
Whanganui District	18.1	3	3	1	1.4	0.5	2.6	8.5	10	8.3	12.4
Horowhenua District	23.3	0	2.4	1.1	1.3	0.1	0.8	6.9	6.5	3.2	3.2
Manawatū District	19.9	0	5	2.8	3.4	2.9	3	6.7	7.7	5.4	9.8
Tararua District	13.7	0.7	2.3	1.2	2	1.2	3.3	2.3	3.5	2.1	3.5
Rangitīkei District	20.3	0.1	3.8	2.6	3.2	0.8	1.8	5	5.1	4	6
Ruapehu District	12.1	0.7	4.5	2.9	4.8	2.4	7.4	3.7	6.3	6.2	10.6
Total buildings											
Palmerston North City	31.8	0.1	31.9	33	33.7	39.7	31.4	18.6	19.8	26.4	32.2
Whanganui District	34.9	0.6	33.8	38	38.9	45.6	59.2	12.9	15.2	31.6	31.3
Horowhenua District	40.4	0	36.2	41	38	60.8	57.5	19.5	22.3	37.1	39.4
Manawatū District	18.3	0	20.1	21.5	23.6	33.1	44.4	15	18.6	18.6	27.7
Tararua District	19.8	0.5	18.4	22.6	25.6	24.6	34.7	12.4	15.3	16.9	15.8
Rangitīkei District	16.9	0.1	16.1	19.5	19.6	30	35.3	10.3	11.4	16.1	16.7
Ruapehu District	21.1	0.5	17.5	24.1	27	19.4	24.9	7.3	11.4	13.6	17.1

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.15.1: Total reinstatement cost of the buildings, by building type, for each District in the Horizons Region

District	Total reinstatement value of buildings	Total reinstatement value of residential buildings (primary structures) (000's NZD)	Total reinstatement value of residential buildings (secondary structures) (000's NZD)	Total reinstatement value of commercial/industrial buildings (primary + secondary) (000's NZD)	Total reinstatement value of rural buildings (primary + secondary) (000's NZD)	Total reinstatement value of other buildings (primary + secondary) (000's NZD)
Palmerston North City	27,127,632	13,768,322	2,192,593	5,984,369	2,045,926	3,136,422
Whanganui District	15,255,369	7,841,571	1,098,153	2,487,459	2,524,581	1,303,605
Horowhenua District	12,273,913	6,260,510	1,198,131	1,289,054	2,823,132	703,086
Manawatū District	13,853,385	4,314,601	924,960	1,018,397	6,730,555	864,872
Tararua District	9,076,220	2,450,164	423,691	911,679	4,600,053	690,632
Rangitīkei District	7,481,198	2,381,621	414,469	685,698	3,346,132	653,278
Ruapehu District	7,922,409	2,552,159	925,308	624,180	3,162,080	658,682

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.1: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 5% AEP with Current Climate and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	18,040,350	6,600	675,595	4,093	429,182	1,820	48,561	371	134,913	201	25,381	115	37,557	18,715,945
Whanganui District	6,028,575	3,364	272,136	1,667	164,818	1,044	15,769	230	55,714	307	16,904	116	18,930	6,300,711
Horowhenua District	4,114,591	2,808	188,750	1,274	105,174	917	18,523	103	28,149	406	25,483	108	11,420	4,303,341
Manawatū District	1,444,848	1,380	99,879	401	28,500	304	6,356	81	22,923	518	33,805	76	8,292	1,544,727
Tararua District	3,770,303	1,528	142,249	343	29,542	272	5,094	74	21,993	798	79,704	41	5,914	3,912,552
Rangitīkei District	1,211,572	963	54,824	329	23,723	283	3,784	51	6,644	256	17,167	44	3,504	1,266,396
Ruapehu District	5,796,959	900	54,149	292	23,019	249	5,504	47	6,860	263	13,470	49	5,294	5,851,108

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.2: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 5% AEP with Current Climate and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	9,885,847	4,320	482,542	2,587	263,134	1,068	38,521	333	122,434	248	27,704	84	30,751	10,368,389
Whanganui District	5,787,233	3,264	256,695	1,634	161,386	1,027	15,637	192	44,122	305	16,862	106	18,686	6,043,928
Horowhenua District	5,128,516	3,203	241,164	1,338	119,321	966	19,212	104	30,049	683	62,829	112	9,753	5,369,680
Manawatū District	2,768,327	2,178	186,346	597	58,801	403	8,368	132	31,904	958	75,572	88	11,700	2,954,673
Tararua District	3,777,251	1,528	143,159	341	29,455	272	5,077	71	22,463	803	80,238	41	5,925	3,920,410
Rangitīkei District	1,510,190	1,141	70,024	384	29,294	325	4,326	56	7,291	323	24,492	53	4,620	1,580,214
Ruapehu District	5,789,543	893	53,773	291	22,728	243	5,425	47	6,860	263	13,465	49	5,294	5,843,316

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.3: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 2% AEP with Current Climate and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	21,276,062	7,445	775,444	4,562	490,932	2,092	52,592	431	164,295	229	25,086	131	42,537	22,051,506
Whanganui District	6,793,167	3,731	313,541	1,838	183,565	1,157	18,108	254	64,549	343	20,122	139	27,196	7,106,708
Horowhenua District	4,605,048	3,305	219,494	1,510	121,490	1,070	21,210	119	33,069	476	31,395	130	12,330	4,824,542
Manawatū District	1,789,453	1,664	121,735	485	37,509	363	7,027	90	24,302	642	43,948	84	8,949	1,911,188
Tararua District	5,754,978	1,827	175,790	459	42,588	364	7,135	90	26,748	870	92,898	44	6,419	5,930,768
Rangitīkei District	1,487,404	1,127	67,346	389	29,234	327	4,362	58	7,387	297	21,022	56	5,341	1,554,750
Ruapehu District	16,866,766	1,046	68,769	337	27,122	294	5,923	55	9,761	305	19,757	55	6,204	16,935,535

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.4: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 2% AEP with Current Climate and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	13,980,433	5,319	576,412	3,155	338,036	1,318	21,153	378	140,245	367	37,873	101	39,102	14,556,845
Whanganui District	6,755,866	3,670	298,465	1,829	182,566	1,151	18,087	219	51,208	342	20,131	129	26,472	7,054,331
Horowhenua District	5,921,392	3,721	278,865	1,581	137,532	1,119	22,089	121	35,464	771	72,855	129	10,923	6,200,257
Manawatū District	3,770,726	2,822	238,016	819	77,916	584	11,790	161	37,481	1,156	96,736	102	14,092	4,008,742
Tararua District	5,760,526	1,824	184,958	457	42,566	368	7,312	86	35,936	869	92,724	44	6,419	5,945,484
Rangitīkei District	1,775,498	1,324	88,326	430	33,919	365	4,990	65	7,982	399	33,052	65	8,383	1,863,824
Ruapehu District	16,851,254	1,033	68,021	331	26,454	287	5,842	55	9,756	305	19,764	55	6,204	16,919,275

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.5: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 1% AEP with Current Climate and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	23,063,480	7,957	794,946	4,868	520,091	2,221	32,875	461	169,024	271	29,888	136	43,067	23,858,426
Whanganui District	9,589,849	4,140	354,095	2,046	207,364	1,264	20,031	285	73,466	386	23,396	159	29,836	9,943,944
Horowhenua District	5,011,859	3,682	245,422	1,656	134,899	1,172	23,210	128	35,175	573	38,139	153	13,997	5,257,281
Manawatū District	2,266,508	2,007	149,008	556	43,523	413	7,874	111	26,724	839	59,732	88	11,154	2,415,516
Tararua District	7,726,040	2,077	207,794	566	55,862	450	9,212	95	29,143	914	105,924	52	7,653	7,933,834
Rangitīkei District	5,803,066	1,323	82,764	449	36,066	367	5,019	73	8,968	362	24,916	72	7,793	5,885,830
Ruapehu District	18,674,327	1,194	77,584	385	31,446	340	6,962	62	8,834	341	22,724	66	7,616	18,751,911

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.6: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 1% AEP with Current Climate and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	20,940,036	6,826	762,657	4,081	457,345	1,722	49,060	424	153,721	476	49,835	123	52,695	21,702,693
Whanganui District	9,586,897	4,083	340,196	2,041	207,424	1,261	20,006	248	60,352	384	23,245	149	29,167	9,927,093
Horowhenua District	6,691,458	4,077	307,966	1,730	151,478	1,215	24,018	130	39,674	844	79,355	158	13,439	6,999,424
Manawatū District	4,616,479	3,292	280,735	962	92,789	700	13,857	179	43,264	1,341	115,014	110	15,810	4,897,214
Tararua District	7,734,819	2,063	215,190	564	55,350	446	9,199	92	38,402	909	104,685	52	7,552	7,950,009
Rangitīkei District	6,043,170	1,501	100,659	477	38,763	394	5,389	81	9,611	468	37,866	81	9,028	6,143,829
Ruapehu District	18,654,783	1,178	76,699	378	30,735	334	6,949	62	8,832	341	22,715	63	7,467	18,731,482

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.7: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Current Climate and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	26,420,916	8,449	848,338	5,092	546,170	2,356	36,070	499	179,742	354	37,927	148	48,428	27,269,254
Whanganui District	15,030,767	4,756	421,773	2,296	238,459	1,445	24,916	339	92,281	495	31,704	181	34,412	15,452,540
Horowhenua District	5,395,916	3,924	265,399	1,759	145,035	1,251	24,953	134	36,633	620	44,744	160	14,031	5,661,315
Manawatū District	2,989,048	2,508	183,071	681	53,784	554	10,139	116	28,405	1,052	77,651	105	13,092	3,172,119
Tararua District	10,199,741	2,312	251,035	655	65,559	512	11,566	109	36,605	972	127,305	64	9,998	10,450,776
Rangitīkei District	6,108,922	1,504	101,702	488	41,758	404	5,734	85	10,112	436	33,146	91	10,950	6,210,624
Ruapehu District	22,766,809	1,363	97,039	434	36,813	381	7,756	66	10,079	399	32,992	83	9,400	22,863,848

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.8: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Current Climate and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	33,932,252	8,706	1,002,650	5,276	621,185	2,218	74,696	463	168,193	586	60,004	163	78,570	34,934,902
Whanganui District	15,061,272	4,730	416,933	2,295	238,925	1,443	24,931	318	87,101	493	31,549	181	34,425	15,478,205
Horowhenua District	7,324,120	4,330	328,467	1,840	162,435	1,292	26,030	138	40,154	896	86,515	164	13,332	7,652,587
Manawatū District	5,415,439	3,695	318,524	1,077	104,585	792	15,638	189	49,010	1,507	130,547	130	18,743	5,733,963
Tararua District	10,211,202	2,296	244,747	658	65,883	508	11,535	106	30,890	960	126,554	64	9,883	10,455,949
Rangitīkei District	6,310,568	1,676	122,072	520	44,998	421	5,814	91	11,986	546	47,295	98	11,977	6,432,640
Ruapehu District	22,742,047	1,339	95,547	422	35,667	373	7,718	66	10,063	399	33,005	79	9,093	22,837,594

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.9: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.2% AEP with Current Climate and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	28,154,995	8,893	899,976	5,384	574,719	2,461	37,540	531	199,764	362	35,702	155	52,250	29,054,971
Whanganui District	49,745,944	7,478	669,352	3,686	390,108	2,465	42,172	419	123,454	656	45,573	252	68,043	50,415,296
Horowhenua District	5,906,543	4,278	302,866	1,909	158,977	1,367	27,010	164	47,067	664	52,363	174	17,449	6,209,409
Manawatū District	3,979,558	3,048	223,458	851	69,644	687	11,345	134	31,724	1,255	94,935	121	15,807	4,203,016
Tararua District	27,541,605	2,631	283,164	764	79,171	593	13,961	127	38,177	1,068	139,191	79	12,662	27,824,769
Rangitīkei District	11,734,168	2,311	167,766	787	68,603	590	8,894	217	25,681	588	47,597	129	16,990	11,901,934
Ruapehu District	41,689,221	1,695	128,005	584	53,544	471	9,282	77	9,975	453	41,014	110	14,189	41,817,226

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.10: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.1% AEP with Current Climate and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	27,695,451	9,283	947,034	5,595	603,606	2,558	39,268	573	212,443	396	37,986	161	53,729	28,642,485
Whanganui District	99,770,940	8,876	842,641	4,377	510,860	2,942	51,734	515	154,063	744	60,335	298	65,649	100,613,581
Horowhenua District	6,197,266	4,460	335,905	1,983	180,224	1,415	28,279	169	47,896	716	58,654	177	20,851	6,533,171
Manawatū District	4,731,314	3,304	247,617	934	79,056	742	12,075	147	35,879	1,349	104,386	132	16,218	4,978,931
Tararua District	43,398,821	2,841	334,617	832	96,751	646	16,924	144	55,309	1,135	151,839	84	13,792	43,733,438
Rangitīkei District	14,982,628	2,536	192,370	874	79,774	633	9,666	232	31,077	658	53,074	139	18,777	15,174,998
Ruapehu District	48,534,949	2,191	163,269	817	78,076	651	11,649	84	10,062	507	45,347	132	18,134	48,698,218

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.11: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	26,798,555	9,053	921,489	5,412	579,282	2,487	38,658	532	200,407	457	48,759	165	54,383	27,720,044
Whanganui District	52,093,978	6,659	586,804	3,261	341,356	2,142	37,763	401	113,117	623	42,863	232	51,705	52,680,782
Horowhenua District	5,830,200	4,274	305,128	1,898	156,622	1,342	26,975	165	47,858	694	57,991	175	15,681	6,135,328
Manawatū District	3,885,106	2,881	218,316	800	66,354	634	11,280	118	29,733	1,217	96,851	112	14,096	4,103,422
Tararua District	27,474,316	2,364	230,904	648	62,892	522	10,877	119	30,608	1,009	116,250	66	10,276	27,705,220
Rangitīkei District	5,702,609	1,713	121,934	542	48,651	439	6,249	125	14,548	499	39,338	108	13,146	5,824,543
Ruapehu District	41,956,434	1,774	132,801	620	55,622	503	9,758	79	13,079	462	41,663	110	12,677	42,089,235

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.12: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	54,142,627	10,827	1,238,786	6,674	819,938	2,769	71,907	509	180,592	681	73,772	194	92,575	55,381,413
Whanganui District	53,991,893	6,717	601,182	3,285	347,798	2,156	37,975	422	121,114	621	42,711	233	51,583	54,593,075
Horowhenua District	8,101,901	4,675	375,223	1,971	175,722	1,378	27,577	167	50,108	977	105,506	182	16,311	8,477,124
Manawatū District	6,203,925	4,065	354,343	1,214	120,402	877	17,081	203	53,451	1,634	145,097	137	18,309	6,558,268
Tararua District	31,464,986	2,562	284,128	747	76,934	580	13,190	119	45,207	1,039	136,949	77	11,846	31,749,114
Rangitīkei District	5,859,038	1,889	154,238	584	64,452	455	6,380	126	15,180	608	54,583	116	13,642	6,013,276
Ruapehu District	42,155,881	1,869	138,321	674	60,452	542	10,238	81	12,915	462	41,651	110	13,064	42,294,202

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.13: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	32,241,758	9,907	1,025,127	5,913	642,606	2,660	42,278	586	220,300	569	62,192	179	57,750	33,266,885
Whanganui District	135,037,597	8,519	799,015	4,201	482,087	2,817	48,474	495	144,982	717	56,922	289	66,548	135,836,612
Horowhenua District	6,338,936	4,638	344,822	2,037	179,692	1,453	28,381	178	48,600	790	67,728	180	20,419	6,683,758
Manawatū District	5,041,472	3,280	257,223	895	77,448	699	12,233	125	33,766	1,427	118,320	134	15,456	5,298,695
Tararua District	61,994,142	2,869	318,000	841	93,580	655	16,841	146	41,145	1,141	151,720	86	14,713	62,312,142
Rangitīkei District	12,443,850	1,903	139,939	587	54,650	473	6,723	158	19,385	568	45,510	117	13,670	12,583,789
Ruapehu District	51,118,071	2,410	181,528	912	88,745	733	12,866	91	14,006	540	47,784	134	18,126	51,299,599

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.14: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	89,845,392	15,065	1,747,946	9,458	1,229,208	3,945	106,678	621	217,679	765	91,674	276	102,706	91,593,338
Whanganui District	137,110,424	8,525	809,837	4,199	487,137	2,817	48,367	506	151,991	716	56,722	287	65,619	137,920,261
Horowhenua District	8,867,587	4,993	419,509	2,084	197,768	1,474	30,007	180	50,328	1,068	120,336	187	21,069	9,287,096
Manawatū District	7,065,607	4,417	391,626	1,329	132,117	951	18,657	216	62,314	1,763	157,810	158	20,727	7,457,233
Tararua District	62,046,370	2,858	316,184	843	94,210	652	16,796	140	39,152	1,137	151,298	86	14,726	62,362,554
Rangitīkei District	12,603,057	2,094	172,839	626	69,001	493	6,979	168	20,435	680	62,146	127	14,276	12,775,896
Ruapehu District	51,229,745	2,474	184,949	946	91,799	763	13,144	93	14,052	540	47,788	132	18,126	51,414,694

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.15: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	40,412,750	11,478	1,263,686	6,827	763,503	3,095	72,286	656	265,628	686	76,703	214	85,564	41,676,436
Whanganui District	260,001,067	10,552	1,064,011	5,318	643,714	3,509	62,304	594	197,464	795	68,658	336	91,870	261,065,078
Horowhenua District	6,854,958	4,995	379,412	2,186	194,609	1,548	30,295	192	52,972	879	79,166	190	22,368	7,234,370
Manawatū District	6,330,437	3,594	295,329	959	85,792	761	14,013	148	40,217	1,588	138,899	138	16,408	6,625,766
Tararua District	88,858,806	3,015	306,547	855	85,899	671	15,022	153	38,063	1,243	152,940	93	14,620	89,165,353
Rangitīkei District	15,391,737	2,051	154,980	638	59,316	500	7,233	175	21,669	613	52,352	125	14,408	15,546,717
Ruapehu District	61,966,871	2,832	221,899	1,098	110,145	877	14,875	110	17,305	604	57,913	143	21,660	62,188,770

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

Table D1.16.16: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Down

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	134,361,622	18,758	2,217,133	11,822	1,568,032	5,060	128,297	689	273,157	843	100,812	344	146,833	136,578,755
Whanganui District	261,194,966	10,552	1,068,643	5,322	649,171	3,505	62,016	594	198,279	795	68,489	336	90,686	262,263,609
Horowhenua District	9,566,845	5,308	452,005	2,204	212,099	1,558	31,997	195	55,679	1,158	128,560	193	23,668	10,018,850
Manawatū District	7,888,866	4,680	412,695	1,428	139,296	1,019	19,845	229	62,852	1,846	169,276	158	21,424	8,301,561
Tararua District	91,372,533	3,238	358,595	939	113,750	737	19,981	184	40,164	1,278	167,721	100	16,978	91,731,128
Rangitīkei District	15,532,468	2,231	189,398	674	75,855	518	7,379	181	23,395	725	67,365	133	15,402	15,721,866
Ruapehu District	62,306,973	2,857	224,946	1,114	113,427	888	14,852	110	16,812	603	57,970	142	21,883	62,531,919

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.16.17: Estimated life cost, and cost to reinstate the proportion of buildings which were modelled to be affected by flooding, by building type, for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

District	Total life cost (000's NZD)	Total no. buildings for reinstatement costs (total buildings)	Total reinstatement cost for buildings (000's NZD)	Total no. of buildings for reinstatement costs (residential primary structures)	Total reinstatement cost for residential buildings (primary structures) (000's NZD)	Total no. of buildings for reinstatement costs (residential secondary structures)	Total reinstatement cost of residential buildings (secondary structures) (000's NZD)	Total no. of buildings for reinstatement costs (commercial/ industrial primary + secondary)	Total reinstatement cost of commercial/industrial buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (rural primary + secondary)	Total reinstatement cost of rural buildings (primary + secondary) (000's NZD)	Total no. of buildings for reinstatement costs (other primary + secondary)	Total reinstatement cost of other buildings (primary + secondary) (000's NZD)	Total cost (human fatalities + reinstatement cost for buildings) (000's NZD)
Palmerston North City	40,410,140	11,478	1,263,453	6,827	763,540	3,095	72,290	656	265,348	686	76,708	214	85,564	41,673,593
Whanganui District	262,913,986	10,728	1,079,969	5,381	651,764	3,586	61,344	622	207,373	795	68,456	344	91,029	263,993,955
Horowhenua District	6,948,947	5,104	388,914	2,257	204,914	1,594	30,902	192	53,017	868	78,026	193	22,052	7,337,861
Manawatū District	6,332,132	3,592	296,325	959	86,648	759	13,956	148	40,393	1,588	138,888	138	16,438	6,628,457
Tararua District	88,879,069	3,032	307,340	860	86,400	679	15,128	157	38,229	1,241	152,892	95	14,691	89,186,409
Rangitīkei District	15,411,310	2,060	155,198	643	59,550	504	7,225	175	21,669	613	52,344	125	14,408	15,566,508
Ruapehu District	61,966,870	2,832	221,899	1,098	110,145	877	14,875	110	17,305	604	57,913	143	21,660	62,188,769

*Refer to Table 7 for total population numbers

**Refer to Table 8 for fatality numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.1: Threat to human safety for each district in the Horizons Region - 5% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	14,336	78.47	21.40	0.03	0.06	0.04
Whanganui District	6,201	82.89	16.94	0.03	0.09	0.05
Horowhenua District	8,666	69.15	30.80	0.01	0.02	0.02
Manawatū District	2,874	89.03	10.90	0.02	0.00	0.06
Tararua District	1,889	87.72	12.10	0.03	0.08	0.07
Rangitīkei District	1,402	89.21	10.41	0.11	0.15	0.12
Ruapehu District	859	91.50	8.00	0.12	0.17	0.22

*Refer to Table 7 for total population numbers

Table D1.17.2: Threat to human safety for each district in the Horizons Region - 5% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	11,311	83.01	16.91	0.02	0.03	0.03
Whanganui District	6,145	83.04	16.79	0.03	0.09	0.05
Horowhenua District	8,828	68.56	31.41	0.01	0.02	0.00
Manawatū District	3,844	85.31	14.60	0.02	0.00	0.06
Tararua District	1,901	87.64	12.18	0.03	0.08	0.07
Rangitīkei District	1,490	88.53	11.05	0.11	0.15	0.16
Ruapehu District	856	91.53	7.97	0.12	0.17	0.22

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.3: Threat to human safety for each district in the Horizons Region - 2% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	15,599	76.57	23.26	0.04	0.05	0.07
Whanganui District	6,646	81.66	18.15	0.05	0.07	0.07
Horowhenua District	9,167	67.43	32.52	0.00	0.03	0.02
Manawatū District	3,193	87.80	12.08	0.04	0.01	0.07
Tararua District	2,104	86.32	13.47	0.06	0.03	0.12
Rangitīkei District	1,556	88.02	11.50	0.08	0.19	0.21
Ruapehu District	939	90.70	8.69	0.11	0.19	0.31

*Refer to Table 7 for total population numbers

Table D1.17.4: Threat to human safety for each district in the Horizons Region - 2% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	12,945	80.56	19.30	0.04	0.03	0.07
Whanganui District	6,626	81.71	18.10	0.04	0.07	0.07
Horowhenua District	9,356	66.74	33.23	0.00	0.03	0.00
Manawatū District	4,358	83.34	16.51	0.04	0.04	0.07
Tararua District	2,132	86.13	13.66	0.06	0.03	0.12
Rangitīkei District	1,648	87.29	12.21	0.09	0.19	0.21
Ruapehu District	928	90.81	8.58	0.11	0.19	0.31

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.5: Threat to human safety for each district in the Horizons Region - 1% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	16,382	75.40	24.30	0.12	0.09	0.09
Whanganui District	7,195	80.14	19.48	0.05	0.25	0.08
Horowhenua District	9,510	66.17	33.75	0.03	0.03	0.02
Manawatū District	3,491	86.66	13.16	0.03	0.08	0.08
Tararua District	2,285	85.14	14.59	0.12	0.01	0.14
Rangitīkei District	1,720	86.77	12.71	0.08	0.15	0.29
Ruapehu District	1,022	89.88	9.42	0.16	0.18	0.36

*Refer to Table 7 for total population numbers

Table D1.17.6: Threat to human safety for each district in the Horizons Region - 1% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	15,209	77.16	22.47	0.16	0.12	0.09
Whanganui District	7,181	80.18	19.44	0.05	0.25	0.08
Horowhenua District	9,688	65.52	34.42	0.04	0.03	0.00
Manawatū District	4,724	81.94	17.84	0.05	0.08	0.08
Tararua District	2,309	84.98	14.75	0.12	0.01	0.14
Rangitīkei District	1,790	86.23	13.21	0.09	0.18	0.29
Ruapehu District	1,008	90.02	9.29	0.16	0.18	0.36

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.7: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	17,039	74.41	24.81	0.26	0.31	0.22
Whanganui District	7,776	78.54	20.79	0.14	0.17	0.36
Horowhenua District	9,778	65.13	34.78	0.03	0.03	0.03
Manawatū District	3,822	85.38	14.30	0.15	0.06	0.11
Tararua District	2,466	83.97	15.59	0.22	0.08	0.14
Rangitīkei District	1,840	85.84	13.37	0.19	0.19	0.40
Ruapehu District	1,109	89.02	10.17	0.20	0.19	0.43

*Refer to Table 7 for total population numbers

Table D1.17.8: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Current Climate and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	17,901	73.12	25.70	0.44	0.50	0.24
Whanganui District	7,776	78.54	20.79	0.14	0.17	0.36
Horowhenua District	9,942	64.53	35.38	0.04	0.03	0.03
Manawatū District	5,049	80.68	18.91	0.20	0.09	0.13
Tararua District	2,485	83.79	15.77	0.22	0.08	0.14
Rangitīkei District	1,915	85.27	13.84	0.27	0.20	0.42
Ruapehu District	1,091	89.20	9.99	0.20	0.19	0.43

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.9: Threat to human safety for each district in the Horizons Region - 0.2% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	17,645	73.50	26.30	0.06	0.05	0.09
Whanganui District	9,931	72.59	25.34	0.51	0.80	0.75
Horowhenua District	10,104	63.95	36.00	0.00	0.02	0.03
Manawatū District	4,141	84.19	15.59	0.11	0.05	0.07
Tararua District	2,690	82.47	17.01	0.18	0.20	0.15
Rangitīkei District	2,246	82.77	15.91	0.30	0.35	0.66
Ruapehu District	1,367	86.49	12.25	0.28	0.34	0.65

*Refer to Table 7 for total population numbers

Table D1.17.10: Threat to human safety for each district in the Horizons Region - 0.1% AEP with Current Climate and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	18,133	72.77	27.02	0.08	0.04	0.10
Whanganui District	11,009	69.62	26.27	0.78	1.17	2.17
Horowhenua District	10,325	63.07	36.86	0.01	0.02	0.03
Manawatū District	4,394	83.23	16.51	0.11	0.07	0.08
Tararua District	2,860	81.36	18.01	0.22	0.16	0.25
Rangitīkei District	2,420	81.43	16.89	0.36	0.37	0.95
Ruapehu District	1,746	82.75	14.87	0.85	0.65	0.88

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.11: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	17,884	73.14	25.36	0.37	0.51	0.63
Whanganui District	9,264	74.43	24.05	0.46	0.37	0.69
Horowhenua District	10,162	63.54	36.32	0.05	0.05	0.04
Manawatū District	4,187	84.03	15.43	0.28	0.13	0.13
Tararua District	2,541	83.48	15.99	0.17	0.20	0.16
Rangitīkei District	1,961	84.98	13.82	0.30	0.26	0.63
Ruapehu District	1,425	85.89	12.75	0.31	0.37	0.68

*Refer to Table 7 for total population numbers

Table D1.17.12: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	21,400	67.86	29.76	0.67	0.87	0.85
Whanganui District	9,287	74.37	24.11	0.46	0.37	0.69
Horowhenua District	10,311	63.00	36.84	0.07	0.05	0.04
Manawatū District	5,367	79.51	19.88	0.30	0.15	0.16
Tararua District	2,684	82.50	16.98	0.17	0.20	0.15
Rangitīkei District	2,026	84.48	14.22	0.30	0.34	0.66
Ruapehu District	1,524	84.91	13.73	0.31	0.37	0.68

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.13: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	19,039	71.41	25.89	0.83	0.76	1.12
Whanganui District	10,768	70.28	26.04	0.78	1.12	1.79
Horowhenua District	10,551	62.09	37.63	0.15	0.10	0.04
Manawatū District	4,517	82.74	16.43	0.29	0.34	0.19
Tararua District	2,923	80.99	18.33	0.25	0.18	0.25
Rangitīkei District	2,063	84.24	14.33	0.33	0.28	0.82
Ruapehu District	1,906	81.13	14.39	1.32	1.68	1.47

*Refer to Table 7 for total population numbers

Table D1.17.14: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	27,713	58.38	37.29	1.38	1.28	1.68
Whanganui District	10,766	70.29	26.03	0.78	1.12	1.79
Horowhenua District	10,681	61.61	38.06	0.18	0.11	0.04
Manawatū District	5,668	78.34	20.75	0.31	0.36	0.24
Tararua District	2,953	80.78	18.54	0.25	0.18	0.25
Rangitīkei District	2,134	83.69	14.70	0.42	0.35	0.85
Ruapehu District	1,948	80.72	14.81	1.32	1.68	1.47

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.15: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	21,192	68.17	27.24	1.57	1.31	1.70
Whanganui District	12,553	65.36	28.27	1.32	1.50	3.54
Horowhenua District	11,002	60.48	39.05	0.25	0.15	0.07
Manawatū District	4,769	81.79	16.90	0.57	0.43	0.31
Tararua District	3,031	80.25	18.91	0.20	0.25	0.40
Rangitīkei District	2,190	83.24	14.97	0.39	0.43	0.97
Ruapehu District	2,135	78.87	13.03	1.32	2.71	4.08

*Refer to Table 7 for total population numbers

Table D1.17.16: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Down

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	32,038	51.88	41.42	2.17	2.00	2.52
Whanganui District	12,551	65.36	28.27	1.32	1.50	3.54
Horowhenua District	11,124	60.03	39.41	0.33	0.16	0.07
Manawatū District	5,883	77.52	21.08	0.57	0.46	0.37
Tararua District	3,158	79.40	19.77	0.20	0.25	0.38
Rangitīkei District	2,275	82.58	15.40	0.49	0.47	1.06
Ruapehu District	2,160	78.62	13.30	1.32	2.71	4.05

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.17.17: Threat to human safety for each district in the Horizons Region - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

District	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety	% of population with extreme threat to human safety
Palmerston North City	21,192	68.17	27.24	1.57	1.31	1.70
Whanganui District	12,661	65.06	28.56	1.32	1.51	3.55
Horowhenua District	11,032	60.37	39.16	0.25	0.15	0.07
Manawatū District	4,769	81.79	16.90	0.57	0.43	0.31
Tararua District	3,036	80.21	18.93	0.20	0.25	0.41
Rangitīkei District	2,189	83.21	14.99	0.39	0.43	0.97
Ruapehu District	2,135	78.87	13.03	1.32	2.71	4.08

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.1: Threat to human safety for each town/settlement in the Horizons Region - 5% AEP with Current Climate and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	13,698	77	22	0	0
Whanganui	6,069	81	18	0	0
Levin	6,646	59	40	0	0
Feilding	1,633	88	11	0	0
Dannevirke	382	93	6	0	0
Marton	670	87	12	0	0
Taumarunui	334	91	8	0	0
Ashhurst	478	86	13	0	0
Pahiatua	657	79	20	0	0
Foxton	976	68	31	0	0
Taihape	46	97	1	0	0
Bulls	284	85	13	0	0
Bunnythorpe	92	94	5	0	0
Shannon	114	93	6	0	0
Foxton Beach	368	78	21	0	0
Woodville	518	69	30	0	0
Rongotea	169	88	11	0	0
Linton	45	96	3	0	0
Halcombe	40	97	2	0	0
Ohakune	189	84	14	1	0
Eketāhuna	55	95	4	0	0
Raetihi	120	88	11	0	0
Hunterville	101	89	10	0	0
Sanson	47	94	5	0	0
Ōhau	69	92	7	0	0
Tokomaru	53	93	5	0	0
Kairanga	137	82	17	0	0
Manakau	97	86	13	0	0
Pohangina	51	92	6	0	0
Waitārere Beach	108	83	16	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	76	85	14	0	0
Longburn	74	85	14	0	0
Waiouru	20	96	3	0	0
Tangimoana	155	69	30	0	0
Ormondville	14	96	3	0	0
Hokio Beach	38	90	9	0	0
Norsewood	33	91	8	0	0
Kimbolton	21	94	5	0	0
Ōwhango	22	93	6	0	0
Rātana	66	80	19	0	0
Mangaweka	15	95	4	0	0
Ohakea	26	91	9	0	0
Pongaroa	19	93	6	0	0
Ōhura	11	95	4	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	23	86	10	0	2
Waikawa Beach	9	94	5	0	0
Mangamutu	10	93	6	0	0
Koitiata	45	66	33	0	0
Raurimu	8	93	6	0	0
Other	1,246	91	8	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.2: Threat to human safety for each town/settlement in the Horizons Region - 5% AEP with Current Climate and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	10,672	82	17	0	0
Whanganui	6,013	81	18	0	0
Levin	6,646	59	40	0	0
Feilding	2,339	83	16	0	0
Dannevirke	382	93	6	0	0
Marton	713	87	12	0	0
Taumarunui	331	91	8	0	0
Ashhurst	456	87	12	0	0
Pahiatua	656	79	20	0	0
Foxton	985	67	32	0	0
Taihape	46	97	1	0	0
Bulls	288	85	14	0	0
Bunnythorpe	92	94	5	0	0
Shannon	120	92	7	0	0
Foxton Beach	361	78	21	0	0
Woodville	531	68	30	0	0
Rongotea	227	84	15	0	0
Linton	49	96	3	0	0
Halcombe	40	97	2	0	0
Ohakune	189	84	14	1	0
Eketāhuna	55	95	4	0	0
Raetihi	120	88	11	0	0
Hunterville	117	87	11	0	0
Sanson	47	94	5	0	0
Ōhau	68	92	7	0	0
Tokomaru	57	93	6	0	0
Kairanga	258	67	32	0	0
Manakau	97	86	13	0	0
Pohangina	51	92	6	0	0
Waitārere Beach	108	83	16	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	76	85	14	0	0
Longburn	88	83	16	0	0
Waiouru	20	96	3	0	0
Tangimoana	135	73	26	0	0
Ormondville	14	96	3	0	0
Hokio Beach	38	90	9	0	0
Norsewood	33	91	8	0	0
Kimbolton	21	94	5	0	0
Ōwhango	22	93	6	0	0
Rātana	66	80	19	0	0
Mangaweka	15	95	4	0	0
Ohakea	26	91	9	0	0
Pongaroa	19	93	6	0	0
Ōhura	11	95	4	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	23	86	10	0	2
Waikawa Beach	9	94	5	0	0
Mangamutu	10	93	6	0	0
Koitiata	45	66	33	0	0
Raurimu	8	93	6	0	0
Other	1,532	89	10	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.3: Threat to human safety for each town/settlement in the Horizons Region - 2% AEP with Current Climate and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	14,892	75	24	0	0
Whanganui	6,498	80	19	0	0
Levin	7,019	56	43	0	0
Feilding	1,805	87	12	0	0
Dannevirke	404	93	6	0	0
Marton	756	86	13	0	0
Taumarunui	364	90	9	0	0
Ashhurst	524	85	14	0	0
Pahiatua	703	77	22	0	0
Foxton	1,011	66	33	0	0
Taihape	46	97	1	0	0
Bulls	315	84	15	0	0
Bunnythorpe	107	93	6	0	0
Shannon	122	92	7	0	0
Foxton Beach	384	77	22	0	0
Woodville	660	61	38	0	0
Rongotea	198	86	13	0	0
Linton	51	96	3	0	0
Halcombe	40	97	2	0	0
Ohakune	217	81	16	0	0
Eketāhuna	69	93	6	0	0
Raetihi	127	87	12	0	0
Hunterville	115	88	11	0	0
Sanson	49	94	5	0	0
Ōhau	76	91	8	0	0
Tokomaru	57	93	6	0	0
Kairanga	178	77	22	0	0
Manakau	101	86	13	0	0
Pohangina	53	92	6	0	0
Waitārere Beach	129	79	20	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	79	84	15	0	0
Longburn	82	84	15	0	0
Waiouru	20	96	3	0	0
Tangimoana	167	66	33	0	0
Ormondville	14	96	3	0	0
Hokio Beach	49	88	11	0	0
Norsewood	37	90	9	0	0
Kimbolton	21	94	5	0	0
Ōwhango	26	92	7	0	0
Rātana	68	79	20	0	0
Mangaweka	16	94	5	0	0
Ohakea	26	91	9	0	0
Pongaroa	17	93	4	0	0
Ōhura	12	94	5	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	9	94	5	0	0
Mangamutu	10	93	6	0	0
Koitiata	45	66	33	0	0
Raurimu	9	92	7	0	0
Other	1,355	90	8	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.4: Threat to human safety for each town/settlement in the Horizons Region - 2% AEP with Current Climate and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	12,217	79	19	0	0
Whanganui	6,478	80	19	0	0
Levin	7,019	56	43	0	0
Feilding	2,603	81	18	0	0
Dannevirke	404	93	6	0	0
Marton	801	85	14	0	0
Taumarunui	353	90	8	0	0
Ashhurst	501	85	14	0	0
Pahiatua	702	77	22	0	0
Foxton	1,027	66	33	0	0
Taihape	46	97	1	0	0
Bulls	315	84	15	0	0
Bunnythorpe	107	93	6	0	0
Shannon	130	92	7	0	0
Foxton Beach	377	77	22	0	0
Woodville	690	59	40	0	0
Rongotea	247	83	16	0	0
Linton	62	95	4	0	0
Halcombe	40	97	2	0	0
Ohakune	217	81	16	0	0
Eketāhuna	69	93	6	0	0
Raetihi	127	87	12	0	0
Hunterville	127	86	13	0	0
Sanson	49	94	5	0	0
Ōhau	76	91	8	0	0
Tokomaru	57	93	6	0	0
Kairanga	309	60	39	0	0
Manakau	101	86	13	0	0
Pohangina	53	92	6	0	0
Waitārere Beach	129	79	20	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	79	84	15	0	0
Longburn	106	79	20	0	0
Waiouru	20	96	3	0	0
Tangimoana	208	58	41	0	0
Ormondville	14	96	3	0	0
Hokio Beach	49	88	11	0	0
Norsewood	37	90	9	0	0
Kimbolton	21	94	5	0	0
Ōwhango	26	92	7	0	0
Rātana	68	79	20	0	0
Mangaweka	16	94	5	0	0
Ohakea	26	91	9	0	0
Pongaroa	17	93	4	0	0
Ōhura	12	94	5	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	9	94	5	0	0
Mangamutu	10	93	6	0	0
Koitiata	45	66	33	0	0
Raurimu	9	92	7	0	0
Other	1,716	88	11	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.5: Threat to human safety for each town/settlement in the Horizons Region - 1% AEP with Current Climate and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	15,617	74	25	0	0
Whanganui	7,003	78	20	0	0
Levin	7,253	55	44	0	0
Feilding	1,949	85	14	0	0
Dannevirke	436	92	6	0	0
Marton	840	84	14	0	0
Taumarunui	392	89	9	0	0
Ashhurst	556	84	15	0	0
Pahiatua	722	77	22	0	0
Foxton	1,042	65	34	0	0
Taihape	50	97	1	0	0
Bulls	339	82	16	0	0
Bunnythorpe	108	93	6	0	0
Shannon	122	92	7	0	0
Foxton Beach	394	76	23	0	0
Woodville	775	54	44	0	0
Rongotea	204	86	13	0	0
Linton	56	95	4	0	0
Halcombe	47	96	3	0	0
Ohakune	239	80	17	1	0
Eketāhuna	73	93	6	0	0
Raetihi	137	86	13	0	0
Hunterville	124	87	12	0	0
Sanson	56	93	6	0	0
Ōhau	76	91	8	0	0
Tokomaru	57	93	6	0	0
Kairanga	228	71	28	0	0
Manakau	108	85	14	0	0
Pohangina	57	91	6	0	0
Waitārere Beach	138	78	21	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	85	83	16	0	0
Longburn	94	81	17	0	0
Waiouru	20	96	3	0	0
Tangimoana	184	63	36	0	0
Ormondville	14	96	3	0	0
Hokio Beach	51	87	12	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	26	92	7	0	0
Rātana	68	79	20	0	0
Mangaweka	16	94	5	0	0
Ohakea	26	91	7	0	1
Pongaroa	16	94	5	0	0
Ōhura	12	94	5	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	13	91	8	0	0
Mangamutu	10	93	6	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	1,579	88	10	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.6: Threat to human safety for each town/settlement in the Horizons Region - 1% AEP with Current Climate and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	14,433	76	23	0	0
Whanganui	6,991	78	20	0	0
Levin	7,253	55	44	0	0
Feilding	2,778	80	19	0	0
Dannevirke	436	92	6	0	0
Marton	858	84	15	0	0
Taumarunui	378	89	9	0	0
Ashhurst	521	85	14	0	0
Pahiatua	718	77	22	0	0
Foxton	1,058	65	34	0	0
Taihape	50	97	1	0	0
Bulls	339	82	16	0	0
Bunnythorpe	108	93	6	0	0
Shannon	133	92	7	0	0
Foxton Beach	386	77	22	0	0
Woodville	807	52	46	0	0
Rongotea	266	81	18	0	0
Linton	72	94	5	0	0
Halcombe	47	96	3	0	0
Ohakune	239	80	17	1	0
Eketāhuna	73	93	6	0	0
Raetihi	137	86	13	0	0
Hunterville	149	84	15	0	0
Sanson	56	93	6	0	0
Ōhau	76	91	8	0	0
Tokomaru	57	93	6	0	0
Kairanga	357	54	45	0	0
Manakau	108	85	14	0	0
Pohangina	57	91	6	0	0
Waitārere Beach	138	78	21	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	85	83	16	0	0
Longburn	118	77	22	0	0
Waiouru	20	96	3	0	0
Tangimoana	261	48	51	0	0
Ormondville	14	96	3	0	0
Hokio Beach	51	87	12	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	26	92	7	0	0
Rātana	68	79	20	0	0
Mangaweka	16	94	5	0	0
Ohakea	26	91	7	0	1
Pongaroa	16	94	5	0	0
Ōhura	12	94	5	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	13	91	8	0	0
Mangamutu	10	93	6	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	1,901	86	12	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.7: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Current Climate and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	16,236	73	25	0	0
Whanganui	7,505	77	22	0	0
Levin	7,419	54	45	0	0
Feilding	2,052	85	14	0	0
Dannevirke	448	92	7	0	0
Marton	878	84	15	0	0
Taumarunui	423	88	10	0	0
Ashhurst	586	83	16	0	0
Pahiatua	760	75	24	0	0
Foxton	1,057	65	34	0	0
Taihape	55	97	2	0	0
Bulls	369	81	17	0	0
Bunnythorpe	109	93	6	0	0
Shannon	133	92	7	0	0
Foxton Beach	402	76	23	0	0
Woodville	906	46	51	1	0
Rongotea	222	84	15	0	0
Linton	58	95	4	0	0
Halcombe	57	95	4	0	0
Ohakune	249	79	17	1	1
Eketāhuna	71	93	6	0	0
Raetihi	150	85	14	0	0
Hunterville	137	85	14	0	0
Sanson	56	93	6	0	0
Ōhau	83	90	9	0	0
Tokomaru	57	93	6	0	0
Kairanga	287	63	36	0	0
Manakau	119	84	15	0	0
Pohangina	76	89	9	0	0
Waitārere Beach	147	77	22	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	86	83	16	0	0
Longburn	102	80	17	1	0
Waiouru	20	96	3	0	0
Tangimoana	238	52	44	2	0
Ormondville	14	96	3	0	0
Hokio Beach	59	85	14	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	26	92	7	0	0
Rātana	68	79	20	0	0
Mangaweka	20	93	6	0	0
Ohakea	41	85	14	0	0
Pongaroa	16	94	5	0	0
Ōhura	12	94	5	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	13	91	8	0	0
Mangamutu	10	93	6	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	1,805	87	11	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.8: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Current Climate and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	17,091	71	26	0	0
Whanganui	7,507	77	22	0	0
Levin	7,419	54	45	0	0
Feilding	2,945	78	21	0	0
Dannevirke	448	92	7	0	0
Marton	891	83	15	0	0
Taumarunui	405	89	10	0	0
Ashhurst	551	84	15	0	0
Pahiatua	758	75	24	0	0
Foxton	1,075	64	35	0	0
Taihape	55	97	2	0	0
Bulls	369	81	17	0	0
Bunnythorpe	109	93	6	0	0
Shannon	143	91	8	0	0
Foxton Beach	393	77	23	0	0
Woodville	928	45	53	1	0
Rongotea	271	81	18	0	0
Linton	75	94	5	0	0
Halcombe	57	95	4	0	0
Ohakune	249	79	17	1	1
Eketāhuna	71	93	6	0	0
Raetihi	150	85	14	0	0
Hunterville	166	82	17	0	0
Sanson	56	93	6	0	0
Ōhau	82	90	9	0	0
Tokomaru	57	93	6	0	0
Kairanga	395	49	49	0	0
Manakau	119	84	15	0	0
Pohangina	76	89	9	0	0
Waitārere Beach	147	77	22	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	23	95	3	0	0
Himatangi Beach	86	83	16	0	0
Longburn	116	77	20	1	0
Waiouru	20	96	3	0	0
Tangimoana	283	43	53	2	0
Ormondville	14	96	3	0	0
Hokio Beach	59	85	14	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	26	92	7	0	0
Rātana	68	79	20	0	0
Mangaweka	20	93	6	0	0
Ohakea	37	87	12	0	0
Pongaroa	16	94	5	0	0
Ōhura	12	94	5	0	0
National Park	12	93	6	0	0
Rangataua	15	91	7	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	13	91	8	0	0
Mangamutu	10	93	6	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	2,128	85	13	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.9: Threat to human safety for each town/settlement in the Horizons Region - 0.2% AEP with Current Climate and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	16,774	72	27	0	0
Whanganui	9,548	70	27	0	0
Levin	7,622	52	47	0	0
Feilding	2,196	84	15	0	0
Dannevirke	491	92	7	0	0
Marton	1,001	81	17	0	0
Taumarunui	557	85	13	0	0
Ashhurst	628	82	17	0	0
Pahiatua	801	74	25	0	0
Foxton	1,112	63	36	0	0
Taihape	84	96	3	0	0
Bulls	560	71	26	0	0
Bunnythorpe	102	94	5	0	0
Shannon	142	91	8	0	0
Foxton Beach	422	75	24	0	0
Woodville	1,014	40	57	0	1
Rongotea	219	85	14	0	0
Linton	61	95	4	0	0
Halcombe	98	92	7	0	0
Ohakune	283	76	20	0	1
Eketāhuna	73	93	6	0	0
Raetihi	168	83	16	0	0
Hunterville	163	83	16	0	0
Sanson	58	93	6	0	0
Ōhau	91	89	10	0	0
Tokomaru	57	93	6	0	0
Kairanga	293	62	37	0	0
Manakau	123	83	16	0	0
Pohangina	81	88	9	0	0
Waitārere Beach	171	73	26	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	102	80	19	0	0
Longburn	120	76	22	0	0
Waiouru	25	95	4	0	0
Tangimoana	316	37	62	0	0
Ormondville	14	96	3	0	0
Hokio Beach	66	83	16	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	5	1	0
Ōwhango	26	92	7	0	0
Rātana	76	79	20	0	0
Mangaweka	20	93	6	0	0
Ohakea	63	78	20	0	1
Pongaroa	33	88	11	0	0
Ōhura	20	90	9	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	24	86	11	0	0
Waikawa Beach	16	89	10	0	0
Mangamutu	10	93	6	0	0
Koitiata	45	66	33	0	0
Raurimu	9	92	7	0	0
Other	2,032	85	12	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.10: Threat to human safety for each town/settlement in the Horizons Region - 0.1% AEP with Current Climate and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	17,239	71	28	0	0
Whanganui	10,522	68	28	0	1
Levin	7,764	51	48	0	0
Feilding	2,298	83	16	0	0
Dannevirke	517	91	8	0	0
Marton	1,110	79	19	0	0
Taumarunui	882	76	19	1	0
Ashhurst	643	81	18	0	0
Pahiatua	828	73	26	0	0
Foxton	1,131	63	36	0	0
Taihape	84	96	3	0	0
Bulls	581	70	27	0	0
Bunnythorpe	109	93	6	0	0
Shannon	148	91	8	0	0
Foxton Beach	444	73	26	0	0
Woodville	1,095	35	62	0	1
Rongotea	221	85	14	0	0
Linton	68	95	4	0	0
Halcombe	113	91	8	0	0
Ohakune	302	74	21	0	2
Eketāhuna	73	93	6	0	0
Raetihi	179	82	17	0	0
Hunterville	192	80	18	0	0
Sanson	58	93	6	0	0
Ōhau	97	88	11	0	0
Tokomaru	57	93	6	0	0
Kairanga	321	59	40	0	0
Manakau	129	82	16	0	0
Pohangina	81	88	9	0	0
Waitārere Beach	171	73	26	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	113	78	21	0	0
Longburn	120	76	23	0	0
Waiouru	26	95	4	0	0
Tangimoana	321	36	63	0	0
Ormondville	14	96	3	0	0
Hokio Beach	66	83	16	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	5	1	0
Ōwhango	26	92	7	0	0
Rātana	76	79	20	0	0
Mangaweka	23	92	7	0	0
Ohakea	72	75	21	1	0
Pongaroa	40	85	13	0	0
Ōhura	23	89	10	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	25	85	10	1	0
Waikawa Beach	16	89	10	0	0
Mangamutu	23	85	14	0	0
Koitiata	45	66	33	0	0
Raurimu	9	92	7	0	0
Other	2,278	84	12	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.11: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	17,005	72	26	0	0
Whanganui	8,905	72	25	0	0
Levin	7,677	52	47	0	0
Feilding	2,211	84	15	0	0
Dannevirke	489	92	7	0	0
Marton	914	83	16	0	0
Taumarunui	628	83	15	0	0
Ashhurst	638	81	18	0	0
Pahiatua	809	74	25	0	0
Foxton	1,098	64	35	0	0
Taihape	55	97	2	0	0
Bulls	395	80	18	0	0
Bunnythorpe	109	93	6	0	0
Shannon	145	91	8	0	0
Foxton Beach	415	75	24	0	0
Woodville	847	50	47	1	1
Rongotea	234	84	15	0	0
Linton	70	94	5	0	0
Halcombe	54	95	4	0	0
Ohakune	278	76	19	0	1
Eketāhuna	83	92	6	0	0
Raetihi	168	83	16	0	0
Hunterville	162	83	16	0	0
Sanson	64	92	7	0	0
Ōhau	91	89	10	0	0
Tokomaru	57	93	6	0	0
Kairanga	338	57	42	0	0
Manakau	123	83	16	0	0
Pohangina	77	89	9	0	0
Waitārere Beach	164	74	25	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	25	95	3	0	0
Himatangi Beach	98	81	18	0	0
Longburn	120	76	21	1	0
Waiouru	21	95	4	0	0
Tangimoana	268	46	45	5	2
Ormondville	14	96	3	0	0
Hokio Beach	66	83	16	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	26	92	7	0	0
Rātana	76	79	20	0	0
Mangaweka	20	93	6	0	0
Ohakea	65	77	21	1	0
Pongaroa	33	88	11	0	0
Ōhura	16	92	7	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	22	87	10	0	0
Waikawa Beach	16	89	10	0	0
Mangamutu	10	93	6	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	2,074	85	12	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.12: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +1°C and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	20,530	66	31	0	0
Whanganui	8,928	72	25	0	0
Levin	7,677	52	47	0	0
Feilding	3,133	77	22	0	0
Dannevirke	491	92	7	0	0
Marton	931	83	16	0	0
Taumarunui	727	80	17	0	0
Ashhurst	607	82	17	0	0
Pahiatua	795	74	25	0	0
Foxton	1,109	63	36	0	0
Taihape	55	97	2	0	0
Bulls	398	79	18	0	0
Bunnythorpe	109	93	6	0	0
Shannon	160	90	9	0	0
Foxton Beach	399	76	23	0	0
Woodville	1,013	39	57	1	1
Rongotea	289	80	19	0	0
Linton	85	93	6	0	0
Halcombe	54	95	4	0	0
Ohakune	278	76	19	0	1
Eketāhuna	73	93	6	0	0
Raetihi	168	83	16	0	0
Hunterville	174	82	17	0	0
Sanson	64	92	7	0	0
Ōhau	90	89	10	0	0
Tokomaru	57	93	6	0	0
Kairanga	411	47	51	0	0
Manakau	123	83	16	0	0
Pohangina	77	89	9	0	0
Waitārere Beach	164	74	25	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	25	95	3	0	0
Himatangi Beach	98	81	18	0	0
Longburn	116	77	20	1	0
Waiouru	21	95	4	0	0
Tangimoana	295	41	50	5	2
Ormondville	14	96	3	0	0
Hokio Beach	66	83	16	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	26	92	7	0	0
Rātana	76	79	20	0	0
Mangaweka	20	93	6	0	0
Ohakea	65	77	21	1	0
Pongaroa	33	88	11	0	0
Ōhura	16	92	7	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	24	86	11	0	0
Waikawa Beach	16	89	10	0	0
Mangamutu	10	93	6	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	2,358	83	14	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.13: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	18,121	70	26	0	0
Whanganui	10,312	68	27	0	1
Levin	7,936	50	49	0	0
Feilding	2,350	83	16	0	0
Dannevirke	531	91	8	0	0
Marton	958	82	16	0	0
Taumarunui	1,029	72	18	2	3
Ashhurst	669	81	18	0	0
Pahiatua	838	73	26	0	0
Foxton	1,121	63	36	0	0
Taihape	55	97	2	0	0
Bulls	421	78	19	0	0
Bunnythorpe	115	93	6	0	0
Shannon	162	90	9	0	0
Foxton Beach	448	73	26	0	0
Woodville	1,101	35	61	1	1
Rongotea	263	82	17	0	0
Linton	75	94	5	0	0
Halcombe	54	95	3	0	0
Ohakune	304	74	21	0	2
Eketāhuna	87	92	7	0	0
Raetihi	184	82	17	0	0
Hunterville	176	81	17	0	0
Sanson	64	92	7	0	0
Ōhau	97	88	11	0	0
Tokomaru	57	93	6	0	0
Kairanga	392	50	48	1	0
Manakau	136	81	17	0	0
Pohangina	84	88	9	0	0
Waitārere Beach	171	73	26	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	105	80	19	0	0
Longburn	120	76	18	2	1
Waiouru	21	95	4	0	0
Tangimoana	290	42	40	8	7
Ormondville	14	96	3	0	0
Hokio Beach	66	83	16	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	29	91	8	0	0
Rātana	76	79	20	0	0
Mangaweka	23	92	7	0	0
Ohakea	75	74	23	0	2
Pongaroa	40	85	13	0	0
Ōhura	23	89	10	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	31	82	13	1	0
Waikawa Beach	16	89	10	0	0
Mangamutu	33	78	21	0	0
Koitiata	49	66	33	0	0
Raurimu	9	92	7	0	0
Other	2,322	83	12	0	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.14: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +2°C and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	26,805	55	39	1	1
Whanganui	10,312	68	27	0	1
Levin	7,936	50	49	0	0
Feilding	3,312	76	23	0	0
Dannevirke	533	91	8	0	0
Marton	985	82	17	0	0
Taumarunui	1,065	71	19	2	3
Ashhurst	640	81	18	0	0
Pahiatua	847	73	26	0	0
Foxton	1,128	63	36	0	0
Taihape	55	97	2	0	0
Bulls	422	78	19	0	0
Bunnythorpe	115	93	6	0	0
Shannon	177	89	10	0	0
Foxton Beach	416	75	24	0	0
Woodville	1,114	34	62	1	1
Rongotea	298	79	20	0	0
Linton	87	93	6	0	0
Halcombe	54	95	3	0	0
Ohakune	304	74	21	0	2
Eketāhuna	87	92	7	0	0
Raetihi	184	82	17	0	0
Hunterville	183	81	18	0	0
Sanson	64	92	7	0	0
Ōhau	96	89	10	0	0
Tokomaru	58	92	6	0	0
Kairanga	429	45	52	1	0
Manakau	136	81	17	0	0
Pohangina	84	88	9	0	0
Waitārere Beach	171	73	26	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	105	80	19	0	0
Longburn	116	77	17	2	1
Waiouru	21	95	4	0	0
Tangimoana	309	38	44	8	7
Ormondville	14	96	3	0	0
Hokio Beach	66	83	16	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	7	0	0
Ōwhango	29	91	8	0	0
Rātana	76	79	20	0	0
Mangaweka	23	92	7	0	0
Ohakea	75	74	23	0	2
Pongaroa	40	85	13	0	0
Ōhura	23	89	10	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	33	81	14	1	0
Waikawa Beach	16	89	10	0	0
Mangamutu	42	72	27	0	0
Koitiata	49	66	33	0	0
Raurimu	15	88	12	0	0
Other	2,600	81	14	1	0

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.15: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	20,238	66	28	1	1
Whanganui	12,027	63	30	1	1
Levin	8,255	48	51	0	0
Feilding	2,489	82	17	0	0
Dannevirke	582	90	9	0	0
Marton	1,038	81	18	0	0
Taumarunui	1,199	67	15	2	5
Ashhurst	704	80	19	0	0
Pahiatua	891	71	28	0	0
Foxton	1,148	62	37	0	0
Taihape	55	97	2	0	0
Bulls	445	77	20	0	0
Bunnythorpe	129	92	7	0	0
Shannon	172	89	9	0	0
Foxton Beach	477	71	27	0	0
Woodville	1,031	39	57	1	0
Rongotea	274	81	18	0	0
Linton	77	94	5	0	0
Halcombe	54	95	3	0	0
Ohakune	316	73	21	0	1
Eketāhuna	99	91	8	0	0
Raetihi	188	81	17	0	0
Hunterville	184	81	17	0	0
Sanson	64	92	7	0	0
Ōhau	110	87	12	0	0
Tokomaru	57	93	6	0	0
Kairanga	413	47	48	3	0
Manakau	143	80	18	0	0
Pohangina	85	87	9	0	0
Waitārere Beach	182	71	28	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	109	79	20	0	0
Longburn	116	77	16	2	2
Waiouru	24	95	4	0	0
Tangimoana	303	40	28	15	11
Ormondville	25	94	4	0	1
Hokio Beach	75	81	18	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	5	1	0
Ōwhango	29	91	8	0	0
Rātana	76	79	20	0	0
Mangaweka	23	92	7	0	0
Ohakea	79	72	24	0	1
Pongaroa	45	84	15	0	0
Ōhura	23	89	10	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	45	74	22	0	0
Waikawa Beach	21	86	13	0	0
Mangamutu	41	73	26	0	0
Koitiata	49	66	33	0	0
Raurimu	15	88	12	0	0
Other	2,534	82	12	1	1

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.16: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +3°C and Defences Down

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	31,087	48	43	2	2
Whanganui	12,027	63	30	1	1
Levin	8,255	48	51	0	0
Feilding	3,458	75	24	0	0
Dannevirke	584	90	9	0	0
Marton	1,080	80	19	0	0
Taumarunui	1,224	67	15	2	5
Ashhurst	679	80	18	0	0
Pahiatua	892	71	28	0	0
Foxton	1,161	62	37	0	0
Taihape	55	97	2	0	0
Bulls	446	77	20	0	0
Bunnythorpe	129	92	7	0	0
Shannon	184	89	9	0	0
Foxton Beach	424	75	24	0	0
Woodville	1,167	30	65	1	0
Rongotea	307	79	20	0	0
Linton	87	93	6	0	0
Halcombe	54	95	3	0	0
Ohakune	316	73	21	0	1
Eketāhuna	89	92	7	0	0
Raetihi	188	81	17	0	0
Hunterville	188	80	18	0	0
Sanson	64	92	7	0	0
Ōhau	109	87	12	0	0
Tokomaru	58	92	6	0	0
Kairanga	438	44	52	3	0
Manakau	143	80	18	0	0
Pohangina	85	87	9	0	0
Waitārere Beach	182	71	28	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	109	79	20	0	0
Longburn	120	76	16	2	2
Waiouru	24	95	4	0	0
Tangimoana	316	37	31	15	11
Ormondville	25	94	4	0	1
Hokio Beach	75	81	18	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	5	1	0
Ōwhango	29	91	8	0	0
Rātana	76	79	20	0	0
Mangaweka	23	92	7	0	0
Ohakea	79	72	24	0	1
Pongaroa	45	84	15	0	0
Ōhura	23	89	10	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	46	73	22	0	0
Waikawa Beach	21	86	13	0	0
Mangamutu	44	71	28	0	0
Koitiata	49	66	33	0	0
Raurimu	15	88	12	0	0
Other	2,796	80	13	1	1

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D1.18.17: Threat to human safety for each town/settlement in the Horizons Region - 0.5% AEP with Climate Warming +3°C + SLR and Defences Up

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Palmerston North	20,238	66	28	1	1
Whanganui	12,135	63	30	1	1
Levin	8,255	48	51	0	0
Feilding	2,489	82	17	0	0
Dannevirke	582	90	9	0	0
Marton	1,038	81	18	0	0
Taumarunui	1,199	67	15	2	5
Ashhurst	704	80	19	0	0
Pahiatua	891	71	28	0	0
Foxton	1,144	62	37	0	0
Taihape	55	97	2	0	0
Bulls	445	77	20	0	0
Bunnythorpe	129	92	7	0	0
Shannon	169	90	9	0	0
Foxton Beach	523	69	30	0	0
Woodville	1,031	39	57	1	0
Rongotea	274	81	18	0	0
Linton	77	94	5	0	0
Halcombe	54	95	3	0	0
Ohakune	316	73	21	0	1
Eketāhuna	99	91	8	0	0
Raetihi	188	81	17	0	0
Hunterville	184	81	17	0	0
Sanson	64	92	7	0	0
Ōhau	110	87	12	0	0
Tokomaru	57	93	6	0	0
Kairanga	413	47	48	3	0
Manakau	143	80	18	0	0
Pohangina	85	87	9	0	0
Waitārere Beach	173	73	26	0	0

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Town/Settlement	Total number of resident population exposed to flooding	% of population with no threat to human safety	% of population with low threat to human safety	% of population with moderate threat to human safety	% of population with significant threat to human safety
Kai Iwi	21	96	2	0	0
Himatangi Beach	109	79	20	0	0
Longburn	116	77	16	2	2
Waiouru	24	95	4	0	0
Tangimoana	303	40	28	15	11
Ormondville	25	94	4	0	1
Hokio Beach	75	81	18	0	0
Norsewood	37	90	9	0	0
Kimbolton	26	92	5	1	0
Ōwhango	29	91	8	0	0
Rātana	76	79	20	0	0
Mangaweka	23	92	7	0	0
Ohakea	79	72	24	0	1
Pongaroa	45	84	15	0	0
Ōhura	23	89	10	0	0
National Park	12	93	6	0	0
Rangataua	18	90	8	0	0
Mangatainoka	45	74	22	0	0
Waikawa Beach	21	86	13	0	0
Mangamutu	41	73	26	0	0
Koitiata	48	64	35	0	0
Raurimu	15	88	12	0	0
Other	2,539	82	12	1	1

*Refer to Table 7 for total population numbers

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

APPENDIX D2 (APPENDIX B) – REGIONAL RESULTS

Table D2.1a: Horizons Regional Summary By District – Current Climate (0°C) and Existing Flood Defences Up

Region/ District*	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**41,070**	**17,543**	**1,487,582**	**36,227**	**40,407.3**	**44,732**	**20,145**	**1,742,119**	**39,204**	**58,573**	**47,720**	**22,380**	**1,911,613**	**41,605**	**72,135.1**
Palmerston North City	11,703	6,600	675,595	14,336	18,040.4	12,779	7,445	775,444	15,599	21,276.1	13,485	7,957	794,946	16,382	23,063.5
Whanganui District	6,905	3,364	272,136	6,201	6,028.6	7,437	3,731	313,541	6,646	6,793.2	8,007	4,140	354,095	7,195	9,589.8
Horowhenua District	10,257	2,808	188,750	8,666	4,114.6	10,937	3,305	219,494	9,167	4,605	11,431	3,682	245,422	9,510	5,011.9
Manawatū District	4,410	1,380	99,879	2,874	1,444.8	4,955	1,664	121,735	3,193	1,789.5	5,467	2,007	149,008	3,491	2,266.5
Tararua District	3,410	1,528	142,249	1,889	3,770.3	3,784	1,827	175,790	2,104	5,755	4,055	2,077	207,794	2,285	7,726
Rangitīkei District	2,390	963	54,824	1,402	1,211.6	2,637	1,127	67,346	1,556	1,487.4	2,895	1,323	82,764	1,720	5,803.1
Ruapehu District	1,995	900	54,149	859	5,797	2,203	1,046	68,769	939	16,866.8	2,380	1,194	77,584	1,022	18,674.3

*Districts are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

Table D2.1b: Horizons Regional Summary By District – Current Climate (0°C) and Existing Flood Defences Up

Region/ District*	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**50,760**	**24,816**	**2,168,357**	**43,830**	**88,912**	**56,446**	**30,334**	**2,674,587**	**48,124**	**168,752**	**59,955**	**33,491**	**3,063,453**	**50,887**	**245,311.3**
Palmerston North City	14,120	8,449	848,338	17,039	26,420.9	14,681	8,893	899,976	17,645	28,155	15,150	9,283	947,034	18,133	27,695.5
Whanganui District	8,713	4,756	421,773	7,776	15,030.8	11,186	7,478	669,352	9,931	49,745.9	12,475	8,876	842,641	11,009	99,770.9
Horowhenua District	11,833	3,924	265,399	9,778	5,395.9	12,358	4,278	302,866	10,104	5,906.5	12,699	4,460	335,905	10,325	6,197.3
Manawatū District	6,053	2,508	183,071	3,822	2,989	6,692	3,048	223,458	4,141	3,979.6	7,076	3,304	247,617	4,394	4,731.3
Tararua District	4,332	2,312	251,035	2,466	10,199.7	4,692	2,631	283,164	2,690	27,541.6	4,954	2,841	334,617	2,860	43,398.8
Rangitīkei District	3,115	1,504	101,702	1,840	6,108.9	3,845	2,311	167,766	2,246	11,734.2	4,123	2,536	192,370	2,420	14,982.6
Ruapehu District	2,594	1,363	97,039	1,109	22,766.8	2,992	1,695	128,005	1,367	41,689.2	3,478	2,191	163,269	1,746	48,534.9

*Districts are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D2.2a: Horizons Regional Summary By District – With Climate Warming (1°C and 2°C) and Existing Flood Defences Up

Region/ District*	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**55,232**	**28,718**	**2,517,377.4**	**47,424**	**163,741.2**	**60,501**	**33,526**	**3,065,654.8**	**51,767**	**304,215.9**
Palmerston North City	14,919	9,053	921,488.7	17,884	26,798.6	15,950	9,907	1,025,126.6	19,039	32,241.8
Whanganui District	10,472	6,659	586,804.5	9,264	52,094	12,209	8,519	799,015.3	10,768	135,037.6
Horowhenua District	12,411	4,274	305,128.1	10,162	5,830.2	12,964	4,638	344,822.3	10,551	6,338.9
Manawatū District	6,558	2,881	218,316.5	4,187	3,885.1	7,087	3,280	257,223.3	4,517	5,041.5
Tararua District	4,449	2,364	230,904.4	2,541	27,474.3	5,021	2,869	317,999.9	2,923	61,994.1
Rangitīkei District	3,368	1,713	121,933.8	1,961	5,702.6	3,578	1,903	139,939.3	2,063	12,443.9
Ruapehu District	3,055	1,774	132,801.4	1,425	41,956.4	3,692	2,410	181,528.1	1,906	51,118.1

*Districts are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

Table D2.2b: Horizons Regional Summary By District – With Climate Warming (3°C and 3°C + Sea Level Rise) and Existing Flood Defences Up

Region/ District*	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**65,872**	**38,517**	**3,685,863.4**	**56,872**	**479,816.7**	**66,126**	**38,826**	**3,713,097.7**	**57,014**	**482,862.4**
Palmerston North City	17,644	11,478	1,263,686.2	21,192	40,412.8	17,645	11,478	1,263,453	21,192	40,410.1
Whanganui District	14,023	10,552	1,064,010.9	12,553	260,001.1	14,180	10,728	1,079,968.6	12,661	262,914
Horowhenua District	13,516	4,995	379,411.5	11,002	6,855	13,592	5,104	388,913.6	11,032	6,948.9
Manawatū District	7,528	3,594	295,329.1	4,769	6,330.4	7,525	3,592	296,324.6	4,769	6,332.1
Tararua District	5,275	3,015	306,546.6	3,031	88,858.8	5,287	3,032	307,340.4	3,036	88,879.1
Rangitīkei District	3,784	2,051	154,979.9	2,190	15,391.7	3,795	2,060	155,198.3	2,189	15,411.3
Ruapehu District	4,102	2,832	221,899.2	2,135	61,966.9	4,102	2,832	221,899.2	2,135	61,966.9

*Districts are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D2.3a: Horizons Regional Summary By District – Current Climate (0°C) and Existing Flood Defences Down

Region/ District*	5% AEP Flood – Current Climate (0°C)					2% AEP Flood – Current Climate (0°C)				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**40,757**	**16,527**	**1,433,703**	**34,375**	**34,646.8**	**45,036**	**19,713**	**1,733,063**	**37,993**	**54,815.7**
Palmerston North City	9,521	4,320	482,542	11,311	9,885.8	10,890	5,319	576,412	12,945	13,980.4
Whanganui District	6,826	3,264	256,695	6,145	5,787.2	7,388	3,670	298,465	6,626	6,755.9
Horowhenua District	10,649	3,203	241,164	8,828	5,128.5	11,355	3,721	278,865	9,356	5,921.4
Manawatū District	5,800	2,178	186,346	3,844	2,768.3	6,609	2,822	238,016	4,358	3,770.7
Tararua District	3,415	1,528	143,159	1,901	3,777.3	3,785	1,824	184,958	2,132	5,760.5
Rangitīkei District	2,560	1,141	70,024	1,490	1,510.2	2,824	1,324	88,326	1,648	1,775.5
Ruapehu District	1,986	893	53,773	856	5,789.5	2,185	1,033	68,021	928	16,851.3

*Districts are listed in order from highest to lowest total population.

Table D2.3b: Horizons Regional Summary By District – Current Climate (0°C) and Existing Flood Defences Down

Region/ District*	1% AEP Flood – Current Climate (0°C)					0.5% AEP Flood – Current Climate (0°C)				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**49,130**	**23,020**	**2,084,102**	**41,909**	**74,267.7**	**53,426**	**26,772**	**2,528,940**	**46,159**	**100,996.9**
Palmerston North City	12,693	6,826	762,657	15,209	20,940	14,666	8,706	1,002,650	17,901	33,932.3
Whanganui District	7,966	4,083	340,196	7,181	9,586.9	8,699	4,730	416,933	7,776	15,061.3
Horowhenua District	11,864	4,077	307,966	9,688	6,691.5	12,252	4,330	328,467	9,942	7,324.1
Manawatū District	7,135	3,292	280,735	4,724	4,616.5	7,628	3,695	318,524	5,049	5,415.4
Tararua District	4,055	2,063	215,190	2,309	7,734.8	4,329	2,296	244,747	2,485	10,211.2
Rangitīkei District	3,062	1,501	100,659	1,790	6,043.2	3,288	1,676	122,072	1,915	6,310.6
Ruapehu District	2,355	1,178	76,699	1,008	18,654.8	2,564	1,339	95,547	1,091	22,742

*Districts are listed in order from highest to lowest total population.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D2.4a: Horizons Regional Summary By District – With Climate Warming (1°C and 2°C) and Existing Flood Defences Down

Region/ District*	0.5% AEP Flood – 1°C climate warming					0.5% AEP Flood – 2°C climate warming				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**59,894**	**32,604**	**3,146,221**	**52,599**	**201,920.2**	**68,359**	**40,426**	**4,042,890**	**61,863**	**368,768.2**
Palmerston North City	17,174	10,827	1,238,786	21,400	54,142.6	21,833	15,065	1,747,946	27,713	89,845.4
Whanganui District	10,510	6,717	601,182	9,287	53,991.9	12,204	8,525	809,837	10,766	137,110.4
Horowhenua District	12,801	4,675	375,223	10,311	8,101.9	13,324	4,993	419,509	10,681	8,867.6
Manawatū District	8,058	4,065	354,343	5,367	6,203.9	8,451	4,417	391,626	5,668	7,065.6
Tararua District	4,648	2,562	284,128	2,684	31,465	5,033	2,858	316,184	2,953	62,046.4
Rangitīkei District	3,543	1,889	154,238	2,026	5,859	3,755	2,094	172,839	2,134	12,603.1
Ruapehu District	3,160	1,869	138,321	1,524	42,155.9	3,759	2,474	184,949	1,948	51,229.7

*Districts are listed in order from highest to lowest total population.

Table D2.4b: Horizons Regional Summary By District – With Climate Warming (3°C and 3°C + Sea Level Rise) and Existing Flood Defences Down

Region/ District*	0.5% AEP Flood – 3°C climate warming					0.5% AEP Flood – 3°C climate warming + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horizons Region Total	**75,201**	**47,624**	**4,923,415**	**69,189**	**582,224.3**	**75,456**	**47,972**	**4,951,732**	**69,169**	**584,602.5**
Palmerston North City	25,015	18,758	2,217,133	32,038	134,361.6	24,911	18,671	2,206,482	31,905	134,106.9
Whanganui District	14,012	10,552	1,068,643	12,551	261,195	14,163	10,703	1,089,064	12,630	263,672.3
Horowhenua District	13,841	5,308	452,005	11,124	9,566.8	14,034	5,572	470,728	11,152	9,684
Manawatū District	8,788	4,680	412,695	5,883	7,888.9	8,780	4,674	413,093	5,885	7,883
Tararua District	5,472	3,238	358,595	3,158	91,372.5	5,484	3,255	359,389	3,163	91,393
Rangitīkei District	3,951	2,231	189,398	2,275	15,532.5	3,962	2,240	188,030	2,274	15,556.3
Ruapehu District	4,122	2,857	224,946	2,160	62,307	4,122	2,857	224,946	2,160	62,307

*Districts are listed in order from highest to lowest total population.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

APPENDIX D3 (APPENDIX C) – DISTRICT RESULTS

Table D3.1a: Palmerston North City Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**11,703**	**6,600**	**675,593**	**14,336**	**18,041**	**12,779**	**7,445**	**775,442**	**15,599**	**21,276**	**13,485**	**7,957**	**794,946**	**16,382**	**23,063**
Palmerston North***	10,792	6,391	648,873	13,698	17,782	11,785	7,195	745,580	14,892	20,984	12,410	7,667	762,190	15,617	22,742
Ashhurst***	458	98	8,273	457	153	505	121	8,823	503	174	547	138	10,022	537	186
Linton	192	38	8,171	45	13	208	42	9,559	51	15	216	44	9,336	56	16
Bunnythorpe***	68	20	921	45	46	73	22	919	51	50	77	24	1,078	52	53
Longburn***	147	46	7,697	67	40	157	54	9,102	72	43	178	71	10,535	82	54
Kairanga***	46	7	1,658	24	7	51	11	1,459	30	10	57	13	1,785	38	12

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table D3.1b: Palmerston North City Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**14,120**	**8,449**	**848,339**	**17,039**	**26,421**	**14,681**	**8,893**	**899,975**	**17,645**	**28,155**	**15,150**	**9,283**	**947,034**	**18,133**	**27,695**
Palmerston North***	12,968	8,103	804,798	16,236	26,043	13,455	8,511	855,269	16,774	27,754	13,884	8,862	897,027	17,239	27,262
Ashhurst***	573	158	11,827	564	206	611	159	11,540	604	231	620	171	12,429	619	245
Linton	222	49	10,304	58	18	233	55	11,363	61	19	238	56	11,277	68	20
Bunnythorpe***	80	26	1,106	52	56	84	28	1,196	48	54	86	28	1,212	49	56
Longburn***	208	99	18,440	90	84	212	114	17,929	108	75	233	136	21,612	108	88
Kairanga***	69	14	1,864	39	14	86	26	2,678	50	22	89	30	3,477	50	24

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.2a: Palmerston North City Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**14,919**	**9,053**	**921,490**	**17,884**	**26,798**	**15,950**	**9,907**	**1,025,126**	**19,039**	**32,242**
Palmerston North***	13,683	8,656	869,375	17,005	26,322	14,655	9,472	969,353	18,121	31,668
Ashhurst***	615	169	12,835	610	238	651	183	14,457	641	264
Linton	241	59	11,849	70	20	254	68	12,378	75	27
Bunnythorpe***	82	29	1,243	52	58	87	29	1,254	53	61
Longburn***	227	120	23,656	108	144	229	134	25,035	108	204
Kairanga***	71	20	2,532	39	16	74	21	2,649	41	18

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table D3.2b: Palmerston North City Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**17,644**	**11,478**	**1,263,685**	**21,192**	**40,411**	**17,645**	**11,478**	**1,263,452**	**21,192**	**40,409**
Palmerston North***	16,287	11,012	1,203,642	20,238	39,736	16,287	11,012	1,203,694	20,238	39,734
Ashhurst***	680	196	15,330	673	291	680	196	15,330	673	291
Linton	268	74	12,784	77	25	268	74	12,784	77	25
Bunnythorpe***	92	31	1,304	56	64	93	31	1,304	56	64
Longburn***	231	134	27,341	104	272	231	134	27,056	104	272
Kairanga***	86	31	3,284	44	23	86	31	3,284	44	23

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.3a: Palmerston North City Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**9,521**	**4,320**	**482,542**	**11,311**	**9,886**	**10,890**	**5,319**	**576,412**	**12,945**	**13,979**
Palmerston North***	8,562	4,052	446,618	10,672	9,610	9,831	5,011	534,946	12,217	13,633
Ashhurst***	430	83	6,068	435	140	473	92	6,695	480	155
Linton	211	57	9,819	49	17	232	63	11,495	62	23
Bunnythorpe***	67	19	866	45	45	72	22	882	51	48
Longburn***	190	91	17,061	76	60	214	108	20,012	94	102
Kairanga***	61	18	2,110	34	14	68	23	2,382	41	18

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table D3.3b: Palmerston North City Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)**					0.5% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**12,693**	**6,826**	**762,657**	**15,209**	**20,941**	**14,666**	**8,706**	**1,002,650**	**17,901**	**33,932**
Palmerston North***	11,566	6,459	715,300	14,433	20,514	13,473	8,292	943,890	17,091	33,420
Ashhurst***	507	113	7,901	502	168	539	133	10,136	529	189
Linton	244	69	11,568	72	32	251	78	13,021	75	38
Bunnythorpe***	76	24	1,038	52	51	79	26	1,062	52	52
Longburn***	226	132	24,491	106	154	229	133	31,097	104	202
Kairanga***	74	29	2,359	44	22	95	44	3,444	50	31

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.4a: Palmerston North City Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**17,174**	**10,827**	**1,238,786**	**21,400**	**54,144**	**21,833**	**15,065**	**1,747,946**	**27,713**	**89,845**
Palmerston North***	15,909	10,376	1,182,392	20,530	53,546	20,513	14,580	1,689,473	26,805	89,162
Ashhurst***	592	149	11,367	579	217	627	173	13,140	612	250
Linton	264	84	14,464	85	43	274	92	15,159	87	47
Bunnythorpe***	81	29	1,189	52	54	85	29	1,202	53	55
Longburn***	230	136	24,973	104	249	230	136	24,510	104	291
Kairanga***	98	53	4,401	50	35	104	55	4,462	52	40

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

Table D3.4b: Palmerston North City Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Palmerston North City Total	**25,015**	**18,758**	**2,217,133**	**32,038**	**134,361**	**24,911**	**18,671**	**2,206,481**	**31,905**	**134,107**
Palmerston North***	23,632	18,243	2,154,759	31,087	133,597	23,526	18,157	2,144,044	30,951	133,342
Ashhurst***	670	192	14,667	648	288	671	192	14,677	651	288
Linton	283	97	15,577	87	45	283	97	15,583	87	45
Bunnythorpe***	90	31	1,264	56	57	91	31	1,260	56	57
Longburn***	232	136	26,398	108	329	232	136	26,381	108	330
Kairanga***	108	59	4,468	52	45	108	58	4,536	52	45

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.5a: Whanganui District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**6,905**	**3,364**	**272,136**	**6,201**	**6,028**	**7,437**	**3,731**	**313,542**	**6,646**	**6,793**	**8,007**	**4,140**	**354,094**	**7,195**	**9,590**
Whanganui	6,474	3,173	263,031	6,069	5,884	6,944	3,491	301,077	6,498	6,578	7,453	3,839	337,106	7,003	7,787
Kai Iwi	59	35	1,242	23	24	59	35	1,252	23	25	59	35	1,262	23	25
Other	372	156	7,863	109	120	434	205	11,213	125	190	495	266	15,726	169	1,778

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

Table D3.5b: Whanganui District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**8,713**	**4,756**	**421,773**	**7,776**	**15,030**	**11,186**	**7,478**	**669,352**	**9,931**	**49,746**	**12,475**	**8,876**	**842,641**	**11,009**	**99,771**
Whanganui	8,017	4,319	394,392	7,505	9,495	10,186	6,762	620,415	9,548	19,636	11,257	7,939	768,464	10,522	36,325
Kai Iwi	58	37	1,282	23	25	60	37	1,265	21	26	60	37	1,247	21	28
Other	638	400	26,099	248	5,510	940	679	47,672	362	30,084	1,158	900	72,930	466	63,418

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.6a: Whanganui District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**10,472**	**6,659**	**586,805**	**9,264**	**52,094**	**12,209**	**8,519**	**799,016**	**10,768**	**135,038**
Whanganui	9,547	6,004	542,310	8,905	31,930	11,035	7,632	730,844	10,312	76,708
Kai Iwi	60	37	1,246	25	26	61	37	1,292	21	26
Other	865	618	43,249	334	20,138	1,113	850	66,880	435	58,304

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

Table D3.6b: Whanganui District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**14,023**	**10,552**	**1,064,011**	**12,553**	**260,000**	**14,180**	**10,728**	**1,079,969**	**12,661**	**262,913**
Whanganui	12,706	9,522	976,153	12,027	156,170	12,861	9,696	992,159	12,135	158,863
Kai Iwi	62	38	1,261	21	28	62	39	1,410	21	28
Other	1,255	992	86,597	505	103,802	1,257	993	86,400	505	104,022

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.7a: Whanganui District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)					2% AEP Flood – Current Climate (0°C)				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**6,826**	**3,264**	**256,696**	**6,145**	**5,787**	**7,388**	**3,670**	**298,466**	**6,626**	**6,756**
Whanganui	6,397	3,077	247,643	6,013	5,643	6,898	3,434	285,964	6,478	6,541
Kai Iwi	59	35	1,242	23	24	59	35	1,252	23	25
Other	370	152	7,811	109	120	431	201	11,250	125	190

*Towns/Settlements are listed in order from highest to lowest total population.

Table D3.7b: Whanganui District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)					0.5% AEP Flood – Current Climate (0°C)				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**7,966**	**4,083**	**340,196**	**7,181**	**9,587**	**8,699**	**4,730**	**416,933**	**7,776**	**15,061**
Whanganui	7,416	3,786	323,374	6,991	7,794	8,007	4,297	389,702	7,507	9,528
Kai Iwi	59	35	1,262	23	25	58	37	1,282	23	25
Other	491	262	15,560	167	1,768	634	396	25,949	246	5,508

*Towns/Settlements are listed in order from highest to lowest total population.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.8a: Whanganui District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming					0.5% AEP Flood – 2°C climate warming				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**10,510**	**6,717**	**601,182**	**9,287**	**53,992**	**12,204**	**8,525**	**809,837**	**10,766**	**137,110**
Whanganui	9,589	6,066	556,869	8,928	33,861	11,036	7,643	742,267	10,312	78,820
Kai Iwi	60	37	1,245	25	26	61	37	1,292	21	26
Other	861	614	43,068	334	20,105	1,107	845	66,278	433	58,264

*Towns/Settlements are listed in order from highest to lowest total population.

Table D3.8b: Whanganui District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming					0.5% AEP Flood – 3°C climate warming + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Whanganui District Total	**14,012**	**10,552**	**1,068,643**	**12,551**	**261,195**	**14,163**	**10,703**	**1,089,065**	**12,630**	**263,672**
Whanganui	12,696	9,524	981,132	12,027	157,277	12,848	9,675	1,001,282	12,106	159,712
Kai Iwi	62	38	1,261	21	28	62	39	1,410	21	28
Other	1,254	990	86,250	503	103,890	1,253	989	86,373	503	103,932

*Towns/Settlements are listed in order from highest to lowest total population.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.9a: Horowhenua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**10,257**	**2,808**	**188,749**	**8,666**	**4,116**	**10,937**	**3,305**	**219,495**	**9,167**	**4,606**	**11,431**	**3,682**	**245,421**	**9,510**	**5,011**
Levin	6,612	869	73,872	6,646	2,078	6,975	1,087	88,660	7,019	2,308	7,239	1,241	99,993	7,253	2,464
Foxton	1,270	768	56,183	976	1,196	1,322	810	58,143	1,011	1,266	1,363	848	61,156	1,042	1,331
Shannon	124	29	1,793	114	37	144	43	2,655	122	48	156	56	3,175	122	58
Foxton Beach	848	441	21,466	368	274	885	472	22,594	384	300	912	491	23,514	394	316
Ōhau	124	29	1,498	69	44	135	40	2,094	76	52	141	45	2,343	76	64
Tokomaru***	60	20	1,898	53	63	63	23	1,958	57	66	66	27	2,201	57	67
Manakau	233	53	2,014	97	34	252	66	2,869	101	38	274	80	3,595	108	40
Waitārere Beach	320	239	9,724	108	162	384	311	13,605	129	239	425	357	16,034	138	310
Hokio Beach	152	73	2,483	38	45	168	89	3,032	49	54	174	97	3,274	51	62
Waikawa Beach	68	31	834	9	4	75	39	1,087	9	5	79	45	1,324	13	6
Other	446	256	16,984	188	179	534	325	22,798	210	230	602	395	28,812	256	293

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.9b: Horowhenua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**11,833**	**3,924**	**265,398**	**9,778**	**5,395**	**12,358**	**4,278**	**302,866**	**10,104**	**5,907**	**12,699**	**4,460**	**335,904**	**10,325**	**6,196**
Levin	7,445	1,328	106,778	7,419	2,621	7,700	1,454	123,097	7,622	2,867	7,872	1,498	144,606	7,764	2,995
Foxton	1,394	868	62,703	1,057	1,379	1,463	940	74,990	1,112	1,480	1,490	952	76,812	1,131	1,524
Shannon	165	60	3,389	133	67	183	65	3,792	142	79	192	73	4,467	148	93
Foxton Beach	933	519	25,257	402	331	991	559	27,896	422	364	1,023	605	30,249	444	401
Ōhau	153	52	2,755	83	78	166	54	2,839	91	86	176	58	2,971	97	86
Tokomaru***	71	32	2,668	57	68	75	32	2,590	57	70	76	32	2,705	57	70
Manakau	284	94	4,608	119	48	295	104	5,217	123	54	313	115	5,846	129	59
Waitārere Beach	464	391	17,825	147	369	526	442	19,838	171	445	535	450	20,123	171	458
Hokio Beach	182	104	3,690	59	72	197	118	4,320	66	82	201	123	4,549	66	88
Waikawa Beach	82	49	1,415	13	7	88	55	1,653	16	16	94	58	1,791	16	17
Other	660	427	34,310	289	355	674	455	36,634	282	364	727	496	41,785	302	405

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.10a: Horowhenua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**12,411**	**4,274**	**305,128**	**10,162**	**5,831**	**12,964**	**4,638**	**344,823**	**10,551**	**6,339**
Levin	7,765	1,468	122,075	7,677	2,813	8,045	1,596	143,938	7,936	3,016
Foxton	1,440	902	72,688	1,098	1,440	1,481	937	74,813	1,121	1,510
Shannon	187	68	4,344	145	79	204	76	4,725	162	98
Foxton Beach	967	555	28,232	415	355	1,008	605	30,484	448	401
Ōhau	166	55	2,816	91	87	179	58	3,044	97	94
Tokomaru***	76	33	2,648	57	70	77	33	2,753	57	71
Manakau	298	106	5,342	123	54	322	127	6,414	136	63
Waitārere Beach	497	425	19,107	164	400	521	448	19,905	171	436
Hokio Beach	195	115	4,081	66	80	203	120	4,393	66	85
Waikawa Beach	88	55	1,665	16	16	96	60	1,830	16	17
Other	732	492	42,130	310	437	828	578	52,524	341	548

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.10b: Horowhenua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**13,516**	**4,995**	**379,411**	**11,002**	**6,855**	**13,592**	**5,104**	**388,913**	**11,032**	**6,948**
Levin	8,347	1,734	156,906	8,255	3,215	8,347	1,734	156,906	8,255	3,215
Foxton	1,514	971	76,082	1,148	1,582	1,509	963	75,272	1,144	1,557
Shannon	226	88	5,561	172	112	225	89	5,690	169	112
Foxton Beach	1,054	658	33,875	477	445	1,148	774	45,274	523	576
Ōhau	203	68	4,008	110	104	203	68	4,008	110	104
Tokomaru***	78	33	2,966	57	72	78	33	2,966	57	72
Manakau	338	137	6,738	143	70	339	137	6,739	143	70
Waitārere Beach	540	453	20,363	182	460	536	461	20,426	173	454
Hokio Beach	211	128	4,800	75	96	211	128	4,801	75	96
Waikawa Beach	104	71	2,466	21	27	104	72	2,498	21	27
Other	901	654	65,646	362	672	892	645	64,333	362	665

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.11a: Horowhenua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**10,649**	**3,203**	**241,165**	**8,828**	**5,129**	**11,355**	**3,721**	**278,866**	**9,356**	**5,921**
Levin	6,612	869	73,872	6,646	2,078	6,975	1,087	88,660	7,019	2,308
Foxton	1,288	784	56,399	985	1,284	1,340	833	58,702	1,027	1,376
Shannon	162	68	5,500	120	84	180	77	8,345	130	118
Foxton Beach	822	404	18,400	361	250	857	435	19,557	377	271
Ōhau	123	26	1,210	68	38	132	33	1,860	76	47
Tokomaru***	59	24	2,407	57	87	65	28	2,468	57	93
Manakau	233	53	2,014	97	34	252	66	2,869	101	38
Waitārere Beach	320	239	9,724	108	162	384	311	13,606	129	239
Hokio Beach	152	73	2,483	38	45	168	89	3,032	49	54
Waikawa Beach	68	31	834	9	4	75	39	1,087	9	5
Other	810	632	68,322	339	1,063	927	723	78,680	382	1,372

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.11b: Horowhenua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)**					0.5% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**11,864**	**4,077**	**307,966**	**9,688**	**6,690**	**12,252**	**4,330**	**328,467**	**9,942**	**7,324**
Levin	7,239	1,241	99,993	7,253	2,464	7,445	1,328	106,778	7,419	2,621
Foxton	1,384	869	61,865	1,058	1,459	1,412	887	63,229	1,075	1,509
Shannon	192	87	11,490	133	166	205	99	11,407	143	201
Foxton Beach	876	450	20,050	386	285	895	469	21,510	393	298
Ōhau	137	39	2,137	76	51	147	43	2,252	82	56
Tokomaru***	67	29	2,465	57	96	71	33	3,075	57	99
Manakau	274	80	3,595	108	40	284	94	4,608	119	48
Waitārere Beach	425	357	16,035	138	310	464	391	17,818	147	369
Hokio Beach	174	97	3,274	51	62	182	104	3,690	59	72
Waikawa Beach	79	45	1,324	13	6	82	49	1,413	13	7
Other	1,017	783	85,738	415	1,751	1,065	833	92,687	435	2,044

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.12a: Horowhenua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**12,801**	**4,675**	**375,223**	**10,311**	**8,103**	**13,324**	**4,993**	**419,509**	**10,681**	**8,867**
Levin	7,765	1,468	122,075	7,677	2,813	8,045	1,596	143,938	7,936	3,016
Foxton	1,452	917	73,104	1,109	1,569	1,487	944	74,622	1,128	1,629
Shannon	236	115	12,488	160	269	251	128	13,912	177	336
Foxton Beach	907	489	22,806	399	313	922	502	23,641	416	329
Ōhau	161	47	2,408	90	61	174	50	2,632	96	66
Tokomaru***	77	35	3,314	57	104	81	37	3,650	58	111
Manakau	298	106	5,342	123	54	322	127	6,414	136	63
Waitārere Beach	497	425	19,107	164	400	521	448	19,905	171	436
Hokio Beach	195	115	4,081	66	80	203	120	4,393	66	85
Waikawa Beach	88	55	1,665	16	16	96	60	1,827	16	17
Other	1,125	903	108,833	450	2,424	1,222	981	124,575	481	2,779

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.12b: Horowhenua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Horowhenua District Total	**13,841**	**5,308**	**452,004**	**11,124**	**9,568**	**14,034**	**5,572**	**470,726**	**11,152**	**9,684**
Levin	8,347	1,734	156,906	8,255	3,215	8,347	1,734	156,906	8,255	3,215
Foxton	1,520	970	75,664	1,161	1,684	1,522	971	75,552	1,161	1,687
Shannon	263	135	16,411	184	386	263	135	16,429	184	388
Foxton Beach	934	517	24,684	424	343	1,131	772	42,858	461	464
Ōhau	199	62	3,674	109	76	199	62	3,674	109	76
Tokomaru***	86	41	4,303	58	119	86	41	4,314	58	119
Manakau	338	137	6,737	143	70	339	137	6,743	143	70
Waitārere Beach	540	453	20,377	182	460	536	461	20,420	173	454
Hokio Beach	211	128	4,800	75	96	211	128	4,801	75	96
Waikawa Beach	103	69	2,386	21	27	104	71	2,475	21	27
Other	1,300	1,062	136,062	512	3,092	1,296	1,060	136,554	512	3,088

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.13a: Manawatū District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**4,410**	**1,380**	**99,879**	**2,874**	**1,446**	**4,955**	**1,664**	**121,736**	**3,193**	**1,789**	**5,467**	**2,007**	**149,011**	**3,491**	**2,267**
Feilding	1,731	300	38,432	1,633	531	1,927	351	44,010	1,805	609	2,100	407	50,202	1,949	674
Rongotea	271	102	5,157	169	108	313	133	7,128	198	142	334	154	8,870	204	177
Halcombe***	80	36	2,655	40	43	85	40	2,545	40	44	98	44	2,492	47	49
Bunnythorpe***	142	39	1,905	47	24	156	45	2,466	56	26	159	50	3,051	56	27
Sanson	98	41	1,466	47	32	102	44	1,884	49	36	107	45	2,102	56	38
Pohangina	99	34	1,956	51	50	111	39	2,220	53	60	125	43	2,256	57	67
Kairanga***	222	79	5,300	113	44	283	134	9,447	148	100	338	187	14,055	190	201
Himatangi Beach	188	88	3,720	76	42	206	103	4,278	79	47	222	113	4,672	85	54
Tangimoana	348	244	9,511	155	174	382	271	10,684	167	203	419	304	11,886	184	236
Ashhurst***	54	17	1,281	21	16	57	17	1,263	21	19	60	20	1,338	19	22
Kimbolton	34	10	610	21	38	35	12	647	21	38	36	14	1,155	26	45
Ohakea	56	12	711	26	10	58	13	623	26	16	68	15	638	26	19
Longburn***	19	6	189	7	2	22	7	242	10	2	31	10	423	12	4
Mangaweka***	1	0	0	0	0	3	0	0	0	0	3	2	31	0	0
Woodville***	1	1	56	2	1	2	1	57	2	1	2	2	65	2	1
Bulls***	0	0	0	0	0	3	1	58	0	0	3	2	113	0	0
Hunterville***	3	3	100	0	0	3	3	74	0	0	3	3	102	0	0
Other	1,063	368	26,830	466	331	1,207	450	34,110	518	446	1,359	592	45,560	578	653

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.13b: Manawatū District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**6,053**	**2,508**	**183,070**	**3,822**	**2,988**	**6,692**	**3,048**	**223,457**	**4,141**	**3,980**	**7,076**	**3,304**	**247,617**	**4,394**	**4,731**
Feilding	2,217	443	56,206	2,052	746	2,385	516	61,866	2,196	823	2,514	570	70,224	2,298	881
Rongotea	354	175	10,137	222	219	369	222	13,381	219	259	390	236	14,350	221	288
Halcombe***	105	59	3,110	57	58	193	90	4,680	98	132	210	102	5,432	113	143
Bunnythorpe***	168	58	3,567	57	28	171	59	3,916	54	28	180	65	4,082	60	29
Sanson	108	47	2,187	56	39	115	47	1,879	58	43	118	50	1,959	58	44
Pohangina	150	50	2,720	76	82	156	54	3,058	81	98	171	60	3,496	81	106
Kairanga***	414	268	20,178	248	382	429	277	21,837	243	355	484	331	26,686	271	497
Himatangi Beach	236	134	5,517	86	63	261	146	6,542	102	68	278	166	7,667	113	78
Tangimoana	515	431	16,073	238	390	659	595	25,525	316	1,090	673	612	27,667	321	1,367
Ashhurst***	68	23	1,622	22	23	78	25	1,672	24	25	82	26	1,632	24	25
Kimbolton	36	14	1,348	26	45	36	14	1,490	26	47	37	15	1,475	26	47
Ohakea	103	28	2,692	41	21	166	111	9,692	63	90	174	117	11,026	72	112
Longburn***	51	32	2,423	12	23	54	33	2,382	12	8	55	33	2,205	12	15
Mangaweka***	3	2	27	0	0	3	2	55	0	0	3	2	63	0	0
Woodville***	2	2	63	2	1	2	2	67	2	1	2	2	64	2	1
Bulls***	3	3	149	0	0	4	4	173	0	0	4	4	183	0	0
Hunterville***	4	4	162	0	0	4	4	199	0	0	4	4	197	0	0
Other	1,516	735	54,889	627	868	1,607	847	65,043	647	913	1,697	909	69,209	722	1,098

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.14a: Manawatū District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**6,558**	**2,881**	**218,314**	**4,187**	**3,884**	**7,087**	**3,280**	**257,222**	**4,517**	**5,041**
Feilding	2,372	506	61,541	2,211	832	2,519	561	68,752	2,350	906
Rongotea	383	193	11,307	234	248	408	213	13,067	263	289
Halcombe***	108	63	3,511	54	66	116	67	3,704	54	74
Bunnythorpe***	172	61	3,962	57	28	182	65	4,183	62	30
Sanson	114	47	2,156	64	42	115	47	2,106	64	43
Pohangina	157	54	3,084	77	102	173	61	3,521	84	149
Kairanga***	488	328	28,093	299	675	609	446	40,980	351	1,092
Himatangi Beach	257	152	6,569	98	74	279	175	7,361	105	90
Tangimoana	559	493	18,786	268	520	596	542	21,848	290	674
Ashhurst***	68	24	1,657	28	25	70	22	1,544	28	26
Kimbolton	36	14	1,365	26	46	37	15	1,427	26	47
Ohakea	138	63	5,273	65	49	149	79	5,688	75	76
Longburn***	53	32	2,507	12	30	54	32	2,604	12	38
Mangaweka***	3	2	43	0	0	3	2	68	0	0
Woodville***	2	2	67	2	1	2	2	64	2	1
Bulls***	4	4	199	0	0	4	4	203	0	0
Hunterville***	4	4	165	0	0	4	4	234	0	0
Other	1,640	839	68,029	692	1,146	1,767	943	79,868	751	1,506

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.14b: Manawatū District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**7,528**	**3,594**	**295,328**	**4,769**	**6,330**	**7,525**	**3,592**	**296,324**	**4,769**	**6,332**
Feilding	2,685	624	81,410	2,489	979	2,684	624	81,547	2,489	979
Rongotea	440	231	13,939	274	325	440	231	13,934	274	325
Halcombe***	121	70	4,012	54	72	121	70	4,013	54	72
Bunnythorpe***	184	65	4,168	73	31	184	65	4,167	73	31
Sanson	116	47	2,165	64	44	116	47	2,165	64	44
Pohangina	184	67	3,669	85	161	184	67	3,669	85	161
Kairanga***	666	515	50,107	369	1,540	666	515	50,054	369	1,540
Himatangi Beach	303	196	8,132	109	106	300	194	9,005	109	105
Tangimoana	620	577	24,197	303	921	621	577	24,238	303	924
Ashhurst***	73	25	1,933	31	30	73	25	1,933	31	30
Kimbolton	37	15	1,478	26	48	37	15	1,478	26	48
Ohakea	162	85	6,723	79	99	162	85	6,723	79	99
Longburn***	55	32	2,862	12	48	55	32	2,862	12	48
Mangaweka***	3	2	65	0	0	3	2	61	0	0
Woodville***	2	2	62	2	1	2	2	62	2	1
Bulls***	4	4	198	0	0	4	4	198	0	0
Hunterville***	4	4	158	0	0	4	4	158	0	0
Other	1,869	1,033	90,050	799	1,925	1,869	1,033	90,057	799	1,925

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.15a: Manawatū District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**5,800**	**2,178**	**186,346**	**3,844**	**2,767**	**6,609**	**2,822**	**238,015**	**4,358**	**3,772**
Feilding	2,479	526	70,729	2,339	843	2,777	696	87,087	2,603	1,028
Rongotea	379	208	13,191	227	293	406	233	14,442	247	335
Halcombe***	80	36	2,655	40	43	85	40	2,545	40	44
Bunnythorpe***	142	39	1,905	47	24	156	45	2,466	56	26
Sanson	98	41	1,466	47	32	102	44	1,884	49	36
Pohangina	99	34	1,956	51	50	111	39	2,219	53	60
Kairanga***	411	254	20,806	224	432	468	312	26,328	268	643
Himatangi Beach	188	88	3,720	76	42	206	103	4,278	79	47
Tangimoana	316	192	7,521	135	146	459	369	14,155	208	312
Ashhurst***	54	17	1,281	21	16	57	17	1,263	21	19
Kimbolton	34	10	610	21	38	35	12	647	21	38
Ohakea	56	12	681	26	9	58	13	636	26	15
Longburn***	44	26	1,405	12	14	49	31	2,348	12	23
Mangaweka***	1	0	0	0	0	3	0	0	0	0
Woodville***	1	1	56	2	1	2	1	57	2	1
Bulls***	0	0	0	0	0	4	2	132	0	0
Hunterville***	3	3	100	0	0	3	3	74	0	0
Other	1,415	691	58,264	576	784	1,628	862	77,454	673	1,145

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.15b: Manawatū District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)**					0.5% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**7,135**	**3,292**	**280,738**	**4,724**	**4,618**	**7,628**	**3,695**	**318,525**	**5,049**	**5,415**
Feilding	2,950	839	100,886	2,778	1,167	3,106	935	115,702	2,945	1,313
Rongotea	428	248	16,183	266	373	448	255	16,324	271	393
Halcombe***	98	44	2,492	47	49	105	59	3,118	57	58
Bunnythorpe***	159	50	3,051	56	27	168	58	3,567	57	28
Sanson	107	45	2,096	56	38	108	47	2,187	56	39
Pohangina	125	43	2,256	57	67	150	50	2,720	76	82
Kairanga***	533	377	33,220	313	823	590	438	40,376	345	985
Himatangi Beach	222	113	4,672	85	54	236	134	5,549	86	63
Tangimoana	534	457	17,988	261	508	581	532	21,432	283	726
Ashhurst***	60	20	1,338	19	22	68	23	1,622	22	23
Kimbolton	36	14	1,155	26	45	36	14	1,348	26	45
Ohakea	68	15	634	26	18	100	27	2,272	37	18
Longburn***	51	31	2,415	12	30	52	31	2,511	12	35
Mangaweka***	3	2	31	0	0	3	2	27	0	0
Woodville***	2	2	65	2	1	2	2	63	2	1
Bulls***	4	3	178	0	0	3	3	191	0	0
Hunterville***	3	3	102	0	0	4	4	162	0	0
Other	1,752	986	91,976	720	1,396	1,868	1,081	99,354	774	1,606

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.16a: Manawatū District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**8,058**	**4,065**	**354,341**	**5,367**	**6,205**	**8,451**	**4,417**	**391,627**	**5,668**	**7,067**
Feilding	3,270	1,081	130,662	3,133	1,451	3,444	1,231	149,125	3,312	1,604
Rongotea	469	263	17,059	289	413	484	269	17,586	298	432
Halcombe***	108	64	3,519	54	66	116	67	3,702	54	74
Bunnythorpe***	172	61	3,962	57	28	182	65	4,183	62	30
Sanson	114	47	2,156	64	42	115	47	2,106	64	43
Pohangina	157	54	3,081	77	102	172	61	3,522	84	149
Kairanga***	640	476	44,877	361	1,139	670	523	48,851	377	1,288
Himatangi Beach	257	152	6,569	98	74	279	175	7,362	105	90
Tangimoana	613	565	23,245	295	934	629	587	25,678	309	1,159
Ashhurst***	68	24	1,658	28	25	70	22	1,544	28	26
Kimbolton	36	14	1,365	26	46	37	15	1,427	26	47
Ohakea	135	60	4,658	65	45	148	79	5,648	75	71
Longburn***	53	32	2,480	12	39	54	32	2,792	12	43
Mangaweka***	3	2	43	0	0	3	2	68	0	0
Woodville***	2	2	67	2	1	2	2	64	2	1
Bulls***	4	4	199	0	0	4	4	231	0	0
Hunterville***	4	4	165	0	0	4	4	234	0	0
Other	1,953	1,160	108,576	806	1,800	2,038	1,232	117,504	860	2,010

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.16b: Manawatū District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Manawatū District Total	**8,788**	**4,680**	**412,694**	**5,883**	**7,889**	**8,780**	**4,674**	**413,093**	**5,885**	**7,883**
Feilding	3,612	1,354	154,286	3,458	1,768	3,606	1,351	154,529	3,457	1,761
Rongotea	506	280	18,334	307	455	506	280	18,183	307	456
Halcombe***	120	70	4,014	54	72	120	70	4,013	54	72
Bunnythorpe***	184	65	4,168	73	31	184	65	4,167	73	31
Sanson	116	47	2,165	64	44	116	47	2,165	64	44
Pohangina	184	67	3,671	85	161	184	67	3,669	85	161
Kairanga***	697	550	53,434	386	1,431	695	549	52,969	386	1,425
Himatangi Beach	303	196	8,126	109	106	300	194	9,005	109	105
Tangimoana	638	594	26,642	316	1,387	640	595	26,559	319	1,398
Ashhurst***	73	26	1,942	31	30	73	25	1,933	31	30
Kimbolton	37	15	1,478	26	48	37	15	1,478	26	48
Ohakea	162	84	6,694	79	93	162	84	6,765	79	94
Longburn***	54	32	2,896	12	46	54	32	2,905	12	46
Mangaweka***	3	2	61	0	0	3	2	61	0	0
Woodville***	2	2	62	2	1	2	2	62	2	1
Bulls***	4	4	191	0	0	4	4	184	0	0
Hunterville***	4	4	158	0	0	4	4	158	0	0
Other	2,089	1,288	124,372	881	2,216	2,090	1,288	124,288	881	2,211

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.17a: Tararua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**3,410**	**1,528**	**142,249**	**1,889**	**3,769**	**3,784**	**1,827**	**175,790**	**2,104**	**5,756**	**4,055**	**2,077**	**207,794**	**2,285**	**7,726**
Dannevirke	629	113	7,080	382	118	682	130	8,098	404	131	722	146	9,331	436	143
Pahiatua	937	371	24,852	657	365	1,008	414	27,757	703	393	1,055	452	29,972	722	406
Woodville***	885	607	60,923	516	2,533	1,076	814	85,301	658	4,372	1,219	984	109,095	773	6,212
Eketāhuna	160	57	3,456	55	32	167	56	3,333	69	36	172	67	3,730	73	37
Ormondville	60	15	406	14	2	64	16	434	14	3	66	17	437	14	3
Norsewood	60	19	768	33	16	63	20	812	37	17	63	20	790	37	17
Pongaroa	62	32	2,122	19	15	72	39	2,971	17	17	67	31	2,250	16	15
Mangatainoka	127	109	15,810	23	232	135	118	17,358	22	300	136	119	18,951	22	347
Mangamutu	44	15	12,798	10	5	46	17	14,512	10	5	51	21	16,027	10	5
Ashhurst***	7	5	410	0	0	8	6	541	0	0	8	6	538	0	0
Other	439	185	13,624	180	451	463	197	14,673	170	482	496	214	16,673	182	541

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.17b: Tararua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**4,332**	**2,312**	**251,035**	**2,466**	**10,200**	**4,692**	**2,631**	**283,163**	**2,690**	**27,541**	**4,954**	**2,841**	**334,616**	**2,860**	**43,400**
Dannevirke	753	161	10,397	448	176	809	179	11,597	491	211	841	190	12,413	517	228
Pahiatua	1,108	488	34,660	760	436	1,164	532	38,533	801	462	1,217	567	41,152	828	496
Woodville***	1,372	1,141	135,337	904	8,534	1,558	1,339	162,802	1,012	25,081	1,660	1,455	191,177	1,093	35,634
Eketāhuna	178	65	3,633	71	38	191	71	3,949	73	39	199	75	4,230	73	40
Ormondville	66	17	460	14	3	68	17	452	14	3	69	18	511	14	3
Norsewood	63	20	791	37	17	65	20	792	37	17	66	21	806	37	17
Pongaroa	69	33	2,197	16	10	87	51	3,179	33	584	95	56	3,764	40	926
Mangatainoka	147	129	26,240	22	392	152	134	27,877	24	454	167	145	30,050	25	494
Mangamutu	52	21	20,065	10	6	60	29	14,082	10	6	81	43	29,451	23	16
Ashhurst***	8	6	533	0	0	8	6	556	0	0	8	6	552	0	0
Other	516	231	16,722	184	588	530	253	19,344	195	684	551	265	20,510	210	5,546

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.18a: Tararua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**4,449**	**2,364**	**230,904**	**2,541**	**27,474**	**5,021**	**2,869**	**318,000**	**2,923**	**61,996**
Dannevirke	803	177	11,604	489	208	852	196	13,194	531	236
Pahiatua	1,169	538	38,956	809	466	1,244	585	42,815	838	509
Woodville***	1,314	1,073	118,791	845	17,993	1,649	1,448	186,348	1,099	51,782
Eketāhuna	204	84	5,100	83	59	211	79	4,686	87	52
Ormondville	68	17	455	14	3	71	18	511	14	3
Norsewood	65	20	792	37	17	67	22	831	37	18
Pongaroa	87	51	3,126	33	528	95	56	3,795	40	932
Mangatainoka	141	123	18,879	22	2,778	172	145	29,673	31	2,897
Mangamutu	58	26	14,049	10	6	91	45	14,914	33	20
Ashhurst***	8	6	559	0	0	8	6	552	0	0
Other	532	249	18,593	199	5,416	561	269	20,681	213	5,547

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.18b: Tararua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**5,275**	**3,015**	**306,547**	**3,031**	**88,859**	**5,287**	**3,032**	**307,341**	**3,036**	**88,879**
Dannevirke	905	230	15,999	582	264	905	230	15,999	582	264
Pahiatua	1,340	640	46,059	891	562	1,340	640	46,059	891	562
Woodville***	1,575	1,339	161,564	1,029	61,938	1,575	1,339	161,564	1,029	61,938
Eketāhuna	245	107	6,183	99	2,556	245	107	6,183	99	2,556
Ormondville	78	20	652	25	72	78	20	652	25	72
Norsewood	67	22	826	37	18	67	22	826	37	18
Pongaroa	101	62	4,092	45	1,303	101	62	4,092	45	1,303
Mangatainoka	210	181	30,669	45	6,928	210	181	30,669	45	6,928
Mangamutu	107	69	15,044	41	30	107	69	15,044	41	30
Ashhurst***	8	8	629	0	0	8	8	629	0	0
Other	639	337	24,830	237	15,188	651	354	25,624	242	15,208

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.19a: Tararua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**3,415**	**1,528**	**143,159**	**1,901**	**3,776**	**3,785**	**1,824**	**184,958**	**2,132**	**5,761**
Dannevirke	632	119	7,619	382	118	683	135	8,649	404	131
Pahiatua	931	375	25,315	656	366	996	413	27,536	702	393
Woodville***	905	603	60,749	529	2,539	1,101	817	85,635	688	4,378
Eketāhuna	161	58	3,502	55	32	167	56	3,310	69	36
Ormondville	60	15	406	14	2	64	16	435	14	3
Norsewood	60	19	768	33	16	63	20	812	37	17
Pongaroa	62	32	2,122	19	15	72	39	2,971	17	17
Mangatainoka	127	109	15,782	23	232	135	118	17,362	22	300
Mangamutu	33	9	13,030	10	5	38	11	23,605	10	5
Ashhurst***	7	5	410	0	0	8	6	541	0	0
Other	437	184	13,456	180	451	458	193	14,102	169	481

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.19b: Tararua District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)**					0.5% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**4,055**	**2,063**	**215,191**	**2,309**	**7,735**	**4,329**	**2,296**	**244,747**	**2,485**	**10,212**
Dannevirke	723	152	9,700	436	143	755	165	10,698	448	176
Pahiatua	1,037	443	29,266	718	406	1,096	480	33,383	758	436
Woodville***	1,251	984	108,707	805	6,222	1,394	1,137	135,854	926	8,547
Eketāhuna	172	67	3,738	73	37	178	65	3,634	71	38
Ormondville	66	17	439	14	3	66	17	460	14	3
Norsewood	63	20	790	37	17	63	20	791	37	17
Pongaroa	67	31	2,250	16	15	69	33	2,197	16	10
Mangatainoka	136	119	18,569	22	347	147	129	26,240	22	392
Mangamutu	42	14	25,117	10	5	41	17	14,925	10	6
Ashhurst***	8	6	538	0	0	8	6	533	0	0
Other	490	210	16,077	178	540	512	227	16,032	183	587

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.20a: Tararua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**4,648**	**2,562**	**284,126**	**2,684**	**31,465**	**5,033**	**2,858**	**316,184**	**2,953**	**62,047**
Dannevirke	806	180	11,844	491	208	854	197	13,373	533	236
Pahiatua	1,157	521	37,532	795	459	1,231	581	42,548	847	511
Woodville***	1,536	1,293	155,801	1,011	21,878	1,669	1,440	186,398	1,112	51,823
Eketāhuna	191	71	4,033	73	40	211	79	4,685	87	52
Ormondville	68	17	455	14	3	71	18	512	14	3
Norsewood	65	20	792	37	17	67	22	831	37	18
Pongaroa	87	51	3,126	33	528	95	56	3,795	40	932
Mangatainoka	152	134	27,862	24	2,848	174	146	29,761	33	2,899
Mangamutu	49	19	23,850	10	6	97	45	13,489	42	27
Ashhurst***	8	6	559	0	0	8	6	552	0	0
Other	529	250	18,272	196	5,478	556	268	20,240	208	5,546

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.20b: Tararua District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Tararua District Total	**5,472**	**3,238**	**358,595**	**3,158**	**91,373**	**5,484**	**3,255**	**359,389**	**3,163**	**91,395**
Dannevirke	909	230	16,053	584	265	909	230	16,053	584	265
Pahiatua	1,331	628	45,510	892	558	1,331	628	45,510	892	558
Woodville***	1,771	1,554	213,551	1,165	66,814	1,771	1,554	213,551	1,165	66,814
Eketāhuna	233	97	5,249	89	62	233	97	5,249	89	62
Ormondville	77	20	656	25	72	77	20	656	25	72
Norsewood	67	22	826	37	18	67	22	826	37	18
Pongaroa	101	62	4,092	45	1,303	101	62	4,092	45	1,303
Mangatainoka	222	190	34,934	46	6,976	222	190	34,934	46	6,977
Mangamutu	119	84	12,530	44	48	119	84	12,530	44	48
Ashhurst***	8	8	629	0	0	8	8	629	0	0
Other	634	343	24,565	231	15,257	646	360	25,359	236	15,278

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.21a: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**2,390**	**963**	**54,825**	**1,402**	**1,211**	**2,637**	**1,127**	**67,347**	**1,556**	**1,488**	**2,895**	**1,323**	**82,763**	**1,720**	**5,804**
Marton	1,035	327	17,658	670	340	1,130	402	23,712	756	447	1,207	453	28,574	840	509
Taihape***	98	38	2,148	46	200	102	37	2,450	46	226	108	41	2,665	50	4,263
Bulls***	416	132	8,253	284	203	472	164	10,181	315	244	510	196	12,712	339	285
Hunterville***	169	89	5,131	101	86	212	111	6,535	115	107	239	139	8,359	124	134
Rātana	69	37	1,783	66	71	69	36	1,811	68	72	69	36	1,810	68	72
Mangaweka***	26	7	751	15	11	31	9	887	16	19	34	9	894	16	20
Koitiata	91	81	3,033	45	89	94	84	3,303	45	94	95	84	3,146	49	97
Other	486	252	16,068	175	211	527	284	18,468	195	279	633	365	24,603	234	424

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.21b: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**3,115**	**1,504**	**101,702**	**1,840**	**6,109**	**3,845**	**2,311**	**167,765**	**2,246**	**11,734**	**4,123**	**2,536**	**192,369**	**2,420**	**14,982**
Marton	1,269	501	33,140	878	556	1,478	833	60,866	1,001	3,369	1,615	926	68,402	1,110	4,733
Taihape***	115	44	3,090	55	4,192	174	73	3,870	84	6,081	181	76	5,426	84	7,777
Bulls***	562	224	15,854	369	319	825	516	36,210	560	777	858	550	41,342	581	688
Hunterville***	250	154	9,498	137	148	313	179	11,798	163	189	351	211	15,326	192	241
Rātana	69	35	1,785	68	72	71	36	1,531	76	70	71	36	1,549	76	70
Mangaweka***	36	12	1,013	20	22	48	23	1,546	20	28	55	28	1,809	23	32
Koitiata	96	83	3,220	49	99	101	84	3,190	45	102	104	87	3,276	45	104
Other	718	451	34,102	264	701	835	567	48,754	297	1,118	888	622	55,239	309	1,337

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.22a: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**3,368**	**1,713**	**121,933**	**1,961**	**5,703**	**3,578**	**1,903**	**139,941**	**2,063**	**12,444**
Marton	1,316	548	37,176	914	3,056	1,382	594	40,155	958	4,340
Taihape***	123	50	3,723	55	933	126	52	3,954	55	5,475
Bulls***	669	295	21,339	395	376	716	367	28,483	421	440
Hunterville***	264	167	10,919	162	185	288	175	12,386	176	218
Rātana	72	37	1,536	76	70	72	37	1,556	76	70
Mangaweka***	37	12	1,006	20	23	39	12	1,002	23	24
Koitiata	97	82	3,219	49	101	98	85	3,206	49	103
Other	790	522	43,015	290	959	857	581	49,199	305	1,774

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.22b: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**3,784**	**2,051**	**154,980**	**2,190**	**15,391**	**3,795**	**2,060**	**155,199**	**2,189**	**15,411**
Marton	1,478	653	44,297	1,038	4,444	1,478	653	44,297	1,038	4,444
Taihape***	129	55	4,110	55	7,244	129	55	4,110	55	7,244
Bulls***	750	394	30,712	445	509	750	394	30,712	445	509
Hunterville***	308	190	13,716	184	268	308	190	13,715	184	268
Rātana	71	36	1,554	76	70	71	36	1,554	76	70
Mangaweka***	40	13	1,081	23	25	40	13	1,081	23	25
Koitiata	101	88	3,357	49	104	113	98	3,646	48	121
Other	907	622	56,153	320	2,727	906	621	56,084	320	2,730

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.23a: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**2,560**	**1,141**	**70,023**	**1,490**	**1,509**	**2,824**	**1,324**	**88,327**	**1,648**	**1,777**
Marton	1,068	379	21,399	713	401	1,163	452	28,874	801	480
Taihape***	98	38	2,147	46	200	102	37	2,446	46	226
Bulls***	425	142	9,154	288	208	474	165	10,036	315	247
Hunterville***	199	115	6,534	117	113	231	137	8,187	127	141
Rātana	69	37	1,783	66	71	69	36	1,811	68	72
Mangaweka***	26	7	751	15	11	31	9	887	16	19
Koitiata	91	81	3,033	45	89	94	84	3,303	45	94
Other	584	342	25,222	200	416	660	404	32,783	230	498

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.23b: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)**					0.5% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**3,062**	**1,501**	**100,660**	**1,790**	**6,043**	**3,288**	**1,676**	**122,072**	**1,915**	**6,310**
Marton	1,233	495	31,060	858	530	1,285	535	35,002	891	574
Taihape***	108	41	2,665	50	4,262	115	44	3,093	55	4,192
Bulls***	511	196	12,769	339	286	565	228	16,209	369	320
Hunterville***	251	152	9,427	149	185	272	164	12,000	166	209
Rātana	69	36	1,810	68	72	69	35	1,785	68	72
Mangaweka***	34	9	894	16	20	36	12	1,013	20	22
Koitiata	95	84	3,146	49	97	96	83	3,220	49	99
Other	761	488	38,889	261	591	850	575	49,750	297	822

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.24a: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**3,543**	**1,889**	**154,238**	**2,026**	**5,860**	**3,755**	**2,094**	**172,841**	**2,134**	**12,603**
Marton	1,333	572	38,819	931	3,077	1,404	626	42,550	985	4,375
Taihape***	123	50	3,724	55	933	126	52	3,945	55	5,475
Bulls***	670	298	21,691	398	378	720	369	28,232	422	440
Hunterville***	288	182	12,793	174	238	301	187	13,532	183	277
Rātana	72	37	1,536	76	70	72	37	1,556	76	70
Mangaweka***	37	12	1,006	20	23	39	12	1,002	23	24
Koitiata	97	82	3,219	49	101	98	85	3,206	49	103
Other	923	656	71,450	323	1,040	995	726	78,818	341	1,839

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.24b: Rangitīkei District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Rangitīkei District Total	**3,951**	**2,231**	**189,399**	**2,275**	**15,531**	**3,962**	**2,240**	**188,031**	**2,274**	**15,556**
Marton	1,508	681	46,452	1,080	4,475	1,508	681	46,440	1,080	4,476
Taihape***	129	55	4,096	55	7,244	129	55	4,109	55	7,244
Bulls***	754	397	30,867	446	509	754	397	31,005	446	511
Hunterville***	311	191	15,084	188	305	311	191	15,080	188	305
Rātana	71	36	1,554	76	70	71	36	1,554	76	70
Mangaweka***	40	13	1,081	23	25	40	13	1,081	23	25
Koitiata	101	88	3,357	49	104	113	98	3,646	48	121
Other	1,037	770	86,908	358	2,799	1,036	769	85,116	358	2,804

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.25a: Ruapehu District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**					1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**1,995**	**900**	**54,149**	**859**	**5,798**	**2,203**	**1,046**	**68,768**	**939**	**16,866**	**2,380**	**1,194**	**77,583**	**1,022**	**18,675**
Taumarunui	500	246	14,024	334	5,260	557	288	16,840	364	10,353	608	330	19,561	392	10,636
Ohakune	449	211	14,377	189	165	505	240	16,244	217	188	544	280	19,239	239	224
Raetihi	209	97	5,064	120	92	218	102	5,150	127	102	231	109	5,712	137	112
Waiouru	71	22	1,691	20	12	76	23	3,417	20	13	80	24	3,330	20	14
Ōwhango	68	22	852	22	10	70	22	923	26	11	72	23	971	26	12
Ōhura	60	30	2,265	11	12	65	29	3,267	12	12	66	29	3,802	12	13
National Park	44	9	1,650	12	2	44	11	2,509	12	2	44	11	860	12	3
Rangataua	31	11	275	15	10	34	15	352	15	11	35	16	360	15	11
Raurimu	29	10	260	8	3	32	10	261	9	3	33	10	255	9	3
Taihape***	6	3	29	0	0	7	5	125	0	0	8	6	179	0	0
Other	528	239	13,662	128	232	595	301	19,680	137	6,171	659	356	23,314	160	7,647

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.25b: Ruapehu District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Up

Town/Settlement	0.5% AEP Flood – Current Climate (0°C)**					0.2% AEP Flood – Current Climate (0°C)**					0.1% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**2,594**	**1,363**	**97,039**	**1,109**	**22,767**	**2,992**	**1,695**	**128,005**	**1,367**	**41,689**	**3,478**	**2,191**	**163,269**	**1,746**	**48,535**
Taumarunui	663	381	22,813	423	11,063	836	541	37,246	557	26,766	1,192	914	61,684	882	28,476
Ohakune	577	309	21,684	249	252	635	337	24,854	283	301	670	375	27,600	302	1,577
Raetihi	249	119	6,350	150	127	259	124	6,794	168	144	266	130	7,094	179	157
Waiouru	82	24	3,810	20	14	98	40	4,981	25	21	99	40	4,710	26	21
Ōwhango	76	23	1,013	26	12	76	24	1,045	26	12	78	27	1,152	26	12
Ōhura	71	33	4,069	12	13	82	40	4,430	20	15	89	46	4,632	23	19
National Park	44	11	1,050	12	3	47	11	1,248	12	3	47	11	1,209	12	4
Rangataua	36	16	460	15	11	41	16	474	18	12	42	16	474	18	12
Raurimu	35	10	266	9	3	37	11	258	9	3	39	12	296	9	4
Taihape***	8	6	235	0	0	9	6	276	0	0	9	6	300	0	0
Other	753	431	35,289	193	11,269	872	545	46,399	249	14,412	947	614	54,118	269	18,253

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.26a: Ruapehu District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**3,055**	**1,774**	**132,802**	**1,425**	**41,955**	**3,692**	**2,410**	**181,528**	**1,906**	**51,118**
Taumarunui	904	616	40,886	628	26,945	1,354	1,087	75,865	1,029	30,039
Ohakune	628	335	24,879	278	304	685	379	27,773	304	1,584
Raetihi	259	124	6,574	168	143	269	130	7,080	184	158
Waiouru	84	27	4,403	21	14	89	29	5,166	21	14
Ōwhango	76	25	1,065	26	12	82	28	1,214	29	13
Ōhura	82	40	4,499	16	15	93	49	4,684	23	19
National Park	47	11	1,200	12	3	47	11	1,125	12	4
Rangataua	41	16	457	18	12	41	16	505	18	12
Raurimu	38	11	257	9	3	39	12	292	9	4
Taihape***	8	6	248	0	0	8	6	264	0	0
Other	888	563	48,334	249	14,504	985	663	57,560	277	19,271

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.26b: Ruapehu District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Up

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**4,102**	**2,832**	**221,900**	**2,135**	**61,967**	**4,102**	**2,832**	**221,900**	**2,135**	**61,967**
Taumarunui	1,608	1,380	97,112	1,199	36,551	1,608	1,380	97,112	1,199	36,551
Ohakune	731	420	31,690	316	1,630	731	420	31,690	316	1,630
Raetihi	280	134	7,258	188	168	280	134	7,258	188	168
Waiouru	97	31	5,812	24	15	97	31	5,812	24	15
Ōwhango	85	29	1,256	29	14	85	29	1,256	29	14
Ōhura	99	52	4,892	23	20	99	52	4,892	23	20
National Park	48	11	935	12	4	48	11	935	12	4
Rangataua	43	16	493	18	13	43	16	493	18	13
Raurimu	45	16	312	15	8	45	16	312	15	8
Taihape***	8	6	279	0	0	8	6	279	0	0
Other	1,058	737	71,861	311	23,544	1,058	737	71,861	311	23,544

*Towns/Settlements are listed in order from highest to lowest total population.

**Flood scenario assumes existing flood defences are in place.

***Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.27a: Ruapehu District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	5% AEP Flood – Current Climate (0°C)**					2% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**1,986**	**893**	**53,773**	**856**	**5,790**	**2,185**	**1,033**	**68,021**	**928**	**16,850**
Taumarunui	491	239	13,652	331	5,252	539	275	16,102	353	10,336
Ohakune	449	211	14,377	189	165	505	240	16,244	217	188
Raetihi	209	97	5,064	120	92	218	102	5,150	127	102
Waiouru	71	22	1,691	20	12	76	23	3,417	20	13
Ōwhango	68	22	852	22	10	70	22	923	26	11
Ōhura	60	30	2,266	11	12	65	29	3,267	12	12
National Park	44	9	1,650	12	2	44	11	2,509	12	2
Rangataua	31	11	275	15	10	34	15	351	15	11
Raurimu	29	10	260	8	3	32	10	261	9	3
Taihape***	6	3	29	0	0	7	5	125	0	0
Other	528	239	13,657	128	232	595	301	19,672	137	6,172

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.27b: Ruapehu District Vulnerability Assessment Results by Town/Settlement - No Climate Warming (0°C) and Existing Flood Defences Down

Town/Settlement	1% AEP Flood – Current Climate (0°C)**					0.5% AEP Flood – Current Climate (0°C)**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**2,355**	**1,178**	**76,699**	**1,008**	**18,656**	**2,564**	**1,339**	**95,547**	**1,091**	**22,742**
Taumarunui	583	314	18,704	378	10,616	633	357	21,314	405	11,037
Ohakune	544	280	19,239	239	224	577	309	21,684	249	252
Raetihi	231	109	5,712	137	112	249	119	6,350	150	127
Waiouru	80	24	3,330	20	14	82	24	3,810	20	14
Ōwhango	72	23	971	26	12	76	23	1,013	26	12
Ōhura	66	29	3,803	12	13	71	33	4,069	12	13
National Park	44	11	860	12	3	44	11	1,050	12	3
Rangataua	35	16	360	15	11	36	16	460	15	11
Raurimu	33	10	255	9	3	35	10	266	9	3
Taihape***	8	6	179	0	0	8	6	235	0	0
Other	659	356	23,286	160	7,648	753	431	35,296	193	11,270

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.28a: Ruapehu District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 1°C climate warming**					0.5% AEP Flood – 2°C climate warming**				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**3,160**	**1,869**	**138,321**	**1,524**	**42,154**	**3,759**	**2,474**	**184,948**	**1,948**	**51,229**
Taumarunui	1,009	711	46,412	727	27,145	1,418	1,151	79,277	1,065	30,148
Ohakune	628	335	24,879	278	304	685	379	27,773	304	1,584
Raetihi	259	124	6,574	168	143	269	130	7,086	184	158
Waiouru	84	27	4,403	21	14	89	29	5,166	21	14
Ōwhango	76	25	1,065	26	12	82	28	1,214	29	13
Ōhura	82	40	4,499	16	15	93	49	4,684	23	19
National Park	47	11	1,200	12	3	47	11	1,125	12	4
Rangataua	41	16	457	18	12	41	16	505	18	12
Raurimu	38	11	257	9	3	42	12	294	15	4
Taihape***	8	6	248	0	0	8	6	264	0	0
Other	888	563	48,327	249	14,503	985	663	57,560	277	19,273

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

Table D3.28b: Ruapehu District Vulnerability Assessment Results by Town/Settlement - 0.5% AEP Flood Event with Climate Warming (1°C, 2°C, and 3°C) and Existing Defences Down

Town/Settlement	0.5% AEP Flood – 3°C climate warming**					0.5% AEP Flood – 3°C climate warming** + Sea Level Rise				
	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)	No. of buildings exposed	Total no. buildings for reinstatement costs	Total building reinstatement cost (NZD 000s)	Total population exposed	Total life cost (NZD 000s)
Ruapehu District Total	**4,122**	**2,857**	**224,947**	**2,160**	**62,307**	**4,122**	**2,857**	**224,948**	**2,160**	**62,307**
Taumarunui	1,628	1,405	100,164	1,224	36,893	1,628	1,405	100,164	1,224	36,893
Ohakune	731	420	31,690	316	1,630	731	420	31,690	316	1,630
Raetihi	280	134	7,258	188	168	280	134	7,258	188	168
Waiouru	97	31	5,812	24	15	97	31	5,812	24	15
Ōwhango	85	29	1,256	29	14	85	29	1,256	29	14
Ōhura	99	52	4,892	23	20	99	52	4,892	23	20
National Park	48	11	935	12	4	48	11	935	12	4
Rangataua	43	16	493	18	13	43	16	494	18	13
Raurimu	45	16	315	15	8	45	16	315	15	8
Taihape***	8	6	279	0	0	8	6	279	0	0
Other	1,058	737	71,853	311	23,542	1,058	737	71,853	311	23,542

*Towns/Settlements are listed in order from highest to lowest total population.

**Due to district boundaries the results for this Town/Settlement are spread across more than one district. See tables D1.7.1-D1.8.17 for complete results for this Town/Settlement.

WSP
Christchurch
12 Moorhouse Avenue
New Zealand
+64 3 363 5400
wsp.com/nz

APPENDIX E – METHODOLOGY FOR RISK OUTPUT POST PROCESSING

MEMORANDUM

To	Jon Roygard, Group Manager Natural Resources and Partnerships
Copy	Julia Jung, Team Leader Design & Investigations
From	Richard Woods, Service Line Leader Risk & Resilience
Office	Auckland
Date	11 February 2026
Subject	Methodology for Risk Output Post Processing

1. Introduction

This memorandum explains the post-processing processes, implemented by WSP, for the Flood Vulnerability Assessment (FVA) risk results. It details the data sources, model scenarios, data processing calculations, corrections and limitations employed or identified during post-processing.

2. Terminology used in reporting

AEP: Annual Exceedance Probability; a proxy for the probability of a flood event (or larger) occurring in a given year. Generally referred to in these reports as a rounded percentage.

- Related to Average Recurrence Interval (years); ARI = −1 / ln(1 − AEP).

ARI: Average Recurrence Interval; a proxy for how frequent a specific flood may occur (average years between events over a long period of time).

- Related to AEP; AEP = 1 – exp(-1 / ARI).

Building reinstatement value: input value (NZD) of each building in the ESNZ population model.

Building reinstatement cost: modelled cost due to flooding to buildings.

- These results use values from the 0.20 m floor level / 0.5 exposed ratio flood conditions.
- Data reported in ESNZ table results column "Building_Repair_Cost".

Climate Scenario: degrees of warming relative to “present” conditions.

- Data reported in ESNZ table results column “ClimateScenario".

Defences: status of flood defences, such as stopbanks.

- Data reported in ESNZ table results column “StopbankStatus". The model conditions can have either defences “up” or defences “down.”
- Some catchments do not have defences infrastructure. These are indicated by results with “no_stopbanks.”
- Equivalent to “Stopbank status”.

District: 10 geographic boundaries defined by the client.

- Equivalent to “TA” or “Territorial Authority”.
- The initial results from ESNZ included some building results within Stratford, Waitomo, Taupo districts. These buildings were removed in the WSP processed results.
- District column added to flood results data by WSP using district boundary shapefiles.

Exposed: boolean (true or false); whether a building meets the defined Floor Level and Exposure Ratio conditions in the flood results.

- Exposure results: value >0.05 in the “Water_Depth” column in ESNZ table results.
- Building reinstatement cost: value >0.20 in the “Water_Depth” column in ESNZ table results

AND

- Value ≥ 0.5 in the “Exposed_Ratio” column in ESNZ table results.

Exposure Ratio: ratio of building area exposed to flooding.

- Data reported as “Exposed_Ratio” (values between 0 and 1) in ESNZ table results
- Similar to ‘exposure percentage' (exposure percentage = exposed ratio * 100)
- Results files named with EP (e.g., EP50) meaning threshold exposure percentage of 50% from ESNZ for some value calculations

Floor Level: height of flooding above ground surface. Displayed in millimetre units in the WSP report documents and appendices.

- Equivalent to “floor height”
- Data reported in metres in ESNZ table results in column “floorHeight”
- Floor level is indicated by “FH” and the respective height in centimetres in the results file naming from ESNZ (e.g., Horizons2_EPL_Bulls_FH20cm_EP50.csv).

Fatality Cost: cost due to fatalities and injuries for each populated building

- Equivalent to previously used terms, “Life Cost,” “injury cost,”
- Data reported in ESNZ table results in column “Life_Cost” for each building

Model Scenario: term used in this documentation to identify different flood results provided by ESNZ. A model scenario represents a combination of different flood recurrence, defences, climate, and sea-level rise conditions.

- Horizons requested flood model results for 17 different model scenarios.

Region: Horizons Regional Council boundary defined by the client.

Sea-level rise: True or False condition for if sea level rise is included in the flood model.

- Represented in the results data table under the “seaLevelRise” column.

Town/Settlement: 52 geographic boundaries defined by the client + “Other”

- Equivalent to “Town” or “Community”
- “Other”: Buildings outside of a mapped town/settlement were designated “remaining” in ESNZ modelling results. These were renamed to “Other” for the WSP reports and tables.
- Data reported in ESNZ table results column “Town”

3. About the Flood Model Data

3.1.1 Flood Model Results Format

ESNZ provided results in .csv files and geopackage files at a Town/Settlement level (i.e., one .csv and geopackage file per Town/Settlement). Each Town/Settlement result file contains all flood model scenario results.

Each row in the results files represents flood results for a single building for a specified model scenario (i.e., for set of model parameters).

The flood modelling results for each building are an aggregation of many river catchments. Therefore, some buildings may appear in aggregated results in more than one district, even for the same model conditions, if it spans multiple river catchments. The summary results calculations and how this was dealt with is explained in more detail below.

Importantly, ESNZ included model results for all combinations of input parameters (AEP, climate scenario, defences status, and sea level rise) in the results files. The flood scenarios and model conditions used in the WSP report and appendices are described in section 3.1.2 Flood Model Scenarios.

3.1.2 Flood Model Scenarios

Table 1 shows the input flood model parameters that define different flood model scenarios used for this study. Note that the letter used for each flood scenario (columns “Model Scenario”) is for internal processing only and is not included in the report.

Table 1: Model scenarios, defined by the associated input parameters, used in the WSP report and appendices.

Model Scenario	ARI	AEP	Rounded Percent AEP	Climate Scenario	Defences/Stopbank Status	Sea Level Rise Status
A	20	0.0488	5	0	up	FALSE
B	50	0.0198	2	0	up	FALSE
C	100	0.01	1	0	up	FALSE
D	200	0.005	0.5	0	up	FALSE
E	500	0.002	0.2	0	up	FALSE
F	1000	0.001	0.1	0	up	FALSE
G	200	0.005	0.5	1	up	FALSE
H	200	0.005	0.5	2	up	FALSE
I	200	0.005	0.5	3	up	FALSE
J	200	0.005	0.5	3	up	TRUE
K	20	0.0488	5	0	down	FALSE
L	50	0.0198	2	0	down	FALSE
M	100	0.01	1	0	down	FALSE
N	200	0.005	0.5	0	down	FALSE
O	200	0.005	0.5	1	down	FALSE
P	200	0.005	0.5	2	down	FALSE
Q	200	0.005	0.5	3	down	FALSE
R	200	0.005	0.5	3	down	TRUE

3.1.3 Sensitivity Testing, Model Conditions, and Result Dataset Validation

The client requested a suite of results for different flood modelling conditions to determine which Floor Level and Exposed Ratio conditions to use in the full regional results modelling. These flood models were performed by ESNZ. The client requested results for the Whanganui Town/Community at 0.5% AEP, defences up, 0°C climate warming and no sea-level rise scenario. The sensitivity test results represented different combinations of building platform exposure percentages (1%, 20%, 50%, and 100%) and floor levels (50 mm, 150 mm, 200 mm, 300 mm, 400 mm, and 500 mm).

WSP analysed and summarized the sensitivity model results, focusing on reinstatement cost and number of buildings exposed, broken down by building type (see section4.1.3 Building type classification).

The client reviewed the results of the sensitivity analysis and decided on the 50% exposure percentage (i.e., 0.5 exposure ratio) and 50 mm Floor Level conditions for the full regional flood model.

ESNZ advised that it is standard practice for reinstatement cost calculations impose a 200 mm condition for floor height. In other words, a building must experience 200 mm of flood water depth before reinstatement costs are calculated. Based on this feedback, it was determined that ESNZ would provide two sets of model results for each chosen model scenario: 50 mm and 200 mm floor height. The 50 mm floor height data would be used to calculate the building and population exposure results, as well as Life Cost and Fatalities. The 200 mm floor height results would be used to calculate the Building Reinstatement Costs, Life Costs and Fatality counts.

Upon delivery of the full model results by ESNZ, WSP validated the full model results for the Whanganui Town/Settlement for the same model parameters and results in the sensitivity test. These values matched, therefore, WSP proceeded with the full results dataset. The other Towns/Communities could not be validated by WSP.

3.1.4 ESNZ-provided data corrections files

After the initial Phase2 full result delivery, ESNZ provided additional “Corrections” files. These included the Foxton, Palmerston North, and ‘remaining’ Town/Settlements for the 5 cm floor height datasets and Palmerston North and ‘remaining’ Town/Settlements for the 20 cm floor height datasets. These ‘corrected’ files superseded the original files for each respective Town/Settlement result file.

It was noted that the ‘corrected’ Palmerston North 20 cm floor height files were missing buildings (result rows) compared to the 5 cm corrected file. This issue was raised with ESNZ and was addressed in with an additional ‘corrected’ Palmerston North results dataset.

After initial processing, it was also noted by WSP that the summarized flood results for model scenarios with Sea-Level Rise were much lower than expected, based on comparisons with other model scenario results. This issue was raised with ESNZ and was addressed by rerunning the full flood model with adjusted input parameters for the scenarios with sea-level rise.

The reprocessed results from the sea-level rise corrected dataset, delivered from ESNZ to WSP on 12 November 2025, superseded and replaced all previous model results.

4. Data Processing and Calculations

4.1.1 Geographic Boundaries, Data Extents, and Result Exclusions

District Boundaries

WSP assigned districts to each building result before calculating flood model results. This was performed by WSP in GIS using a spatial join. WSP saved the new results into combined (all Town/Settlement) csv files, one for 50 mm, and one for 200 mm floor height, for python post-processing.

The original flood model results dataset from ESNZ included buildings in the Stratford District (679), Waitomo District (181), and Taupō District (1). Buildings in Stratford, Waitomo, and Taupō Districts were excluded from the flood results datasets before summary post-processing.

Building footprint and District boundary interactions

Two buildings fall outside of the provided district boundaries geospatial files. These buildings were removed from the flood model results.

Building footprint and Property boundary interactions

Property boundaries were used to calculate areas as in Appendix Table D1.1 to D1.6. Some buildings fall outside of the property boundary boundaries. As discussed below, all buildings were only classified into use type by area. Therefore, no further action was required.

Building footprint and Town/Settlement boundary interactions

The client requested that buildings be assigned to the Town/Settlement with the largest proportion of building area, based on the geospatial boundaries provided by the client.

ESNZ provided flood result data to WSP with Town/Settlement already assigned. However, for each building intersected by a Town/Settlement border, the building was split into two buildings, with each portion assigned to the two respective Towns/Settlements. For some calculations, this would lead to double-counted buildings, one for each Town/Settlement. There were 82 buildings that were impacted by this issue, resulting in ~4000 extra rows of results.

Buildings outside Town/Settlement boundaries

Some of the modelled buildings fall outside of a Town/Settlement. These were provided in the ESNZ results files with the name ‘remaining.’

The ‘remaining’ Town/Settlement was renamed to ‘Other’ in the WSP reporting and result tables.

4.1.2 Flood model raster resolution differences and corrections

During data processing, WSP noticed inconsistencies in results for smaller Towns/Communities at low-frequency AEPs, given the same other model parameters (e.g., Models A to F in Table 1). This manifested as increases in building exposure at progressively lower-frequency AEPs (as expected) but decreases in building exposure at 2% and 0.2% AEP (not expected).

WSP identified the cause as changes in the flood raster resolution, which is a primary input in the RiskScape model. The higher frequency flood results had coarser raster resolution (larger cells) and the

lower-frequency flood rasters had finer resolution (smaller cells). This resulted in fewer buildings exposed at resolution changes (e.g., between 5% and 2%, and between 0.5% and 0.2%) that was unrelated to flood severity.

After discussions with ESNZ, it was determined that raster resolution changes were a limitation of the method and could not be changed. Since this issue primarily affected small towns, WSP and ESNZ determined the best solution for this project was to manually adjust the flood results for the following town-district localities: Halcombe- Manawatū, Hunterville-Rangitikei, Kimbolton-Manawatū, Longburn-Manawatū, Longburn-Palmerston North City, Mangaweka-Manawatū, Mangaweka-Rangitikei, Taihape-Rangitikea, and Taihape-Ruapehu.

This was explained in powerpoint slides provided to the client. The client agreed with the following manual corrections below.

The corrections incorporated into the final report assumed that the 0.1% AEP (the least frequent modelled flood, model F in Table 1) should have the most affected buildings. Therefore, the exposed buildings for all other flood scenarios were limited to (at maximum) the specific buildings exposed at the 0.1% AEP scenario. This correction was only applied to the above (town-district) localities at the 0° C, defences up, and no SLR scenarios.

Finally, the Longburn-Manawatū locality showed more exposed buildings at the 0.2% AEP than the 0.5% AEP after the initial corrections. WSP applied a second correction that assumed areas exposed to flooding in the 0.5% AEP event would also be exposed to flooding in the 0.2% AEP event. Therefore, 0.2% AEP (model scenario E) results for this location were modified to include the buildings exposed to the 0.5% AEP event (model scenario D), without additional modifications.

4.1.3 Building type classification and area exclusions

Buildings were assigned one use type classification from the following categories:

- Residential
- Commercial/Industrial
- Rural
- Other

The building types were assigned to categories above using the client-provided document “Bins of property use type.xlsx” and the results column “Property_Use”.

The ESNZ dataset included some buildings classified as “Unknown,” which was not included in the table provided by the client. These buildings were assigned to the “Other” use type category during the WSP post-processing.

Additionally, the client requested designations based on the number of buildings on a property and the building size (area). The client initially requested the following designations:

> “First exclude all structure less than or equal to 10m^2.
> Define primary and secondary structures as:
> Where there is one structure per property parcel:
> - That structure is counted as the primary structure, do not consider the size of the structure.
>
> Where there are multiple structures per property parcel:
> - If structure(s) are between 10.1m^2 and 70m^2 (inclusive of these values) then count as secondary.
> - If structure(s) are greater than or equal to 70.1m^2 count as primary”

However, not all buildings had an associated property geospatial layer and therefore could not be classified based on number of buildings on a property. Additionally, the data precision specified above could leave some buildings between size categories (e.g., a building with area 70.05 m^2). Therefore, WSP classified buildings only based on area, using the following logic:

- Exclude buildings from results if area ≤ 10.0 m^2
- Classify “Secondary” if building area > 10.0 and building area ≤ 70.0 m^2
- Classify “Primary” if building area > 70.0 m^2

The area is provided in the “Area” column of ESNZ flood results dataset.

4.1.4 Total Building and Total Population Counts

The total population and number of buildings for each town/settlement or district in the WSP reports represents the number included in the flood model datasets. It may not reflect census data or current populations.

The total population is calculated by summing the “Population” column for all unique buildings in the filtered results dataset. The filtered results dataset excludes small buildings, duplicate buildings split across Town/Settlement borders, or buildings outside the area of interest (see sections 4.1.1, 4.1.3).

The total number of buildings was calculated from the filtered full results dataset by counting the number of unique buildings for each category of building type.

4.1.5 Filtering by model scenario

The results data were grouped by model scenario in order to summarise results. For each requested model scenario (see section 3.1.2), the full results were subset by extracting data rows with matching parameters shown in Table 1.

Importantly, some buildings occupy catchments without stopbanks. These buildings have “no_stopbank” in the StopbankStatus column instead of “up” or “down”. The flood model results for these buildings do not change between Defences Up or Defences Down model conditions. Therefore, buildings with “no_stopbank” were included in the summarized results for both “Defences Up” and “Defences Down” model scenario results for the same ARI, Climate, and Sea Level Rise conditions.

4.1.6 Life Cost and Total Fatalities

The ESNZ results provided population, fatality damage ratio, and life cost (per building result), where:

Fatality cost per building (Life_Cost) =

building population * value of one life * fatality damage ratio

ESNZ advised to calculate total fatalities by summing up the product of the fatality ratios and building populations for each building exposed. In other words:

Number of fatalities per building = building population * fatality ratio

Number of fatalities for town or district =

sum (building population * fatality ratio) for all buildings in town or district

However, the fatality ratio and summed total do not reflect an actual number of modelled fatalities. Many fatality ratios are less than one, and it is unclear what ratio corresponds to a fatality versus an injury. For example, if one building has a fatality damage ratio of 0.25 and a population of 4, the total fatalities would be 1. However, it is possible that this situation may result in zero fatalities.

Therefore, the total fatalities do not reflect the number of people affected but may be considered when comparing impacts between flood model scenarios. The total fatalities is likely more accurate when considered over larger population.

In the results tables, WSP reported fatalities to the nearest whole number. For Total Fatalities between 0 and 1, the table values read “0 to 1.” This is to capture that the conditions are present for fatalities to occur, but the chance is low. Additionally, this approach maintains consistency between the Total Fatalities and Fatality Cost, since even small fatality ratios will incur Fatality Cost. It would appear incorrect if the Total Fatalities were zero, but the Fatality Cost was greater than zero.

4.1.7 Safety Threat Level

The Safety Threat Level is provided by the column “Safety_Threat_Level_Text” in the ESNZ flood model result data. The possible results for each building in the model are “None”, “Low”, “Moderate”, “Significant”, and “Extreme.”

The total counts for each safety threat level were calculated by summing the number of each threat rating for each unique building for a given flood model scenario. As explained above (section 3.1.1), some buildings have more than one model result for each flood model scenario because they span multiple catchments. In these cases, the highest rating for each building is used in the sum totals for each model scenario.

APPENDIX F – SENSITIVITY ANALYSIS LETTER REPORT 1

23 January 2026

Horizons Regional Council
15 Victoria Avenue
Palmerston North Central
Palmerston North 4410

Whanganui Sensitivity Analysis Results

1-E0315.00

Dear Julia,

Following the original flood vulnerability assessment risk model outputs for residential buildings, Horizons Regional Council (HRC) has requested that WSP and Earth Sciences New Zealand (ESNZ) expand the model to include additional building types. To support a more comprehensive review of how model parameters influence outcomes, sensitivity testing was conducted using the Whanganui Flood Model Extent.

This letter report presents the results of the sensitivity analysis, with recommendations and the selected model parameters for the full risk assessment outlined at the beginning. It then provides detailed information on the sensitivity analysis parameters, results, and supporting data included in the appendices.

1. Discussion on Options for Flood Risk Model Configuration

This section outlines various flood risk model configurations, commonly applied in New Zealand, to support different types of risk assessments. The discussion focusses on three main variables to either modify or report on:

1. **Exposed Ratio (ER):** The percentage of the building footprint exposed to flooding as a minimum threshold for whether that building is included in exposure or risk calculations.
2. **Floor Level (FL):** A minimum floor level threshold for whether that building is included in exposure or risk calculations.
3. **Building Use Type:** A classification (Residential, Commercial, Rural, etc.) that defines the primary use of a building. For the purposes of the Horizons Flood Vulnerability Assessment, these use cases have been separated into Primary and Secondary use types to provide an understanding of the risk to all buildings including appurtenant structures.

Depending on what the risk assessment aims to assess, different configurations of these variables, or reporting of use types, can provide more representative results. For example, an exposed ratio of 1% and floor level of 50mm provides a conservative estimate of all buildings exposed to a flood scenario. In comparison, this approach would not be satisfactory to represent habitable floor flooding where an exposed ratio of 50% and a floor level of 200mm is more appropriate.

1.1 Approach taken in national flood risk studies

ESNZ has implemented several national and regional flood risk modelling studies for fluvial, pluvial, and coastal flooding. When mapping flood exposure, a conservative approach will classify any building touched by water as exposed (1% ER, 50mm FL). ESNZ has found this approach tends to overestimate economic losses, as many buildings with minor water contact are unlikely to sustain damage, especially if floor levels are not exceeded.

To improve damage model accuracy, ESNZ's national models apply a threshold where at least 50% (ER) of the building footprint must be inundated by water deeper than 50mm (FL) to be considered at risk of damage. These thresholds have been chosen as water depths below 50 mm in pluvial flood models are often uncertain, and 50 mm provides confidence that water is present on-site. This is particularly relevant for regional (Level A) models where urban stormwater networks are poorly represented or not included in the model – leading to an overestimation of inundation in areas where the network would typically manage flooding up to design levels. Results using this approach, are considered best practice to represent all buildings exposed to flooding.

While this approach calculates how many buildings could be exposed to flooding under each scenario, it does not distinguish between buildings that are simply exposed to water and those that are damaged. In real-world flood events, only a portion of exposed buildings typically sustain damage, often much less than the total number

exposed. For example, observations from past events suggest that a smaller number of buildings exposed to floodwaters may actually sustain damage. This means that the number of buildings shown as "exposed" in the model is likely higher than the number that would be damaged in reality. This distinction is important for interpreting the results as the model provides a broad overview of potential exposure, but not all exposed buildings will experience damage.

With this in mind, the 50% ER and 50mm FL thresholds do not consider New Zealand building code floor level requirements for slabs on ground where the minimum clearance is 150mm above unpaved ground and 100mm above paved areas. In practice, we find that most finished floor levels are often higher than 150mm above ground, possibly due to other requirements for elevation relative to road level (i.e., 150mm above the lowest point on the site boundary, 150mm above the crown of the road). In addition, the vertical error of LiDAR is typically between +/- 0.05m and 0.25m so the 200mm proxy would fall within the confidence intervals of any LiDAR topography for the site.

As most building losses are incurred when the habitable floor level is exceeded, an approach to model habitable building losses can be to adopt a 200mm as a general proxy for floor level. In this case, we would recommend retaining the 50% ER. While national scale event data for validation is limited, this approach produces annual loss estimates broadly consistent with Insurance Council figures over the past five years.

1.2 Observations using data from previous events

Empirical observations of flood damage are a useful dataset to calibrate damage and loss models but less useful to compare the number of exposed buildings during an event.

Design storm modelling vs specific events
Specific flood events do not occur uniformly across communities, so it is difficult to compare design flood event exposure calculations. In real events, the spatial variability of rainfall and different catchment responses mean it can be difficult to directly compare real event and modelled data.

Building placards as a proxy for damage
Damage observations are typically sourced from buildings placards or insurance claim information which can be subjective or incomplete. For example, placard status is sometimes not static and may be changed during the recovery following further inspection. This was an issue in documenting impacted buildings in Hastings following the Cyclone Gabrielle event in 2023. In addition, placards relate to the suitability of the building for access and does not necessarily represent damage or loss. White placards are frequently undocumented or not used. While they indicate that a building is safe to occupy, they do not necessarily mean the structure is free from damage.

Observations from the 2015 event
Horizons has provided us with placard information for the June 2015 event in Whanganui; 20 red placards and 140 yellow placards. Return periods for this event are estimated to be within the 100- and 130-year annual recurrence interval (ARI). Assuming that 30%[1] (see Section 1.1) of our modelled exposure results represent the number of damaged buildings, for the 1% annual exceedance probability (AEP) event, 50% ER, and 50mm FL:

- all buildings we estimate 2,405 damaged buildings.
- all primary buildings we estimate 1,454 damaged buildings.
- all buildings, fluvial flooding only we estimate 145 damaged buildings.

Our modelled estimates are much higher than the 160 recorded placards mainly due to our combined pluvial and fluvial design-storm approach. In addition, our results are conservative as there is no representation of the stormwater network in the regional model – leading to an overestimation of exposed buildings from pluvial flooding. While the fluvial flooding only estimates are similar to the number of red and yellow placards, this is still considered an underestimate as damaged properties with white placards have not been recorded.

1.3 Comparative analysis with Feilding

This section provides a relative comparison of exposed buildings between our study and GHD's Feilding 2024 study. The Whanganui study area includes 34,006 buildings, while the Feilding study covers 12,606 buildings. To make the results comparable, a simple approach is to scale our figures by 0.37 (12,606 ÷ 34,006). In Figure 1, the grey bars represent GHD's 2024 results, which include observed data from 2004 as well as upper and lower

[1] Due to the lack of empirical evidence, 30% has been selected as an indicative proxy for 'the smaller number of exposed buildings' mentioned in Section 1.1.

scenario estimates. The black bar shows the average across all GHD scenarios, and the red bars display our results for both all buildings and primary structures only. This visual check helps assess the relative magnitude of exposure between the two studies in a straightforward way.

To provide context, GHD's Feilding scenarios range from about 1,300 to 1,659 buildings exposed at 100mm depth, with an average of 1,471 buildings. When scaled for relativity, Whanganui's results for all buildings range from 2,266 (1% ER) down to 1,555 (100% ER), while primary structures alone range from 1,475 to 914. This shows that, after adjustment, Whanganui's exposure numbers are broadly in line with Feilding's, especially for primary structures at 1% exposure, which closely matches the Feilding scenario average. The comparison is not perfect but provides useful context for decision-making and highlights that the two sets of results are not significantly different when normalised for building counts.

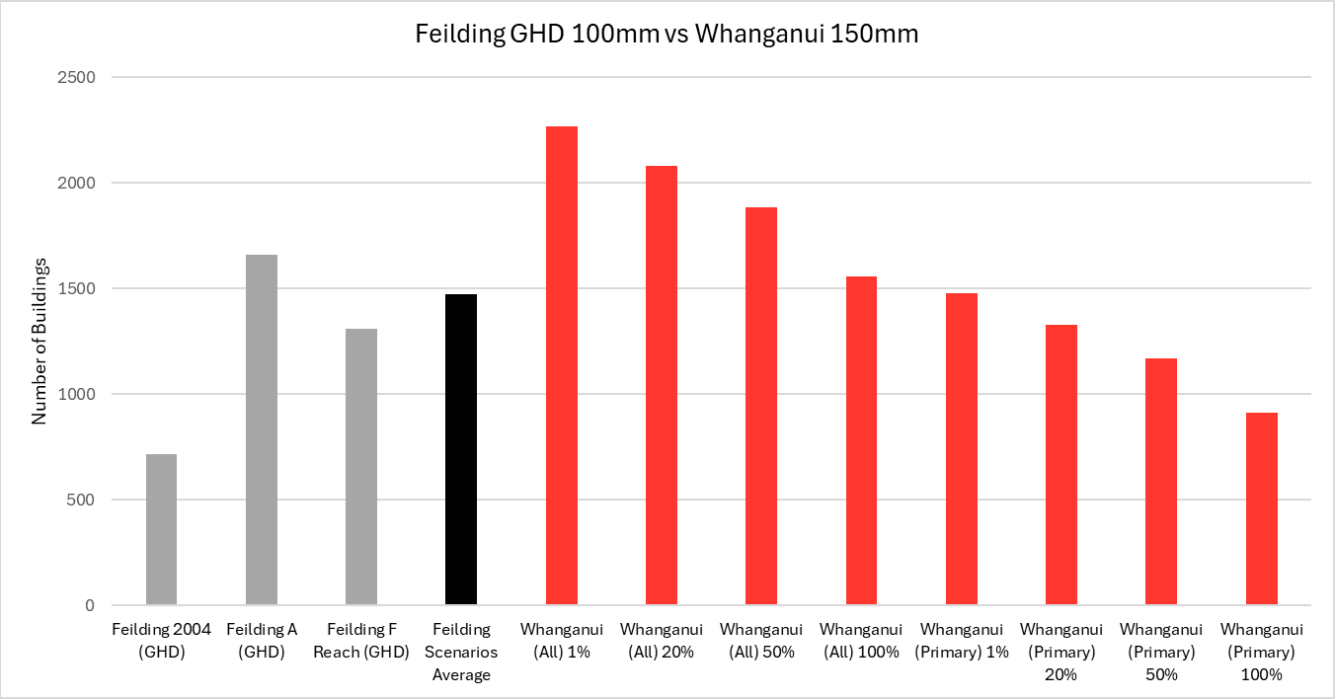


Figure 1: Feilding GHD 100mm vs Whanganui 150mm

1.4 Recommended approach

Based on the results of sensitivity analysis and Horizons' requirements we recommend adopting the following risk model configuration:

- **Building Exposure Counts:** Use a 50% Exposed Ratio and 50mm Floor Level for all buildings.
- **Building Reinstatement Costs:** Use a 50% Exposed Ratio and 200mm Floor Level for all buildings.
- **Fatality Costs:** Employ the same methodology as previously undertaken using Rising Rate.

There is currently no formal guidelines on applying water depth and exposed building area thresholds. This is an evolving area of research from the MBIE endeavour programme on modelling national flood hazards. We have observed with estimating fluvial-pluvial flooding losses that a ER>1% can result in up to 5 times the exposure and loss for buildings compared to ER>50%. We believe that a ER>1% greatly overestimates building damage caused by flooding and ER>50% provides a more realistic representation of the hazard intensities a building site that are likely to cause damage. We recommend applying ER>50% for both estimating both building exposure and damage for consistency (i.e., damage results from exposure). For exposure counts FL, 50mm is further recommended to account for the vertical error of LIDAR topography i.e. water depths >50mm are more likely to indicate the presence of water when vertical error is +/- 50mm.

Based on ESNZ's experience with national modelling, including review of other international studies, we recommend a 50% Exposed Ratio and 200mm Floor Level as reasonable for quantifying building reinstatement values. These variables sufficiently moderate the results to provide a reasonable representation of flooding that will incur damage and loss.

We have used the results of the Whanganui sensitivity analysis to determine the recommended model configuration described above. This analysis has considered a range of modelling contexts to settle on a representative and plausible regional modelling approach. We note that results will differ if alternative model configurations are applied, and this should be considered when interpreting the regional data and results from the broader flood vulnerability assessment.

This section outlines the selected inputs to be applied in the full flood vulnerability risk model rerun, based on the outcomes of the sensitivity testing (Table 1).

Table 1: Model Parameters Selection For Full Risk Assessment

Parameter	**Value**
Scenarios	1. 5% AEP current climate (defences up and down) 2. 2% AEP current climate (defences up and down) 3. 1% AEP current climate (defences up and down) 4. 0.5% AEP current climate (defences up and down) 5. 0.5 % AEP for +1˚ C of climate change (defences up and down) 6. 0.5 % AEP for +2˚ C of climate change (defences up and down) 7. 0.5 % AEP for +3˚ C of climate change (defences up and down) 8. 0.2% AEP current climate (defences up) 9. 0.1% AEP current climate (defences up) 10. 0.5% AEP +3˚ C of climate change with sea level rise (defences up)
Floor Level	For Exposure: 50mm For Reinstatement Cost: 200mm
Exposure Ratio	For Exposure: 50% For Reinstatement Cost: 50%
Primary vs Secondary Structures	Exclude all structures less than or equal to $10m^2$. Where there is one structure per property parcel: • That structure is counted as the primary structure, do not consider the size of the structure. Where there are multiple structures per property parcel: • If structure(s) are between $10.1m^2$ and $70m^2$ (inclusive of these values) then count as secondary. If structure(s) are greater than or equal to $70.1m^2$ count as primary.

2. Sensitivity Testing Parameters

Sensitivity testing has been carried out under a 0.5% Annual Exceedance Probability (AEP) scenario with defences up under current climate conditions for the Whanganui community extent. The analysis incorporates a range of Exposure Ratios and Floor Levels:

- Building platform Exposure Ratios of 1%, 20%, 50%, and 100%
- Varying Floor Levels of 50mm, 150mm, 200mm, 300mm, 400mm and 500mm

Results are categorised across four building use types:

- Residential Buildings,
- Rural Buildings (includes rural industry and lifestyle uses),
- Commercial / Industrial Buildings (includes commercial and industrial uses), and
- Other Buildings (includes transport, utility services, community services, recreational and unknown uses).

Each building structure has been further classified as either primary or secondary. Primary structures are defined as those with a footprint equal to or greater than 70.1m², while secondary structures range between 10.1m² and 70m². Structures with a footprint less than 10m² are excluded from the analysis.

This sensitivity analysis has been implemented for both the 0.5% AEP fluvial/pluvial design event and the 0.5% AEP fluvial only case study.

3. Results

The sensitivity analysis quantifies the number of exposed buildings and their reinstatement costs for each of the ER and FL variations.

Table 2 summarises the total number of buildings used in this analysis and corresponding full reinstatement value across different building types. Residential Primary Structures represent the largest share of total reinstatement value at $7.53 billion, primarily due to their high count of 17,798 buildings. In contrast, Other Primary Buildings, despite being fewer in number, exhibit the highest average reinstatement value per structure at $2.15 million.

Table 2: Total number and reinstatement value for all building types within Whanganui.

Building type	Total number of buildings	Total Reinstatement Value ($M)
Residential Buildings (Primary Structures)	17,798	$7,527
Residential Buildings (Secondary Structures)	11,653	$1,042
Rural Buildings (Primary Structures)	1,246	$769
Rural Buildings (Secondary Structures)	1,048	$101
Commercial/Industrial Buildings (Primary Structures)	1,203	$2,380
Commercial/Industrial Buildings (Secondary Structures)	328	$96
Other Buildings (Primary Structures)	479	$1,028
Other Buildings (Secondary Structures)	251	$50
All Buildings (Primary Structures)	20,726	$11,705
All Buildings (Secondary Structures)	13,280	$1,288
All Buildings	**34,006**	**$12,993**

3.1 Number of Exposed Buildings

The analysis of exposed building counts across varying FLs and ERs provides insight into how these parameters influence model outcomes. As shown in Figure 2, there is a consistent decrease in the number of exposed buildings as floor level increases from 50mm to 500mm. This trend is also observed across all exposure ratio scenarios: 1%, 20%, 50%, and 100%.

Figure 3 presents the same results as Figure 2 but in a different configuration. For example, under the 1% ER scenario the number of exposed buildings decreases by approximately 79%, from 11,223 at 50mm to 2,332 at 500mm. Comparable patterns are evident at other exposure levels, with reductions of 76% at ER 20%, 73% at ER 50%, and 67% at ER 100%. These results highlight the sensitivity of the model to both floor level and exposure ratio inputs.

All tabled results can be found in Appendix F1.

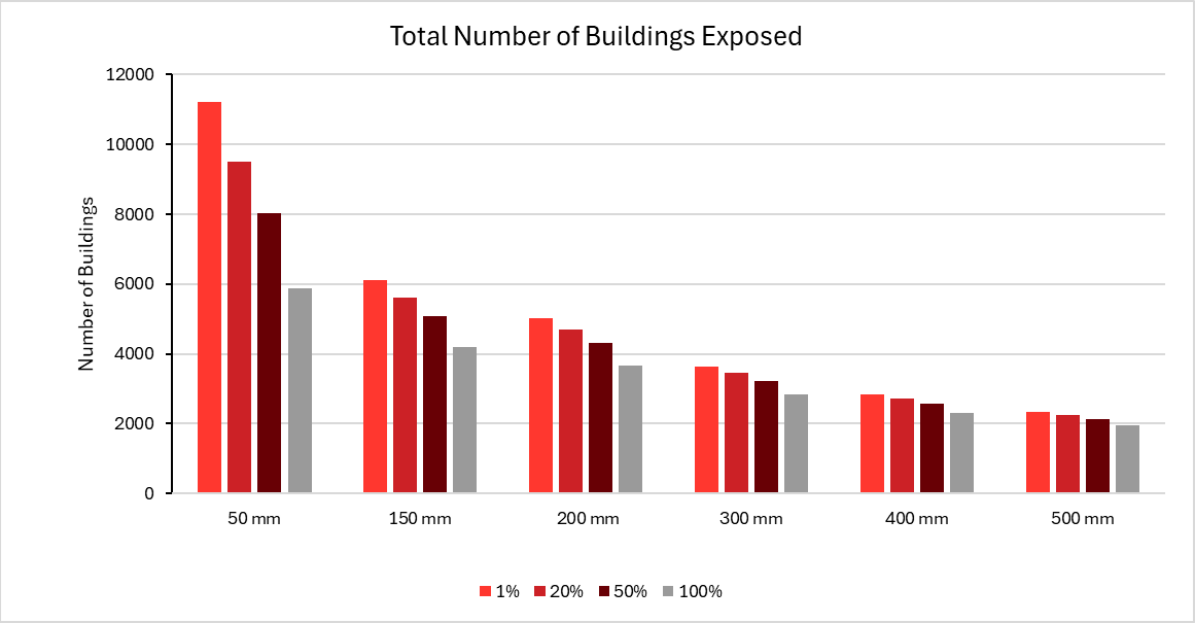


Figure 2: Total Number of Buildings Exposed

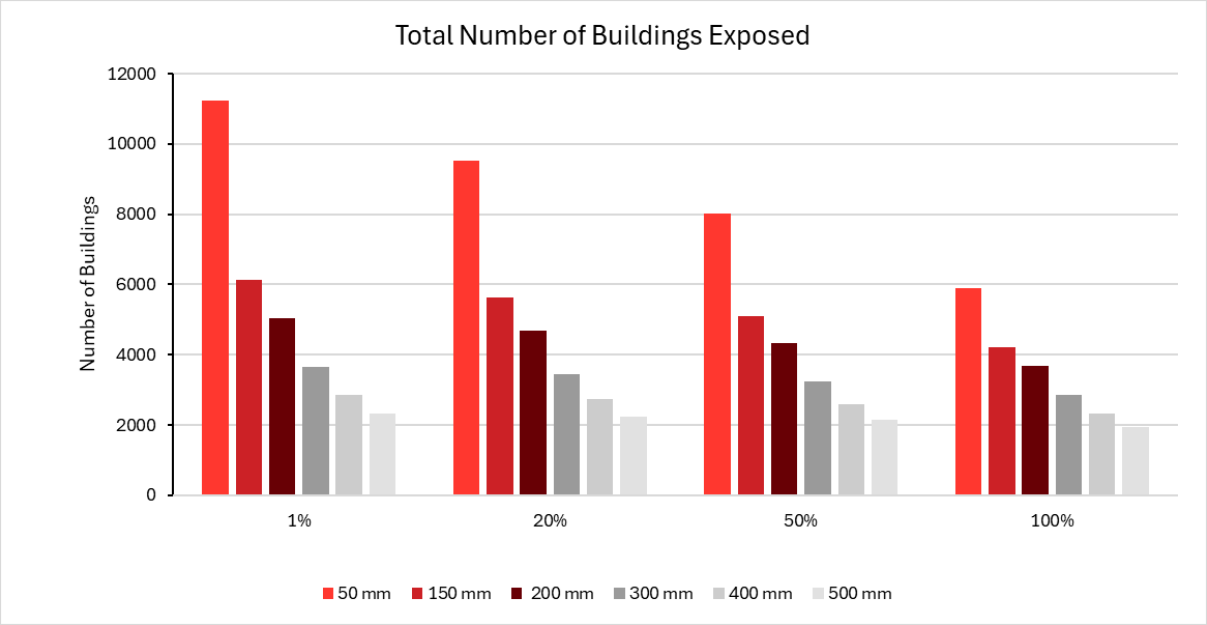


Figure 3: Total Number of Buildings Exposed

An alternative way to interpret these results is by focusing only on primary structures (Figure 4). When we isolate primary structures across all building types, the total number of buildings, and therefore the number exposed to flooding, is lower. However, the percentage reduction in exposure from shallow flooding (50 mm) to deeper flooding (500 mm) remains almost the same as in the case of all buildings.

The fluvial/pluvial methodology also provides a conservative estimate of building exposure as stormwater networks and their flood conveyance are not represented in the regional model. Figure 5 shows building exposure results for the 0.5% AEP 'fluvial only' case study providing a representation of how much fluvial flooding from the Whanganui River is contributing to overall results compared to pluvial sources.

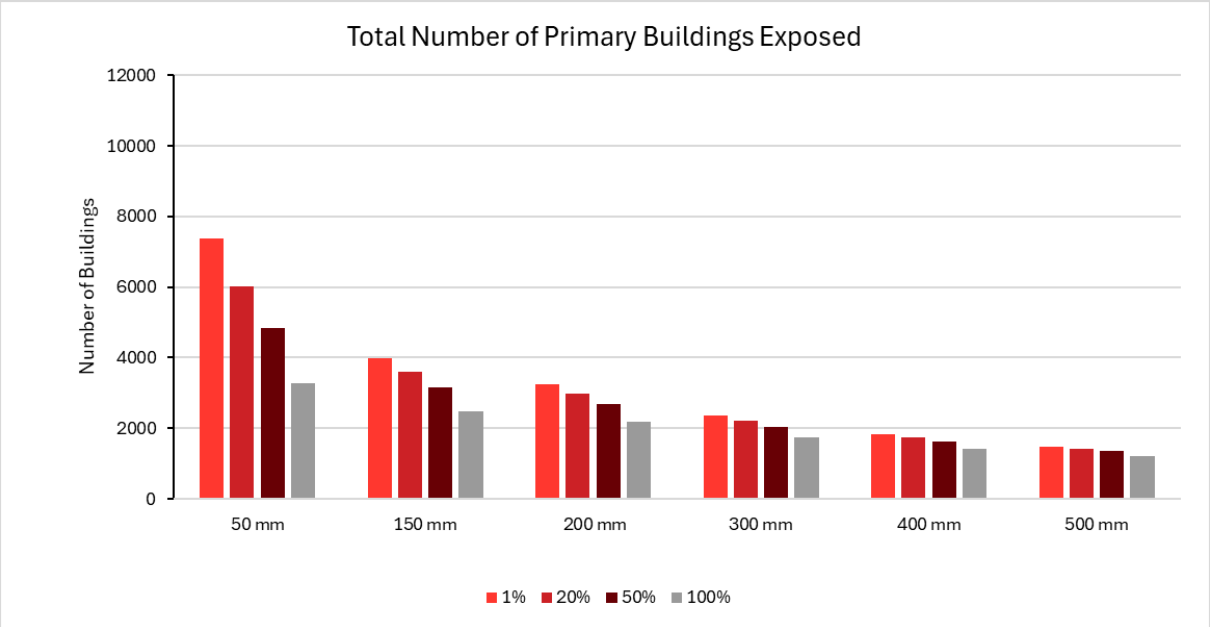


Figure 4: Total Number of Primary Buildings Exposed with the x-axis remaining the same as Figure 2 for comparability.

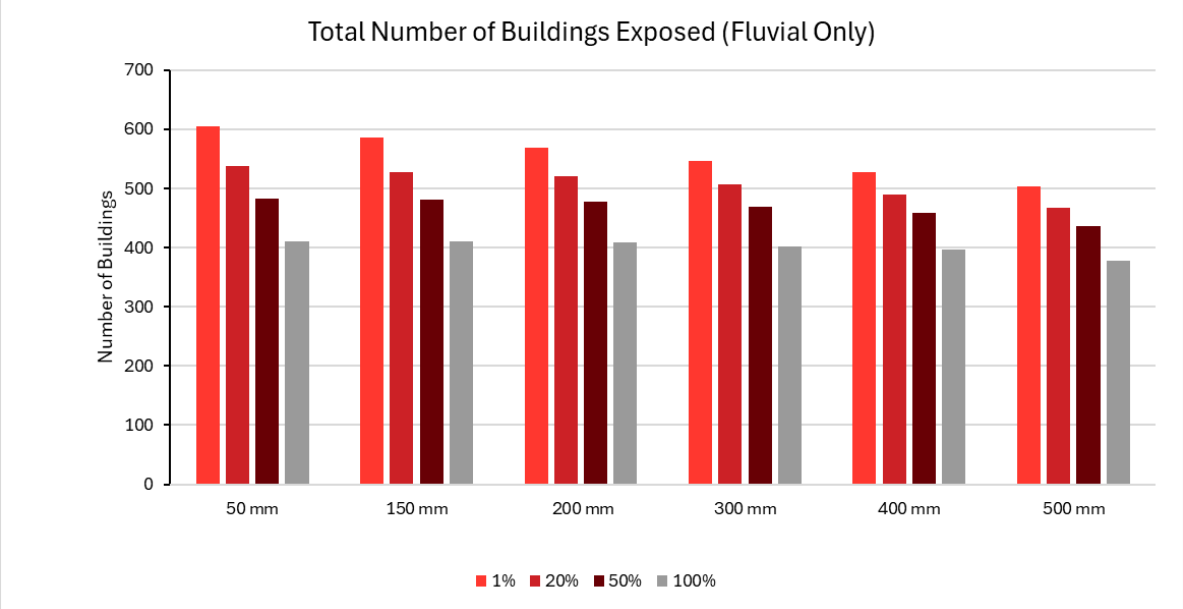


Figure 5: Number of Buildings Exposed (Fluvial Only)

When comparing the fluvial/pluvial flooding results with the fluvial only case study (Tables 3 & 4), the number of exposed buildings is notably higher for the fluvial/pluvial results. For example, for pluvial/fluvial at 50mm FL and 1% ER, 11,223 buildings are exposed, while only 605 buildings are exposed under for the fluvial only case study (Table 3). This pattern holds across all depths and exposure ratios, with pluvial/fluvial flooding consistently showing exposure rates much higher than fluvial-only.

Additionally, the percentage reduction from shallow (50mm) to deep flooding (500mm) is much larger for combined flooding (67-79%) compared to fluvial-only (8-17%), meaning floor level adjustments have a much greater impact when pluvial flooding is included. This could be due to the nature of fluvial flooding, which typically occurs in well-defined river floodplains where water levels rise uniformly across large areas. In these situations, once the river overtops its banks, the surrounding land is inundated to a similar depth, so small changes in floor level, such as raising a building by 50mm or even 500mm, do not greatly reduce exposure. Typically, you would see this because river flooding is less sensitive to floor level differences compared to pluvial flooding, which is highly localised and affected by small changes in ground level.

All tabled fluvial only results can be found in Appendix F2.

Table 3: Total number of all exposed buildings for the 0.5% AEP Fluvial & Pluvial scenarios compared to the 0.5% AEP Fluvial Only scenarios.

Exposed Ratio	1%		20%		50%		100%	
Floor Level	Fluvial & Pluvial	Fluvial Only	Fluvial & Pluvial	Fluvial Only	Fluvial & Pluvial	Fluvial Only	Fluvial & Pluvial	Fluvial Only
50mm	11,223	605	9,515	537	8,017	483	5,886	411
150mm	6,124	586	5,624	527	5,095	481	4,204	410
200mm	5,033	568	4,698	520	4,319	478	3,668	409
300mm	3,646	547	3,459	506	3,230	469	2,843	402
400mm	2,847	528	2,725	489	2,575	458	2,314	396
500mm	2,332	503	2,244	467	2,138	437	1,941	377

Table 4: Percentage Difference in Building Exposure (Pluvial/Fluvial vs Fluvial Only Results)

Exposure Ratio	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm
1%	1,755%	945%	786%	567%	439%	364%
20%	1,672%	967%	803%	584%	457%	381%
50%	1,560%	959%	804%	589%	462%	389%
100%	1,332%	925%	797%	607%	484%	415%

3.2 Reinstatement Cost

The analysis of reinstatement costs across varying floor levels and exposure ratios highlights a consistent trend: as floor level increases, total reinstatement costs decrease. This pattern is evident across all exposure ratios, 1%, 20%, 50%, and 100% (Figure 6).

At the 1% ER scenario, reinstatement costs decrease from $1,114.3 million at 50mm to $487.5 million at 500mm, a reduction of $626.8 million or approximately 56.3%. Similar trends are observed at higher exposure ratios, with reductions of 46.9% at ER 20%, 50.2% at ER 50%, and 40.3% at ER 100%.

The most significant reductions in reinstatement costs occur between the lower floor levels (e.g., 50mm to 200mm), with diminishing returns at higher elevations. This suggests that while increasing floor level continues to reduce reinstatement costs, the rate of reduction slows beyond 300mm for this study area.

All tabled results can be found in Appendix F3.

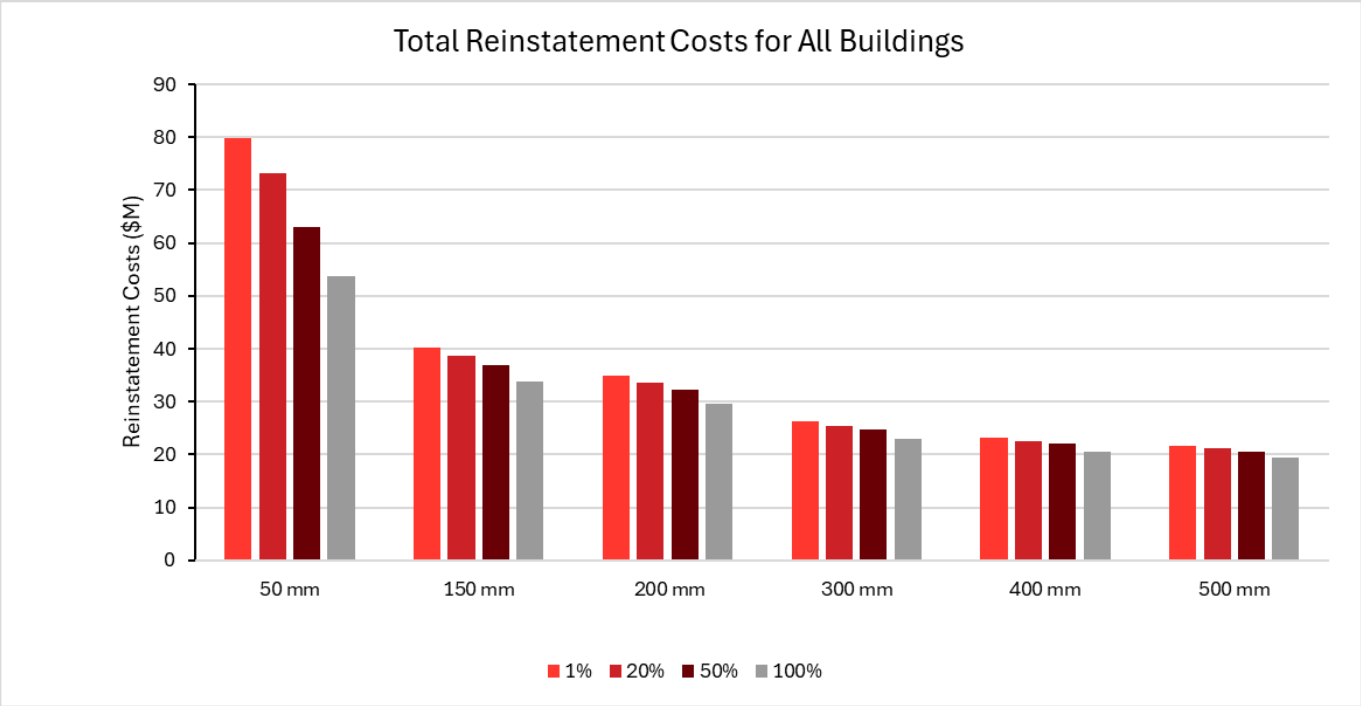


Figure 6: Reinstatement Costs for All Buildings

4. Conclusion

This sensitivity analysis demonstrates that the number of buildings exposed and associated reinstatement costs for the Whanganui study area are highly sensitive to the selection of exposure ratio and floor level thresholds. Adopting a 50% exposed ratio and 50mm floor level provides a conservative estimate of all buildings potentially exposed to flooding. For reinstatement cost estimation, a 50% exposed ratio and 200mm floor level are recommended to better represent buildings likely to incur damage, reflecting best practice and empirical observations. These model configurations balance the need for comprehensive risk assessment with realistic loss estimation, to support robust decision-making for optimal flood risk management in the region.

Yours sincerely,
Richard Woods
Service Line Lead Risk & Resilience

5. Appendix F1 – Exposed Buildings (Fluvial & Pluvial Combined)

Table 5: Number of exposed buildings across different floor levels for a 1% exposure ratio

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings (Primary Structures)	6,267	3,346	2,702	1,961	1,502	1,220	81%
Residential Buildings (Secondary Structures)	3,412	1,850	1,527	1,085	864	716	79%
Rural Buildings (Primary Structures)	235	136	116	94	75	68	71%
Rural Buildings (Secondary Structures)	181	118	104	87	70	62	66%
Commercial/Industrial Buildings (Primary Structures)	676	375	319	228	180	135	80%
Commercial/Industrial Buildings (Secondary Structures)	157	102	96	61	43	29	82%
Other Buildings (Primary Structures)	204	129	111	85	73	66	68%
Other Buildings (Secondary Structures)	91	68	58	45	40	36	60%
All Buildings (Primary Structures)	7,382	3,986	3,248	2,368	1,830	1,489	80%
All Buildings (Secondary Structures)	3,841	2,138	1,785	1,278	1,017	843	78%
All Buildings	11,223	6,124	5,033	3,646	2,847	2,332	79%

Table 6: Number of exposed buildings across different floor levels for a 20% exposure ratio

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings (Primary Structures)	5,169	3,032	2,495	1,846	1,431	1,172	77%
Residential Buildings (Secondary Structures)	3,096	1,761	1,468	1,049	837	694	78%
Rural Buildings (Primary Structures)	187	115	99	83	67	61	67%
Rural Buildings (Secondary Structures)	165	111	98	81	67	60	64%
Commercial/Industrial Buildings (Primary Structures)	507	324	284	214	171	129	75%
Commercial/Industrial Buildings (Secondary Structures)	144	98	93	60	42	28	81%
Other Buildings (Primary Structures)	161	117	104	82	71	65	60%
Other Buildings (Secondary Structures)	86	66	57	44	39	35	59%
All Buildings (Primary Structures)	6,024	3,588	2,982	2,225	1,740	1,427	76%
All Buildings (Secondary Structures)	3,491	2,036	1,716	1,234	985	817	77%
All Buildings	9,515	5,624	4,698	3,459	2,725	2,244	76%

Table 7: Number of exposed buildings across different floor levels for a 50% exposure ratio

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings (Primary Structures)	4,212	2,694	2,256	1,700	1,341	1,113	74%
Residential Buildings (Secondary Structures)	2,798	1,668	1,399	1,009	808	670	76%
Rural Buildings (Primary Structures)	149	93	85	71	58	53	64%
Rural Buildings (Secondary Structures)	156	109	96	79	67	60	62%
Commercial/Industrial Buildings (Primary Structures)	356	268	242	192	156	120	66%
Commercial/Industrial Buildings (Secondary Structures)	133	97	92	60	42	28	79%
Other Buildings (Primary Structures)	130	101	92	75	64	59	55%
Other Buildings (Secondary Structures)	83	65	57	44	39	35	58%
All Buildings (Primary Structures)	4,847	3,156	2,675	2,038	1,619	1,345	72%
All Buildings (Secondary Structures)	3,170	1,939	1,644	1,192	956	793	75%
All Buildings	8,017	5,095	4,319	3,230	2,575	2,138	73%

Table 8: Number of exposed buildings across different floor levels for a 100% exposure ratio

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings (Primary Structures)	2,871	2,131	1,861	1,483	1,205	1,013	65%
Residential Buildings (Secondary Structures)	2,285	1,490	1,267	927	747	625	73%
Rural Buildings (Primary Structures)	114	76	71	59	51	46	60%
Rural Buildings (Secondary Structures)	133	98	87	73	62	55	59%
Commercial/Industrial Buildings (Primary Structures)	202	182	170	144	119	92	54%
Commercial/Industrial Buildings (Secondary Structures)	115	89	86	55	38	25	78%
Other Buildings (Primary Structures)	93	81	74	61	55	51	45%
Other Buildings (Secondary Structures)	73	57	52	41	37	34	53%
All Buildings (Primary Structures)	3,280	2,470	2,176	1,747	1,430	1,202	63%
All Buildings (Secondary Structures)	2,606	1,734	1,492	1,096	884	739	72%
All Buildings	5,886	4,204	3,668	2,843	2,314	1,941	67%

6. Appendix F2 - Exposed Buildings (Fluvial Only)

Table 9: Number of exposed buildings across different floor levels for a 1% exposure ratio for the Fluvial Only Model

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings	444	434	426	416	407	397	11%
Rural Buildings	23	23	23	22	21	13	43%
Commercial/Industrial Buildings	44	41	41	41	36	34	23%
Other Buildings	94	88	78	68	64	59	37%
All Buildings	605	586	568	547	528	503	17%

Table 10: Number of exposed buildings across different floor levels for a 20% exposure ratio for the Fluvial Only Model

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings	396	390	385	380	372	365	8%
Rural Buildings	23	23	23	22	21	13	43%
Commercial/Industrial Buildings	40	39	39	39	35	33	18%
Other Buildings	78	75	73	65	61	56	28%
All Buildings	537	527	520	506	489	467	13%

Table 11: Number of exposed buildings across different floor levels for a 50% exposure ratio for the Fluvial Only Model

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings	353	352	350	347	343	337	5%
Rural Buildings	22	22	22	22	21	13	41%
Commercial/Industrial Buildings	38	38	38	38	34	32	16%
Other Buildings	70	69	68	62	60	55	21%
All Buildings	483	481	478	469	458	437	10%

Table 12: Number of exposed buildings across different floor levels for a 100% exposure ratio for the Fluvial Only Model

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm	% Difference (50 mm to 500 mm)
Residential Buildings	300	299	298	295	294	290	3%
Rural Buildings	22	22	22	22	21	13	41%
Commercial/Industrial Buildings	34	34	34	34	31	29	15%
Other Buildings	55	55	55	51	50	45	18%
All Buildings	411	410	409	402	396	377	8%

Appendix F3 - Reinstatement Cost (Fluvial & Pluvial Combined)

Table 13: Reinstatement costs ($M) of buildings across different floor levels for a 1% exposure ratio

Building type	50 mm	150 mm	200 mm	300 mm	400 mm	500 mm
Residential Buildings (Primary Structures)	639	361	310	262	242	225
Residential Buildings (Secondary Structures)	65	31	26	19	16	14
Rural Buildings (Primary Structures)	29	16	14	16	8	8
Rural Buildings (Secondary Structures)	4	2	2	2	1	1
Commercial/Industrial Buildings (Primary Structures)	266	160	166	142	149	132
Commercial/Industrial Buildings (Secondary Structures)	5	3	2	2	1	1
Other Buildings (Primary Structures)	101	90	90	90	90	101
Other Buildings (Secondary Structures)	6	5	5	4	4	5
All Buildings (Primary Structures)	1,034	626	580	510	489	466
All Buildings (Secondary Structures)	80	40	35	26	23	22
All Buildings	1,114	666	615	536	513	488

Table 14: Reinstatement costs ($M) of buildings across different floor levels for a 20% exposure ratio

Building type	**50 mm**	**150 mm**	**200 mm**	**300 mm**	**400 mm**	**500 mm**
Residential Buildings (Primary Structures)	521	325	287	247	232	218
Residential Buildings (Secondary Structures)	60	30	25	18	16	14
Rural Buildings (Primary Structures)	21	13	13	15	7	7
Rural Buildings (Secondary Structures)	4	2	2	1	1	1
Commercial/Industrial Buildings (Primary Structures)	183	135	146	129	136	119
Commercial/Industrial Buildings (Secondary Structures)	4	3	2	2	1	1
Other Buildings (Primary Structures)	75	85	86	88	88	98
Other Buildings (Secondary Structures)	6	5	5	4	4	5
All Buildings (Primary Structures)	799	559	532	478	463	441
All Buildings (Secondary Structures)	73	39	34	26	23	21
All Buildings	872	597	565	504	486	463

Table 15: Reinstatement costs ($M) of buildings across different floor levels for a 50% exposure ratio

Building type	**50 mm**	**150 mm**	**200 mm**	**300 mm**	**400 mm**	**500 mm**
Residential Buildings (Primary Structures)	406	270	243	210	195	168
Residential Buildings (Secondary Structures)	50	28	24	18	15	13
Rural Buildings (Primary Structures)	15	10	10	12	6	6
Rural Buildings (Secondary Structures)	4	2	2	1	1	1
Commercial/Industrial Buildings (Primary Structures)	105	91	99	94	102	91
Commercial/Industrial Buildings (Secondary Structures)	4	3	2	2	1	1
Other Buildings (Primary Structures)	38	28	28	29	29	27
Other Buildings (Secondary Structures)	6	5	5	4	4	5
All Buildings (Primary Structures)	564	399	381	344	332	292
All Buildings (Secondary Structures)	63	37	32	25	22	21
All Buildings	627	436	413	369	354	312

Table 16: Reinstatement costs ($M) of buildings across different floor levels for a 100% exposure ratio

Building type	**50 mm**	**150 mm**	**200 mm**	**300 mm**	**400 mm**	**500 mm**
Residential Buildings (Primary Structures)	280	219	203	185	178	156
Residential Buildings (Secondary Structures)	42	25	22	16	14	12
Rural Buildings (Primary Structures)	9	6	6	5	5	5
Rural Buildings (Secondary Structures)	3	2	2	1	1	1
Commercial/Industrial Buildings (Primary Structures)	56	55	57	57	65	52
Commercial/Industrial Buildings (Secondary Structures)	3	2	2	2	1	1
Other Buildings (Primary Structures)	23	21	21	22	22	20
Other Buildings (Secondary Structures)	5	5	4	4	4	5
All Buildings (Primary Structures)	368	300	287	270	270	232
All Buildings (Secondary Structures)	54	34	30	23	21	19
All Buildings	422	334	317	293	291	252

APPENDIX G – METHODOLOGY MEMO FOR DIFFERENTIATING FLUVIAL AND PLUVIAL FLOODING

MEMORANDUM

To	Horizons Regional Council
Copy	Jon Roygard
From	Richard Woods
Office	Auckland
Date	30 June 2025
Subject	Methodology Memo for Differentiating Fluvial and Pluvial Flooding

Background

The regional flood modelling for Horizons Regional Council was conducted as part of a comprehensive Flood Vulnerability Assessment. This study encompassed twelve inundation domains, covering floodplains and river corridors within the Horizons Region. The results provided detailed flood maps, including maximum water depth, water level, and velocity, which were used for the risk assessment.

The regional flood modelling results were used to determine vulnerability outcomes in the Horizons Region Flood Vulnerability Assessment using RiskScape software for multi-hazard risk analysis. The analysis focused on residential buildings and their usually resident populations, evaluating flood hazard exposure, direct economic loss, and human safety threats.

Combined fluvial and pluvial flood hazard layers were developed for the various flood scenarios modelled based on rainfall design storms at a variety of AEPs. Vulnerability models estimated building damage and assessed human safety threats based on water depth and flow velocity. The risk metrics calculated included building exposure, direct economic loss, and human safety threat levels, providing detailed insights into the potential impacts of flooding on residential buildings and populations.

These vulnerability results are intended to assist Horizons Regional Council in making informed decisions regarding flood protection schemes across the entire region. By identifying key districts and communities of concern, the council can prioritise areas that would benefit most from further flood protection investments. The council seeks to determine the optimal locations for installing flood defences to safeguard their communities. Understanding whether the vulnerability costs are primarily due to fluvial or pluvial flooding will help determine the most effective approach to future flood management and investment.

Introduction

This memo outlines the methodology for distinguishing between fluvial and pluvial flooding in regional flood modelling outputs. The purpose is to assist Horizons Regional Council in making informed decisions regarding stopbank management and funding.

Our regional flood modelling has shown areas of inundation that may not be connected to the main fluvial inundation area. If an area is not connected to the main fluvial inundation area, it could be excluded from the analysis used for the flood protection schemes assessment.

WSP
Christchurch
12 Moorhouse Avenue
Christchurch 8011
New Zealand
+64 3 363 5400
wsp.com/nz

Case Study: Levin - Impact of Fluvial vs. Pluvial Flooding on Vulnerability Results

An illustrative example of the significant impact of pluvial flooding on vulnerability results is the Levin area. The flood vulnerability assessment final report includes a table outlining the estimated repair costs for residential homes from various flood events. Table 1 highlights the five communities with the highest repair costs for the 0.5% Annual Exceedance Probability (AEP) scenario under current climate conditions and a +3 degrees Celsius warming scenario.

An initial high-level review of these results indicates that Levin has the third highest repair costs under current climate conditions. However, examining the flood map for this scenario (Figure 1) reveals that the flooding in Levin appears to result from rainfall on the plains draining in a north-westerly direction towards Levin and Lake Horowhenua in small topographic depressions. The table also shows that the repair costs for Levin do not significantly change between the current climate scenario and the +3°Cwarming scenario, unlike in Whanganui or Palmerston North. The Ōhau River, which flows from the Tararua Range to the coast, south of Levin remains primarily in bank and does not affect the flooding in Levin. This suggests that the primary issue is surface water flooding originating from rainfall, indicating that the repair costs are driven by pluvial flooding.

Table 1: Top 5 communities with the highest cost to repair for residential properties

Defences Up Town	Modelled Total Population	Modelled Total Buildings	Cost (NZD) 0°C	Cost (NZD) 3°C
Palmerston North	59,807	22,292	$634,294,948	$824,959,963
Whanganui	31,726	13,664	$275,375,093	$537,371,074
Levin	14,680	6,201	$272,782,161	$318,289,952
Feilding	13,006	5,112	$59,163,728	$70,821,352
Woodville	1,245	543	$32,782,630	$42,055,326

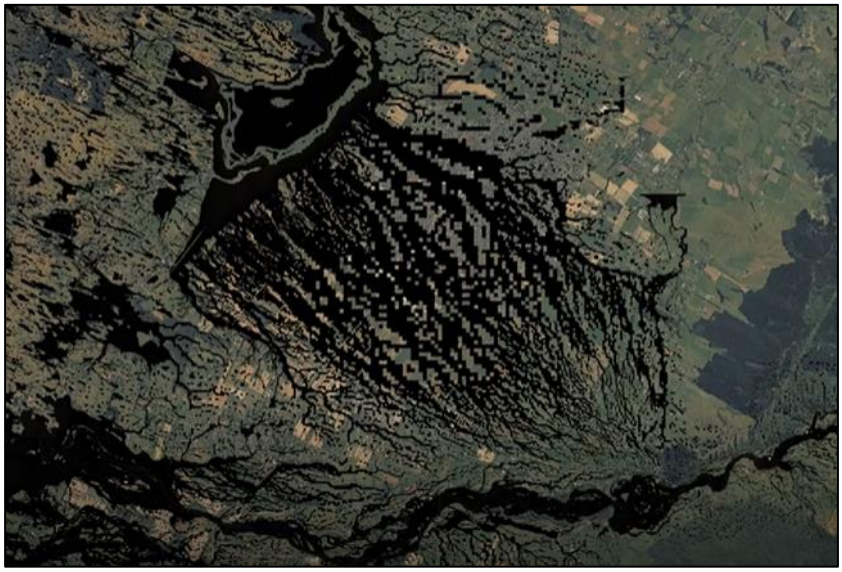


Figure 1: Regional Flood Modelling Results for Levin

Further investigation into the contributions of fluvial versus pluvial flooding to the vulnerability results is important. By solely examining the vulnerability table, Levin might appear to be a high priority for hydraulic modelling and flood scheme protection. However, further analysis suggests that the flood management in Levin would require improved stormwater management. This high-level review of Levin serves as an example of how further investigation into the contributions of fluvial and pluvial flooding can inform Horizons Regional Council's flood protection investments.

Methodology Options for Horizons Regional Council

To better understand whether the regional flood model has fluvial or pluvial flooding contributing more, two methods have been outlined below.

GIS Exercise:

- One approach involves using GIS to identify all disconnected pixels and pixels disconnected from the main flow paths. These independent pixels, which are not connected to the primary river corridor, river channels, or tributaries, are likely to represent pluvial flooding. By removing these pixels, we can create an indicative fluvial layer. Although this method won't provide a definitive separation, it will help distinguish between the two types of flooding, in particular in isolated areas. This method would require first identifying the primary river corridor, likely through use of REC2 lines (River Environment Classification). A key limitation is that it would not be able to distinguish between pluvial flooding that then drained directly into mains rivers.
- Additionally, we can determine the size of the upstream watercourse catchment area of interest. Flooding in locations with upstream catchment areas larger than a specified size can be considered fluvial, while smaller catchment areas can be considered pluvial sources. This categorisation could also help in understanding the flooding based on the size of the watercourse. A kye limitation is that in some floodplains this methodology could incorrectly identify regions where flood water breaks out from a large river and flows overland into a smaller catchment as pluvial flooding (such as the Lower Manawatū).

Hydrological and Hydraulic Modelling

- Another method involves performing hydrological and hydraulic modelling with specific river inflows to separate fluvial and pluvial flooding. This process involves identifying which watercourses are of interest for flood assessments and running the hydraulic models with direct inflows for those rivers. The results from this model would define the areas affected by fluvial flooding. Taking the difference between this modelling and the original combined fluvial and pluvial modelling would then differentiate between the two flooding types. Furthermore, this methodology could also identify areas that are prone to both types of flooding and could be used to understand the relative importance of the two modelling mechanisms for a given location.

Regardless of the chosen method, it is recommended to conduct further investigations in specific areas where the distinction between fluvial and pluvial flooding is critical. This may involve more detailed modelling and data collection. Once either method is completed, it is advisable to assess the impact of removing independent pluvial flooding from the risk values. This assessment helps in understanding how the flood risk associated with flood protection schemes changes when pluvial flooding is excluded.

It is important to note that the separation between fluvial and pluvial flooding is not definitive. The suggested methodologies provide indicative separation based on the available data and assumptions.

Recommendations

Based on our assessment, we recommend the following approach:

- Conduct further case study investigations for the four largest townships with significant pluvial contributions to distinguish between pluvial and fluvial flooding in these locations.
- For each of these town, model the fluvial flooding due to the main river(s) that flows by or through that town (indicated below).
    - Levin: Ōhau River
    - Feilding: Oroua River, Kiwitea Stream, Makino Stream
    - Whanganui: Whanganui River
    - Palmerston North: Manawatū River, Mangaone
- Calculate and compare the risk associated with the fluvial only flooding to that from the combined fluvial and pluvial flooding. This will include a robust evaluation of the risk modelling process.

Recommended Methodology - Detailed Approach

This is a detailed methodology of the process of differentiating between fluvial and pluvial flooding for the townships of interest in the four case studies.

Specify flow input locations on each river of interest upstream of each township of interest:

- Levin - Ōhau just out of gorge,
- Feilding – 2-3 km upstream of town for both rivers,
- Whanganui – near Upokongaro,

- Palmerston North - just downstream of confluence of Pohangina and Manawatū Rivers.

Modelling will be done in order of priority for the townships. Our current understanding is the above order. Please confirm that you are happy with this or specify a different order. Figures 2-5 show approximate locations for each township for the detailed methodology.

For each township and each AEP and climate change scenario being modelled:

- Extract hydrographs from cross-sections across river(s) of interest from hourly hydraulic modelling outputs.
- Model fluvial flooding by inputting hydrograph in river(s) of interest at the location of the cross-section where the data was extracted (and including tide for Whanganui and Levin scenarios). We will linearly interpolate between hourly hydrograph values. No rain-on-grid and no inputs from smaller rivers and streams will be included in the modelling. The same DEM and roughness maps and the same adaptive resolution as used for the combined pluvial and fluvial modelling will be used to ensure a direct comparison can be made.
- Extract flood results for Townships of interest. (Maximum Water Depth, Maximum Elevation, Maximum Depth times Velocity, Rise Rate to 1.2m).
- Crop outputs to rectangle around the township of interest where the fluvial flooding is valid for.
- Calculate risk information for these townships based on the fluvial flooding.
- Shape files of the rectangle which the flood output is cropped to will be provided so that the matching information from the combined fluvial and pluvial modelling can be extracted allowing the difference to be calculated between the two models and both the hazard and risk outputs to be compared.

The following scenarios are to be modelled:

- Stopbanks up: 5% AEP, 2% AEP, 1% AEP, 0.5% AEP, 0.5% AEP + 1˚C, 0.5% AEP + 2 ˚C, 0.5% AEP + 3˚C
- Stopbanks down: 5% AEP, 2% AEP, 1% AEP, 0.5% AEP, 0.5% AEP + 1˚C, 0.5% AEP + 2 ˚C, 0.5% AEP + 3˚C
- Overdesign events
- Stopbanks up: 0.2% AEP, 0.2% AEP + 1˚C, 0.2% AEP + 2 ˚C, 0.2% AEP + 3˚C, 0.1% AEP, 0.1% AEP + 1˚C, 0.1% AEP + 2 ˚C, 0.1% AEP + 3˚C

NIWA (or its successor Earth Science NZ) will provide WSP with the fluvial only outputs for all these scenarios, a letter report outlining the methodology used and the fluvial-flooding-only risk statistics for the four case study locations.

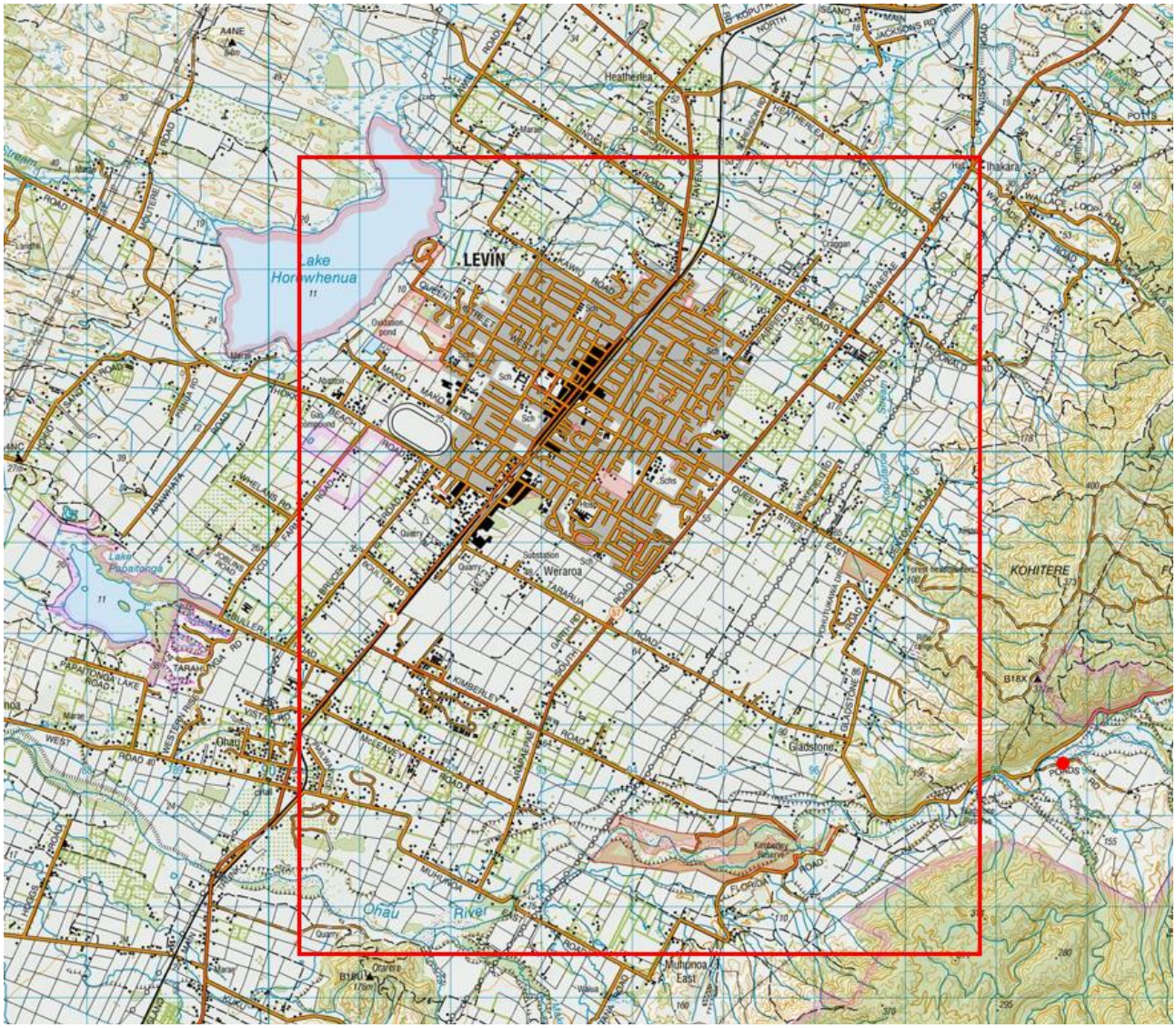


Figure 2. Levin Case Study. Red rectangle shows approximate area outputs will cover.

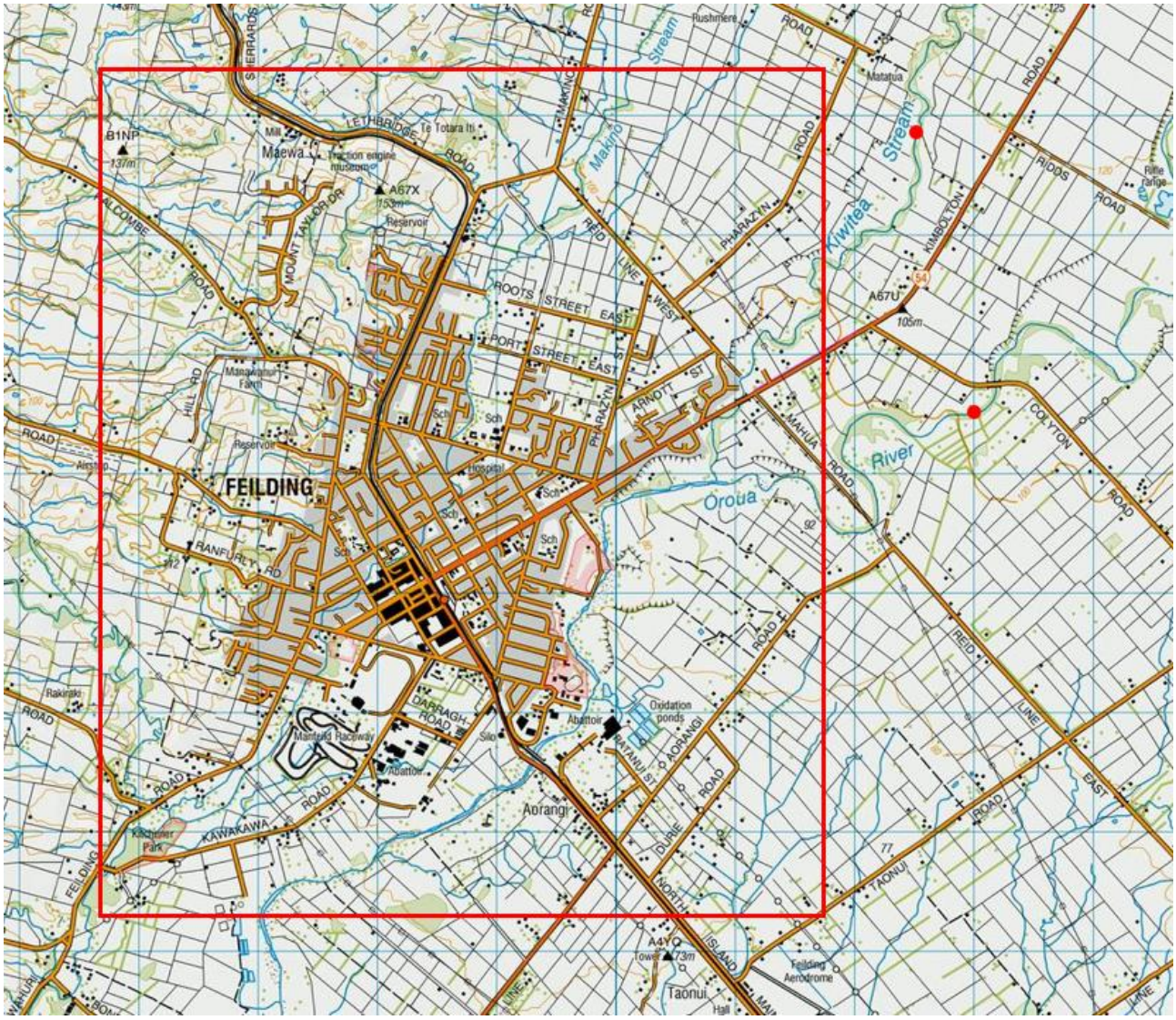


Figure 3. Feilding Case Study. Red rectangle shows approximate area outputs will cover.

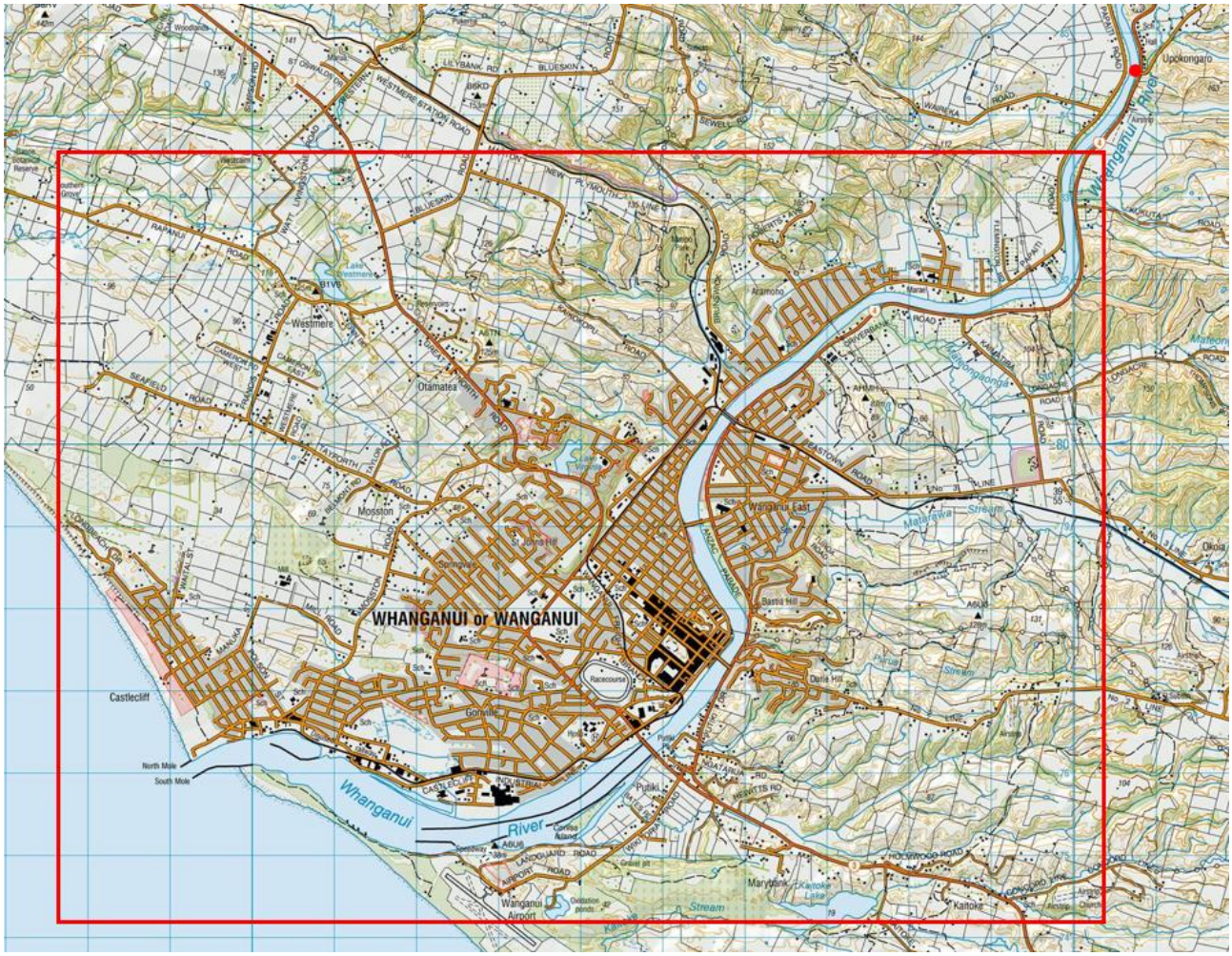


Figure 4. Whanganui Case Study. Red rectangle shows approximate area outputs will cover.

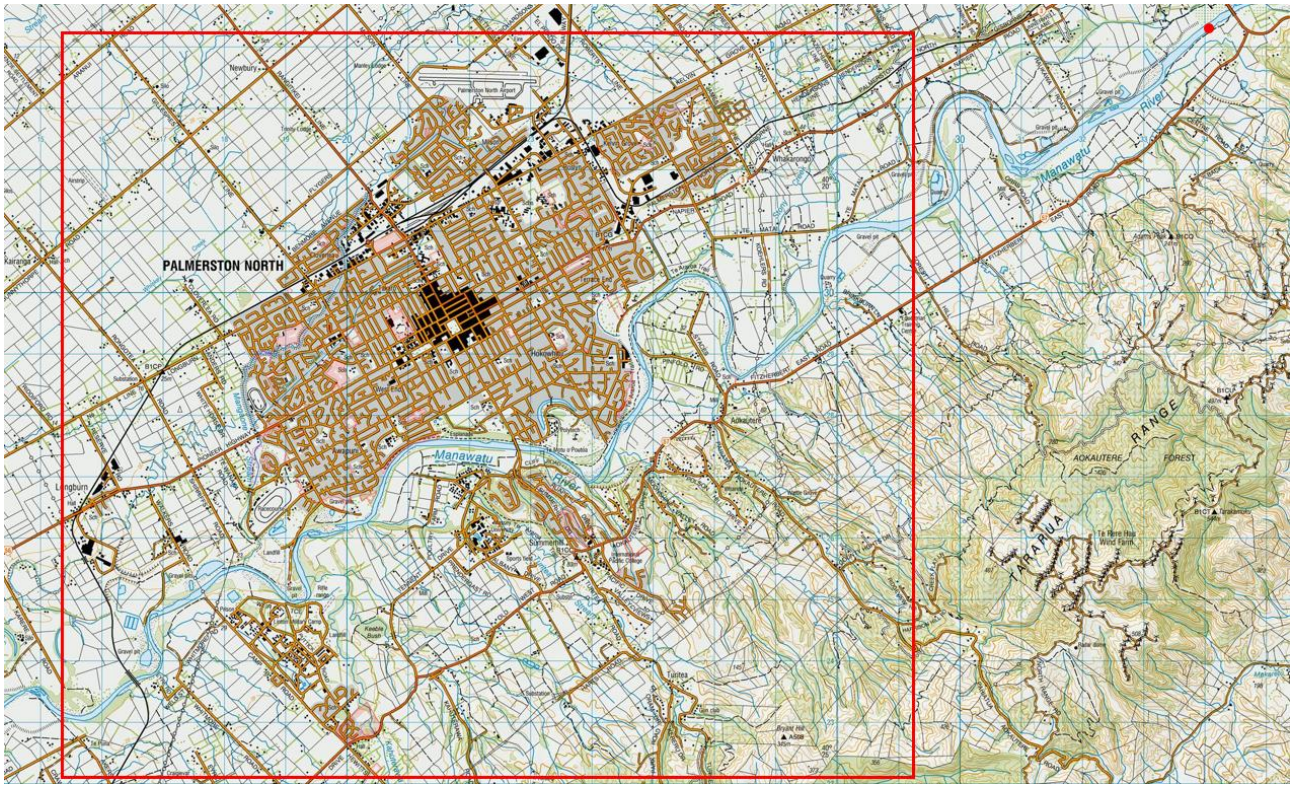


Figure 5. Palmerston North Case Study. Red rectangle shows approximate area outputs will cover.

APPENDIX H – FLUVIAL FLOOD MODELLING OF FOUR URBAN AREAS FOR THE HORIZONS REGION (ESNZ)

Earth Sciences New Zealand

Fluvial flood modelling of four urban areas for the Horizons region

Methodology for Palmerston North, Levin, Feilding and Whanganui fluvial modelling

Prepared for WSP

February 2026

Prepared by:
Alice Harang, Emily Lane

For any information regarding this report please contact:

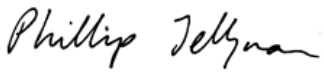
Alice Harang
Hydrodynamics Scientist
Environmental Hazards Group
alice.harang@niwa.co.nz

New Zealand Institute for Earth Science Limited
PO Box 8602
Riccarton
Christchurch 8440

Phone +64 3 348 8987

Client Report No: 2025255CH
Report date: February 2026
Project No: WSP26501

Revision	Description	Date
Version 1.0	Final version sent to client	18 August 2025
Version 2.0	Updated with project extension: Mangaone and Makino Streams	17 November 2025
Version 3.0	Revisions from Horizons regional council	10 February 2026

Quality Assurance Statement		
	Reviewed by:	Zhonghou Xu
	Formatting checked by:	Rachel Wright
	Approved for release by:	Phillip Jellyman

© New Zealand Institute of Earth Science Limited ("Earth Sciences New Zealand") 2025. All rights reserved. This publication may not be reproduced or copied in any form without the permission of the copyright owner(s). Such permission is only to be given in accordance with the terms of the client's contract with Earth Sciences New Zealand. This copyright extends to all forms of copying and any storage of material in any kind of information retrieval system.

Whilst Earth Sciences New Zealand has used all reasonable endeavours to ensure that the information contained in this document is accurate, Earth Sciences New Zealand does not give any express or implied warranty as to the completeness of the information contained herein, or that it will be suitable for any purpose(s) other than those specifically contemplated during the project or agreed by Earth Sciences New Zealand and the client.

Contents

Executive summary **5**

1 Introduction **6**

2 Methodology **7**

2.1 Identification of the river injection locations 7

2.2 Creation of the local fluvial models 7

3 Results **12**

3.1 List of scenarios 12

3.2 Fluvial vs Fluvial-Pluvial flooding 13

3.2.1 Palmerston North 13

3.2.2 Levin 15

3.2.3 Feilding 16

3.2.4 Whanganui 16

3.3 Stopbanks up vs Stopbanks down flood maps 17

4 Conclusion **19**

5 Acknowledgements **20**

6 References **21**

Appendix A List of files provided **22**

Appendix B Comparison with Horizons level B Lower Manawatū fluvial model developed by WSP **24**

Tables

Table 1-1: Top four communities with the highest cost to total reinstatement costs for residential properties due to pluvial and fluvial flooding for a 0.5% AEP event with current climate conditions and defences up (from WSP 2025). 6

Table 2-1: Description of the computational models. 7

Table A-1: List of scenarios explored for each domain. 22

Figures

Figure 2-1: Ōhau Levin fluvial flooding model from the Ōhau River. 8

Figure 2-2: Palmerston North fluvial flooding model from the Manawatū River and Mangaone Stream. 9

Figure 2-3: Feilding fluvial flooding model from the Oroua River, Kiwitea and Makino Stream. 10
Figure 2-4: Whanganui fluvial flooding model from the Whanganui River and Ūpokongaro Stream. 11
Figure 3-1 Fluvial flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.5% AEP for current climate scenario. 13
Figure 3-2: Fluvial (blue) versus pluvial (green) flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.5% AEP for current climate scenario. 14
Figure 3-3: Fluvial (blue) vs pluvial (green) flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.1% AEP+3˚C of climate change scenario. 14
Figure 3-4: Fluvial (blue) versus pluvial (green) flooding with stopbanks up in Levin from the Ōhau River for 0.1% AEP+3˚C of climate change scenario. 15
Figure 3-5: Fluvial (blue) vs pluvial (green) flooding with stopbanks in Feilding from Oroua River, Kiwitea and Makino Stream for 0.1% AEP +3˚C of climate change scenario. 16
Figure 3-6: Fluvial (blue) versus pluvial (green) flooding with stopbanks up in Whanganui from Whanganui River and Ūpokongaro Stream for 0.1% AEP +3˚C of climate change scenario. 17
Figure 3-7: Stopbanks up (blue) vs stopbanks down (red) for the fluvial flooding in Palmerston North from the Manawatū River and Mangaone Stream for a 0.5% AEP event in a +3˚C future climate. 18

Executive summary

Earth Sciences New Zealand is contributing to a Flood Vulnerability Study for Horizons Regional Council in conjunction with WSP New Zealand Ltd. Previous regional fluvial-pluvial flood modelling and associated risk assessment identified four urban areas with the highest flood-induced damages for the region: Palmerston North, Whanganui, Feilding and Levin. To better identify the sources of the flooding in these areas, the present study produced fluvial-only flood maps for these four urban areas. These maps complement the earlier regional fluvial-pluvial flood hazard assessment and help distinguish between flooding caused by riverbank overtopping (fluvial flooding) or that resulting from rainfall ponding, overland flow and secondary streams (pluvial flooding).

The method developed in this report aims to produce local fluvial inundation models that are consistent with those used in the regional assessment but forced only by river flows. Ensuring consistency between these fluvial-only maps and the previous regional fluvial-pluvial models is key to accurately interpreting the sources of flooding in the four urban centres. The hydrological models developed in this report use the same inputs layers as the regional fluvial - pluvial model, including Digital Elevation Model (DEM), roughness layer and grid refinement maps. To replicate the river flow observed in the earlier modelling, hydrographs were extracted from the regional fluvial-pluvial outputs and applied to the main rivers upstream of each urban area of interest. No rainfall input was applied in these fluvial-only models, and a lower grid resolution was used outside the targeted urban areas. Tidal forcing was also applied at the downstream boundary. For each domain, fluvial flood inundation was modelled for rainfall design storms events corresponding to 5%, 2%, 1%, 0.5% Annual Exceedance Probability (AEP). Climate change scenarios were also modelled for the 0.5% AEP rainfall design storm for +1 ˚C, +2 ˚C, +3 ˚C above actual climate conditions (i.e., +2 ˚C, +3 ˚C, +4 ˚C above pre-industrial levels). These scenarios are modelled for ‘stopbanks up’ configuration (with stopbanks enforced) and ‘stopbanks down’ configuration (i.e., scenarios where the stopbanks have been removed). Additional modelling of the 0.2% AEP and 0.1% AEP rainfall design storm for actual and climate change configurations (i.e., +1 ˚C, +2 ˚C, +3 ˚C above current climate) were completed for the stopbanks up scenario to understand overdesign floods.

This report outlines the methodology used to produce the local fluvial flood maps. A preliminary analysis of the maps confirms pluvial-only flooding in Levin. In the other three urban areas, combined fluvial-pluvial flooding was observed, with the relative contribution for each scenario to be further quantified in a later risk assessment. For the most extreme flood scenario, Whanganui showed fluvial-dominant flooding whereas in lower intensity scenario, pluvial flooding is dominant. Comparison with a higher-resolution model in Palmerston North suggests that some flood extent might be overestimated for smaller events and underestimated for larger events in the current mapping. The final flood maps, delivered for use in future risk assessments, are listed with associated parameters and formats.

1 Introduction

A regional flood modelling for Horizons Regional Council was conducted as part of a comprehensive Flood Vulnerability Assessment, covering floodplains and river corridors within the Horizons Region. This study aims to complement the regional fluvial-pluvial flood assessment by focusing on four flood prone major urban areas. By performing a fluvial-only flood assessment for these locations, it allows us to separate fluvial and pluvial flooding to better understand the cause of the flooding and to inform better flood adaptation solutions.

The regional flood modelling results were used to determine vulnerability outcomes in the Horizons Region Flood Vulnerability Assessment using RiskScape software for multi-hazard risk analysis (WSP 2025). The analysis focused on residential buildings and their usually resident populations, evaluating flood hazard exposure, direct economic loss, and human safety threats.

Combined fluvial and pluvial flood hazard layers were developed for the various flood scenarios modelled based on rainfall design storms at a variety of AEPs (Harang et al. 2025). Vulnerability models estimated building damage and assessed human safety threats based on water depth and flow velocity. The risk metrics calculated included building exposure, direct economic loss, and human safety threat levels, providing detailed insights into the potential impacts of flooding on residential buildings and populations.

These vulnerability results are intended to assist Horizons Regional Council in making informed decisions regarding flood protection schemes across the entire region. By identifying key districts and communities of concern (Table 1-1), the council can prioritise areas that would benefit most from further flood protection investments. The council seeks to determine the optimal locations for installing flood defences to safeguard their communities. Understanding whether the vulnerability costs are primarily due to fluvial or pluvial flooding will help determine the most effective approach to future flood management and investment.

Table 1-1: Top four communities with the highest cost to total reinstatement costs for residential properties due to pluvial and fluvial flooding for a 0.5% AEP event with current climate conditions and defences up (from WSP 2025).

Defences Up Town	Total No. buildings	No. buildings exposed	No. buildings that contribute to the reinstatement cost	Total building reinstatement cost (000's NZD)
Palmerston North	51,584	13,883	8,472	860,872
Whanganui	35,239	8,198	4,442	403,575
Levin	18,156	7,630	1,377	109,615
Feilding	12,553	2,221	422	54,990

This report outlines the methodology for distinguishing between fluvial and pluvial flooding in regional flood modelling. The purpose is to assist Horizons Regional Council in making informed decisions regarding stopbanks management and funding. By identifying the type of flooding, the council can implement appropriate flood defences or stormwater management solutions.

2 Methodology

To better differentiate fluvial from pluvial flooding from these towns (those most impacted by flooding), a local fluvial flooding model was designed for each urban area identified. Information from the domains is presented in Table 2-1 including the rivers used in the fluvial flooding assessment and the upstream locations where flow discharges were calculated from the original fluvial-pluvial modelling and injected into the rivers for the fluvial modelling. The spatial features of the four domains are shown in Figure 2-2 to Figure 2-4.

Table 2-1: Description of the computational models.

Urban area modelled	Larger floodplain	Nearby rivers	Location of the injection point for specified river
Levin	Ōhau-Levin	Ōhau River	Just out of Ōhau gorge
Palmerston North	Manawatū	Manawatū River	Downstream of confluence of Pohangina and Manawatū Rivers, at SH3 bridge
		Mangaone Stream	Upstream of Palmerston North Airport
Feilding	Manawatū	Oroua River	Above Colyton Road
		Kiwitea Stream	Above Brewster Road
		Makino Stream	Above Brewster Road
Whanganui	Whanganui	Whanganui River	Above Kaiwhaiki
		Ūpokongaro Stream	Just above its convergence with Whanganui River

2.1 Identification of the river injection locations

For each domain, the main watercourses that flow past the urban area have been identified (see previous table). For each water course, a cross section has been identified upstream of the modelled area. The cross section is wide enough to capture the stream or river flow for the largest event modelled, i.e., a 0.1% AEP +3˚C of climate change. For the Whanganui model, the location is chosen sufficiently far upstream to be out of the tidally influenced river zone. This was iteratively based on observations of the river flow extracted from the fluvial-pluvial model results, considering the smallest event modelled, the 5% AEP for actual climate conditions.

2.2 Creation of the local fluvial models

In order to facilitate comparison with the fluvial-pluvial results, we have kept most of the inputs from the regional flood assessment models the same (Harang et al. 2025). The DEM (Digital Elevation Model), roughness map and tidal forcing are the same as the one used in the fluvial-pluvial regional modelling. As done in previous fluvial-pluvial models, the stormwater systems are not included in these models.

The computational domains are based on the previous regional modelling with the same catchments used for the rainfall design storm scenarios. The model extent starts just above the relevant cross-section injection points, and a wall boundary is imposed to avoid back flow up the river. The full downstream domain is retained in the model. However, the same variable high-resolution grid as used for the fluvial-pluvial regional model is only applied locally around the towns identified and down to the end of the urban area or next confluence. Further downstream and outside the areas of interest, only a low-resolution grid is used.

As the focus is on fluvial flooding from the major rivers and streams, rain-on-grid is not applied in these models and there is no water injected into the secondary waterways. The models are forced by river discharge directly upstream from the urban area at the identified cross-sections. Along these cross-sections, the river discharge (Q) is extracted for each of the scenarios from the hourly 2D outputs of the fluvial-pluvial flood models by integrating the flux product for each snapshot at time t as:

$$Q_t = \sum_{i=1}^{N} \left(\overrightarrow{U_{t,i}}.\vec{n}\right).h_{t,i}.dx$$

Where computational cells i= [1, N] intersect the cross-section line, $\vec{n}$ is the normal to the cross section, $\overrightarrow{U_{t,i}}$ and $h_{t,i}$ are the horizontal flow velocity and water depth respectively at the cell i and time t, and dx is the local grid resolution (i.e., the distance between two cell centres). These hourly hydrographs are then injected into the fluvial models at the same location by linearly interpolating between each hourly value in the inundation software to inject the appropriate discharge at each computational time step.

After running these models, the Maximum Water Depth (m), Maximum Elevation (m), Maximum Depth times Velocity (m^2s^{-1}), Rise Rate to 1.2 m (mh^{-1}) for each scenario are extracted from the model outputs and saved as flood maps in a tiff format, in the NZTM2000/NZVD2016 datum. For more clarity, the maps are cropped around the local model domain (red line on Figure 2-1 to Figure 2-4) for each township of interest where the fluvial flooding generated is valid.

Figure 2-1: Ōhau Levin fluvial flooding model from the Ōhau River. Red polygon: local model domain where high resolution modelling is undertaken, thick black line: injection cross-section, blue line: full

modelling domain, light blue overlay: flood extent from combined fluvial-pluvial results for 0.1% AEP +3˚C of climate change scenario.

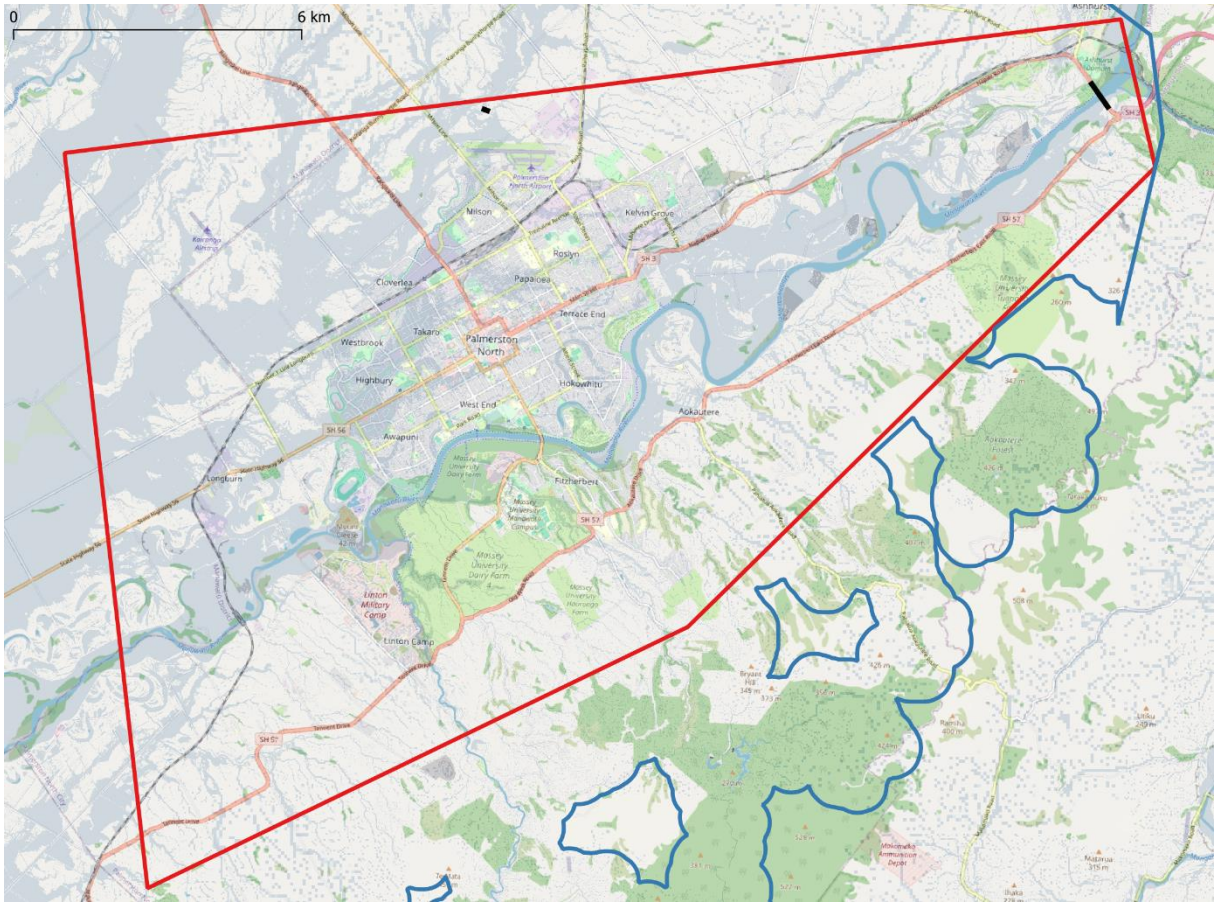


Figure 2-2: Palmerston North fluvial flooding model from the Manawatū River and Mangaone Stream. Red polygon: local model domain where high resolution modelling is undertaken, thick black line: injection cross-section, blue line: full modelling domain, light blue overlay: flood extent from combined fluvial-pluvial results for 0.1% AEP +3˚C of climate change scenario.

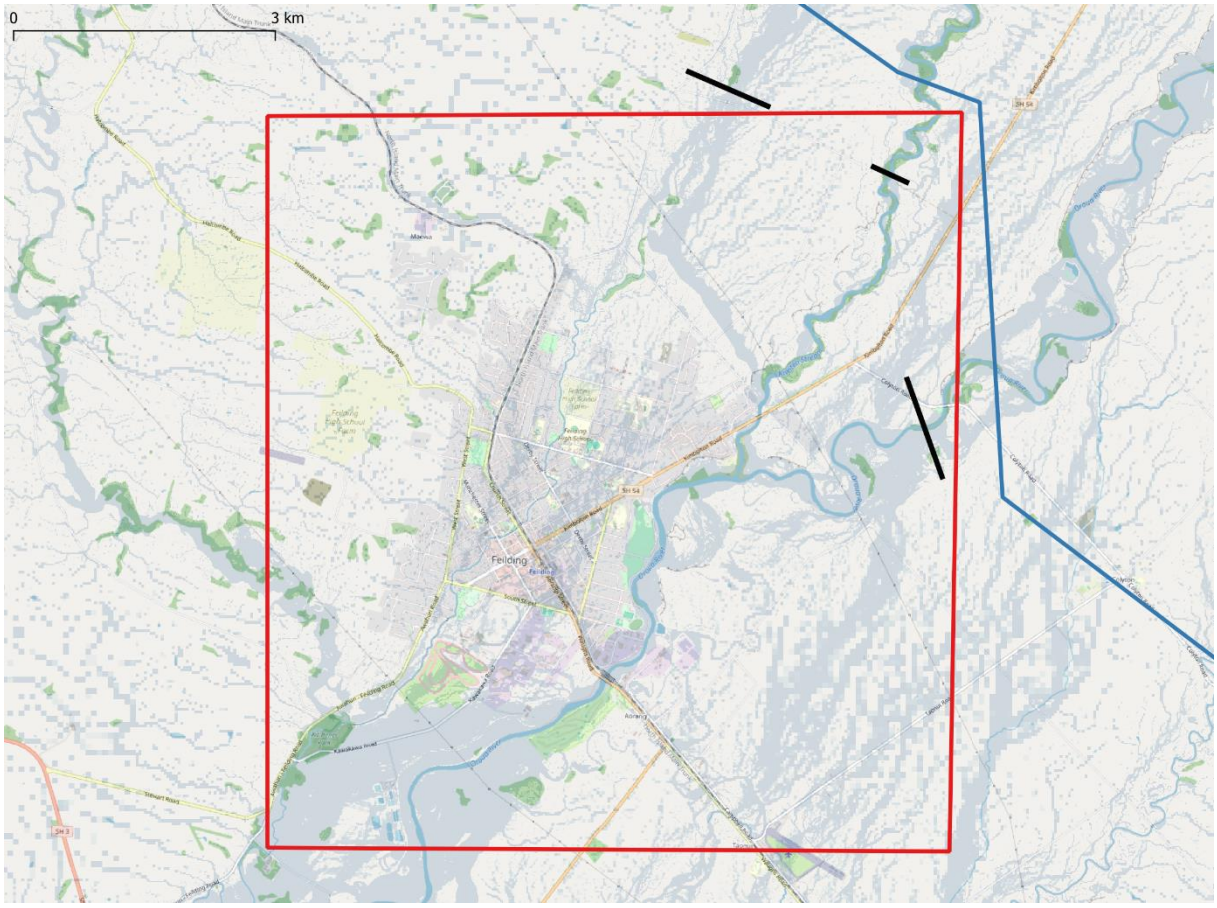


Figure 2-3: Feilding fluvial flooding model from the Oroua River, Kiwitea and Makino Stream. Red polygon: local model domain where high resolution modelling is undertaken, thick black line: injection cross-section, blue line: full modelling domain, light blue overlay: flood extent from combined fluvial-pluvial results for 0.1% AEP +3˚C of climate change scenario.

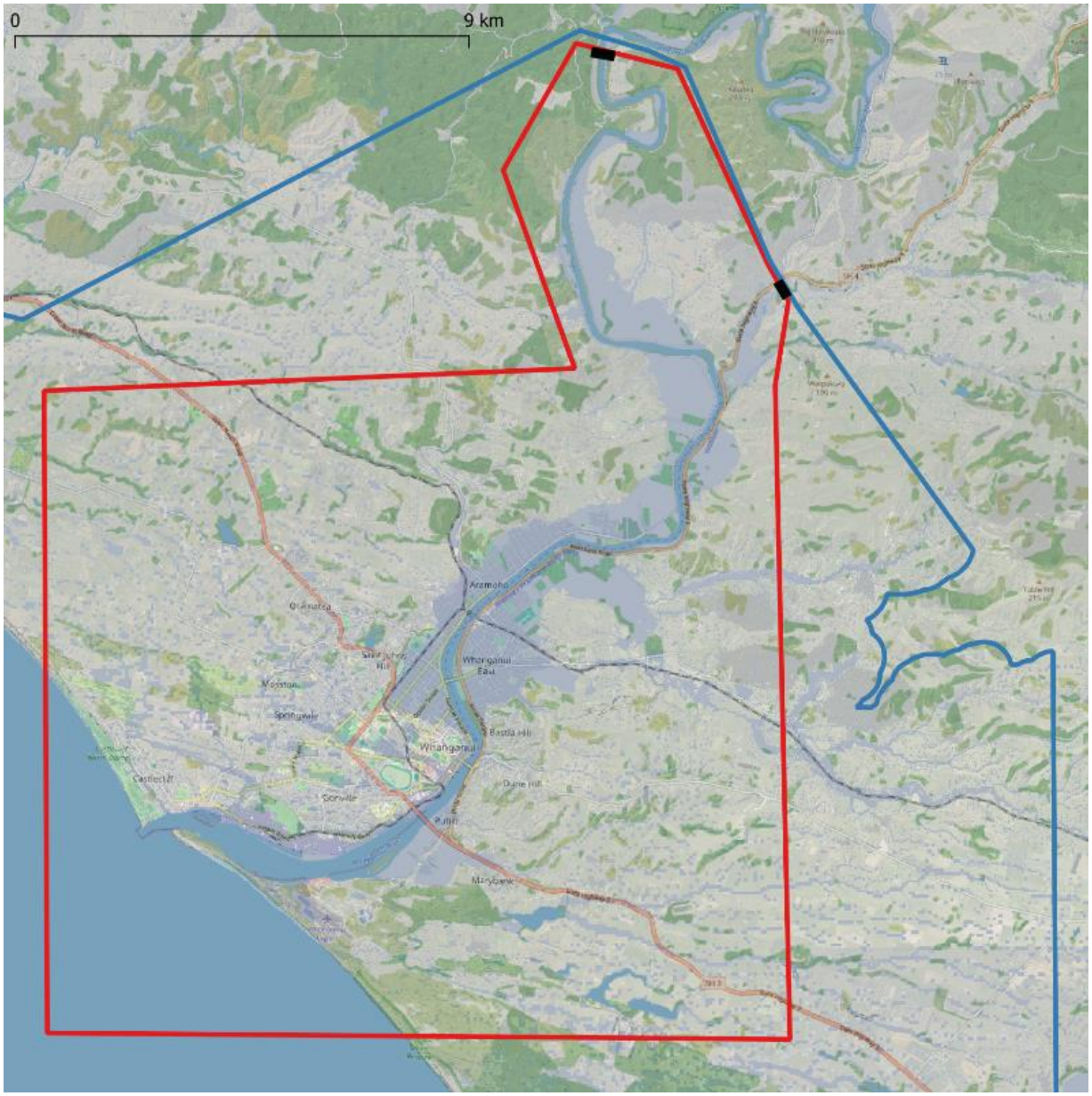


Figure 2-4: Whanganui fluvial flooding model from the Whanganui River and Ūpokongaro Stream. Red polygon: local model domain where high resolution modelling is undertaken, thick black line: injection cross-section, blue line: full modelling domain, light blue overlay: flood extent from combined fluvial-pluvial results for 0.1% AEP+3˚C of climate change scenario.

3 Results

3.1 List of scenarios

The fluvial flood maps are generated for the same set of scenarios as the regional fluvial-pluvial flood assessment (but the sea level rise ones). These 22 scenarios are:

- Stopbanks up (or DEM enforced flood stopbanks configuration)
  - 5%, 2%, 1%, 0.5%, 0.2%, 0.1% Annual Exceedance Probability (AEP) for actual climate conditions (or a 20, 50, 100, 200, 500, 1000-year return period +1˚C above pre-industrial levels)
  - 0.5%, 0.2%, 0.1% AEP for +1 ˚C, +2 ˚C, +3˚C of climate change above actual climate conditions (or a 200, 500, 1000-year return period +2˚C, +3˚C, +4˚C above pre-industrial levels).
- Stopbanks down (or configuration with removed flood stopbanks from the DEM)
  - 5%, 2%, 1%, 0.5% AEP for actual climate conditions (or a 20, 50, 100, 200-year return period 1˚C above pre-industrial levels)
  - 0.5% AEP for +1 ˚C, +2 ˚C, +3˚C of climate change above actual climate conditions (or a 200-year return period +2˚C, +3˚C, +4˚C above pre-industrial levels).

Figure 3-1Figure 3-1 Fluvial flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.5% AEP for current climate scenario.presents an example of fluvial flood maps for Palmerston North urban area, for a stopbanks up scenario and a 0.5% AEP event in a +3˚C climate change projection (relative to actual climate conditions).

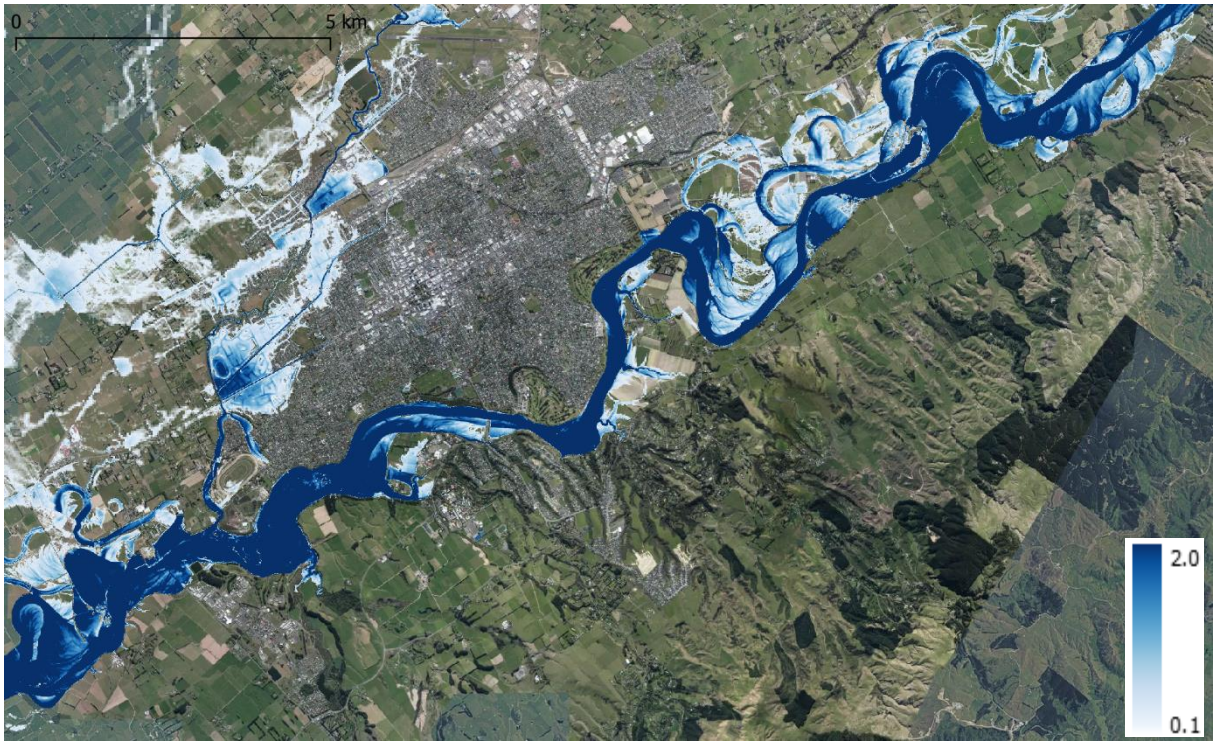


Figure 3-1 Fluvial flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.5% AEP for current climate scenario. Flood depth is indicated by the darkness of the colour. Dark blue indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

3.2 Fluvial vs Fluvial-Pluvial flooding

As the fluvial flood model is based on the pluvial-fluvial regional flood hazard assessment models with same inputs, coherent forcing and the same resolution within the modelling domain, the fluvial flood maps can be overlayed on top of fluvial-pluvial flood maps to identify the source of the flooding.

3.2.1 Palmerston North

In Figure 3-2, we identify the river-induced flooding in blue and pluvial (and secondary streams) induced flooding in green for the 0.5% AEP scenario with +3˚C climate change. Most of the flooding in the urban area for this scenario is seen to not originate from the Manawatū River, but from the Mangaone Sream or local rain input. Note that for the Palmerston North model, although most of the river-induced flooding originates from the Manawatū River and Mangaone Stream (injected outside of the top right corner and top respectively of the Figure 3-2) some overland flow from the Oroua River can be observed on the top left of the Figure 3-2 (and following Palmerston North river-induced flooding Figure 3-3 to Figure 3-6). The cross-section length is similar to the map resolution (8m). The combination of stopbanks and the narrow Mangaone Stream is not well represented in these models with the enforcement of the stopbanks reducing the conveyance of the stream, particularly from Tremaine Avenue in Palmerston North. This limitation might lead to over-flooding in this area.

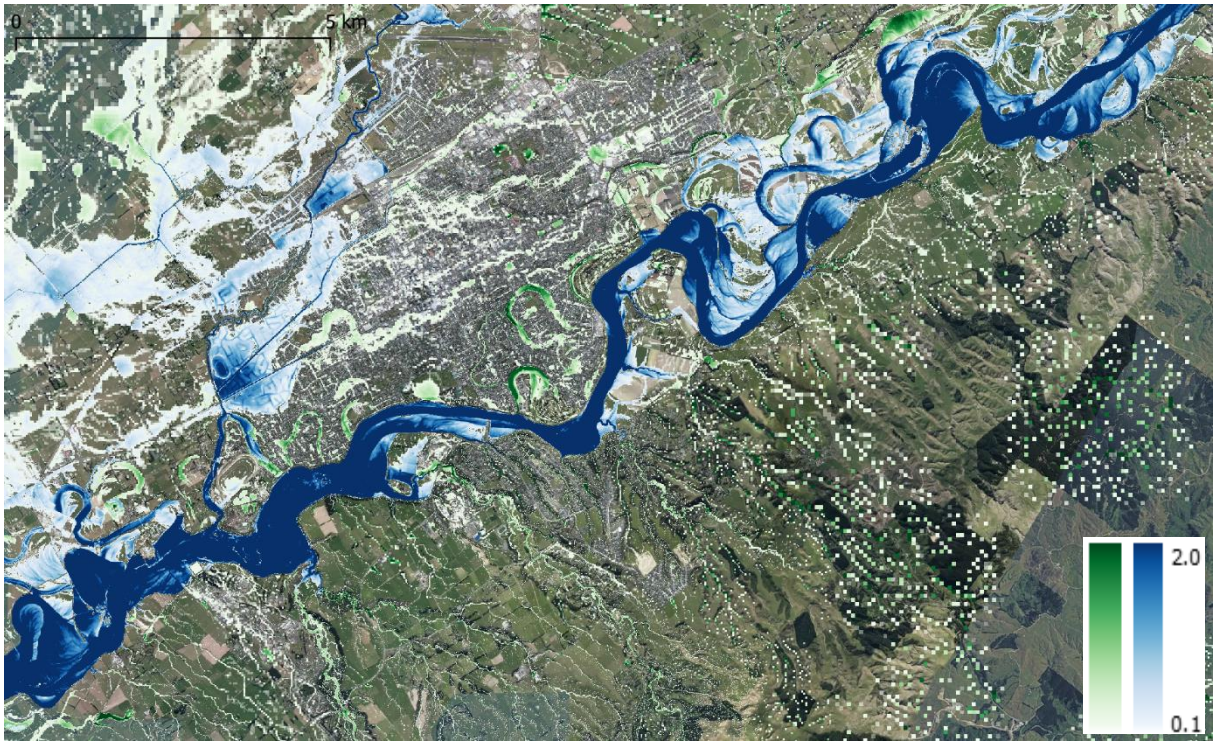


Figure 3-2: Fluvial (blue) versus pluvial (green) flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.5% AEP for current climate scenario. Flood depth is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

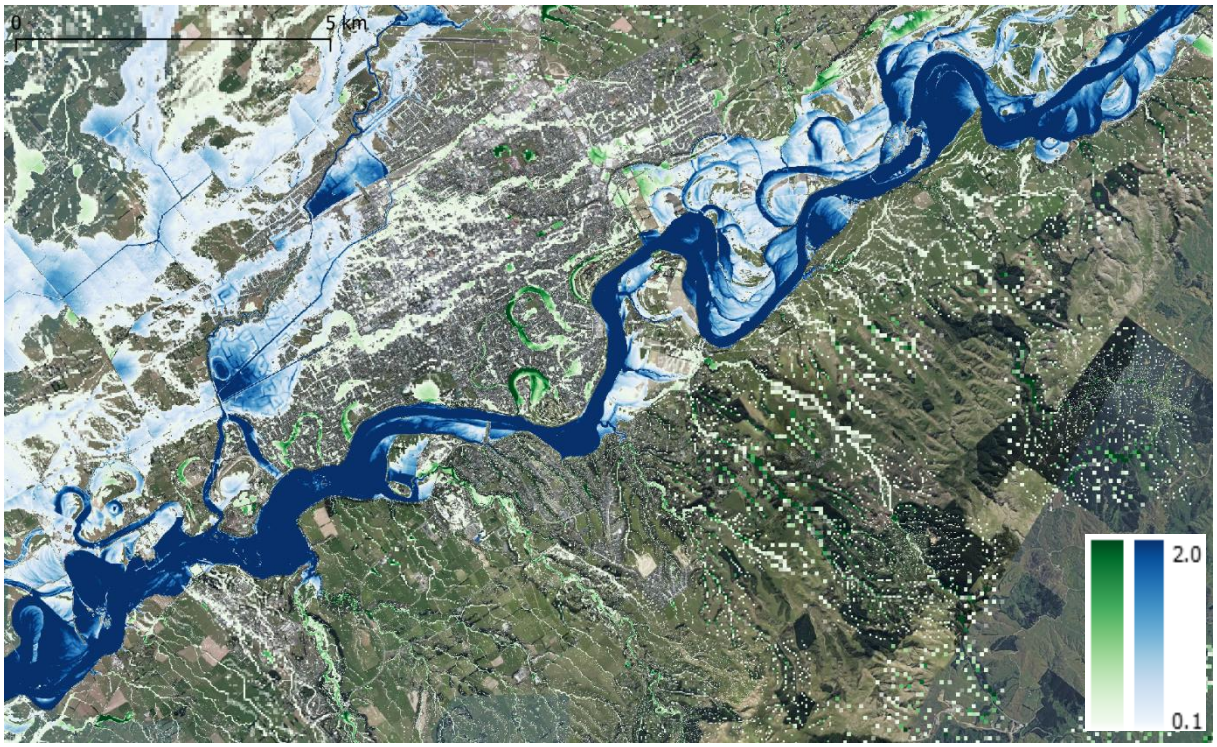


Figure 3-3: Fluvial (blue) vs pluvial (green) flooding with stopbanks up in Palmerston North from the Manawatū River and Mangaone Stream for 0.1% AEP+3˚C of climate change scenario. Flood depth

is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

For Palmerston North, we observe a mix of fluvial and pluvial flooding in the town, but we do not observe significant stopbank overflow from the Manawatū River in any of the rainstorm scenarios explored (see Figure 3-3 which shows the largest flood event simulated). These results might be underestimating some flooding, however, as some stopbank overflow has been observed in the "level B lower Manawatū" model, a higher-level resolution model developed and calibrated by WSP for the area (see Appendix B).

3.2.2 Levin

Figure 3-4 presents the fluvial flooding (blue) and pluvial flooding (green) in Levin for the largest modelled event (0.1% AEP + 3˚C). It confirms the initial hypothesis that the flooding observed in Levin for the region-wide flood assessment is predominantly pluvial flooding, as we do not see significant out-of-banks river flow in this model, even for the largest rainfall scenarios considered.

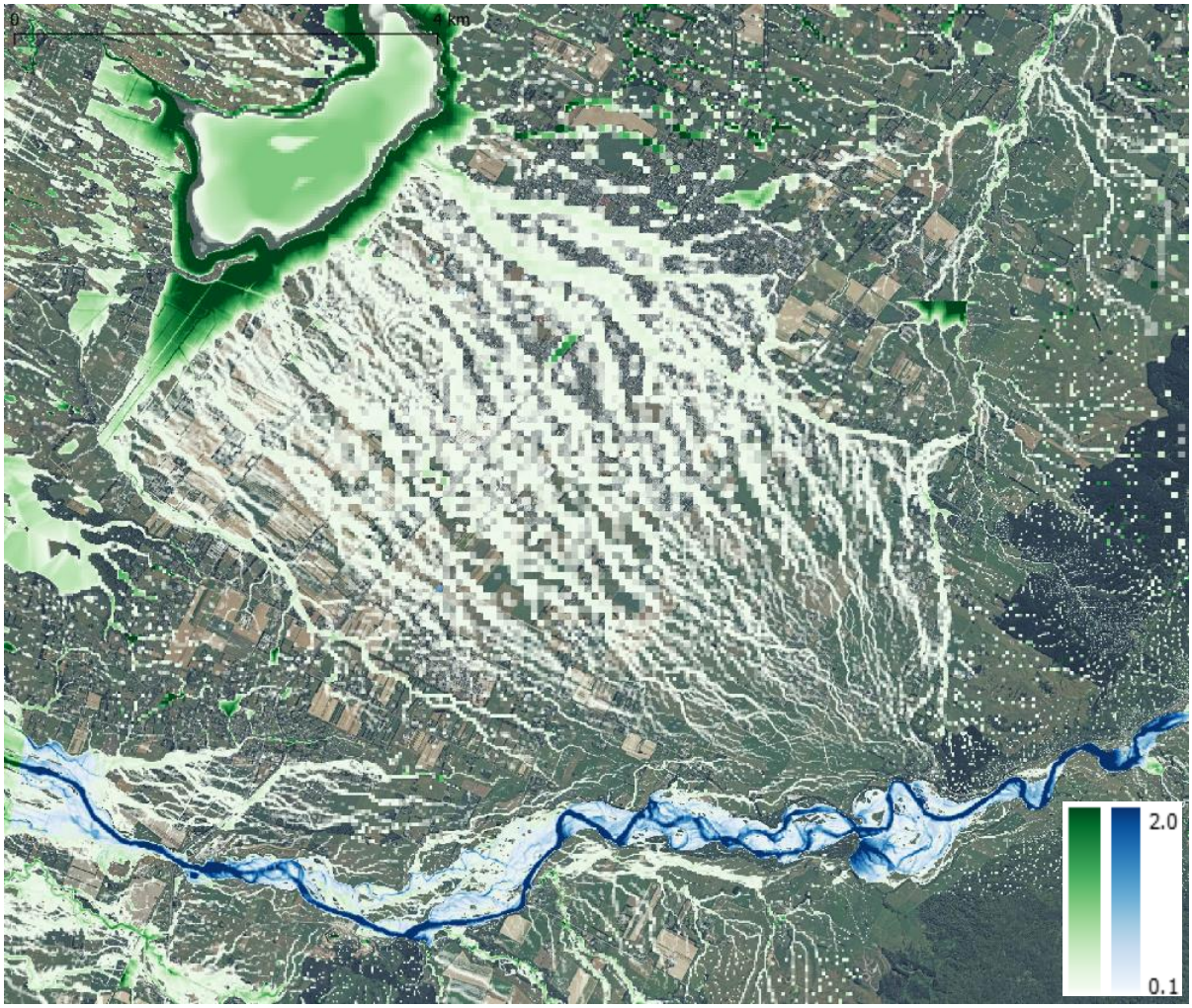


Figure 3-4: Fluvial (blue) versus pluvial (green) flooding with stopbanks up in Levin from the Ōhau River for 0.1% AEP+3˚C of climate change scenario. Flood depth is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

3.2.3 Feilding

Figure 3-5 presents the fluvial (blue) and pluvial (green) flooding in Feilding for the largest modelled event (0.1% AEP +3˚C). For the urban area, pluvial flooding appears to be dominant.

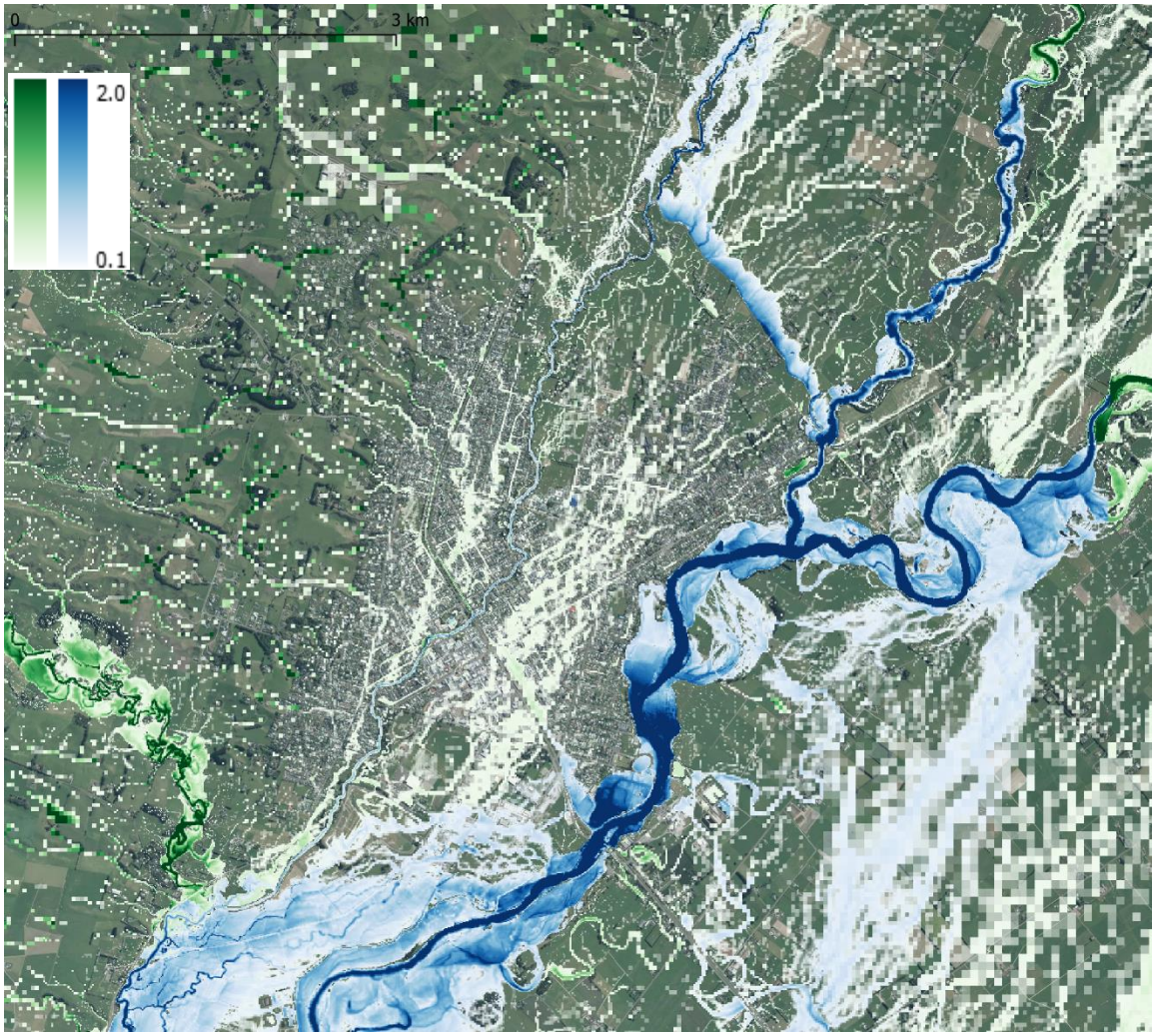


Figure 3-5: Fluvial (blue) vs pluvial (green) flooding with stopbanks in Feilding from Oroua River, Kiwitea and Makino Stream for 0.1% AEP +3˚C of climate change scenario. Flood depth is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

3.2.4 Whanganui

Figure 3-6 presents the fluvial (blue) versus pluvial (green) flooding for the Whanganui urban area for the largest modelled event (0.1% AEP +3˚C). For these large event, fluvial flooding is the dominant source of flooding in the Whanganui urban area.

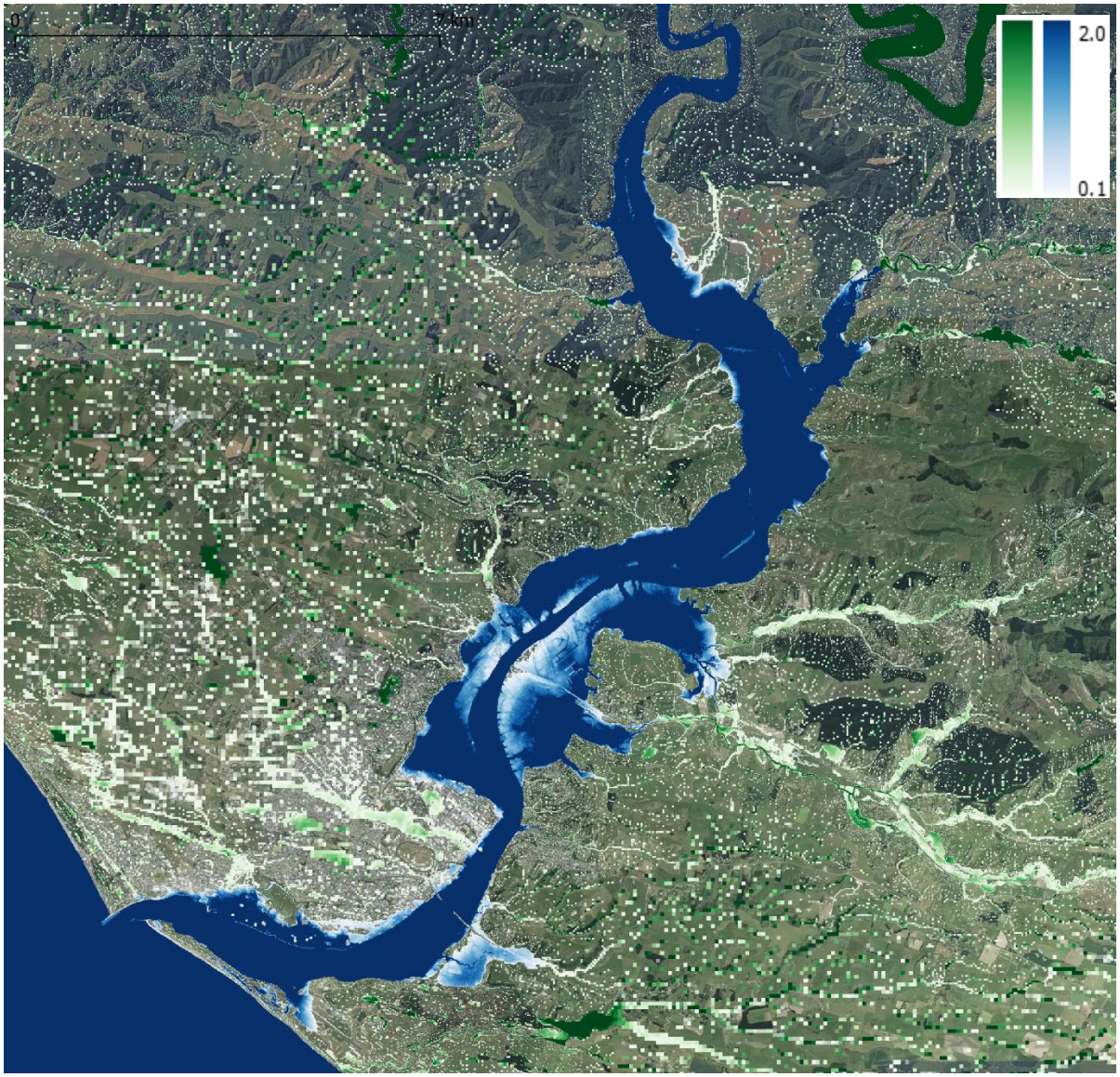


Figure 3-6: Fluvial (blue) versus pluvial (green) flooding with stopbanks up in Whanganui from Whanganui River and Ūpokongaro Stream for 0.1% AEP +3˚C of climate change scenario. Flood depth is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

The relative importance of these two fluvial and pluvial flooding mechanisms for the different rainfall event flood modelled will be further quantified through the risk assessment based on the two different sets of flood maps. This will also account for changes in depth between fluvial and combined fluvial-pluvial flooding.

3.3 Stopbanks up vs Stopbanks down flood maps

These fluvial models also allow for a clear identification of the impact of the stopbanks on the flood extents. An example is shown in Figure 3-7, with the same rainfall scenario for stopbanks up (blue) and stopbanks down (red) configurations (with the stopbanks up scenario flood map on top of the stopbanks down scenario flood map).

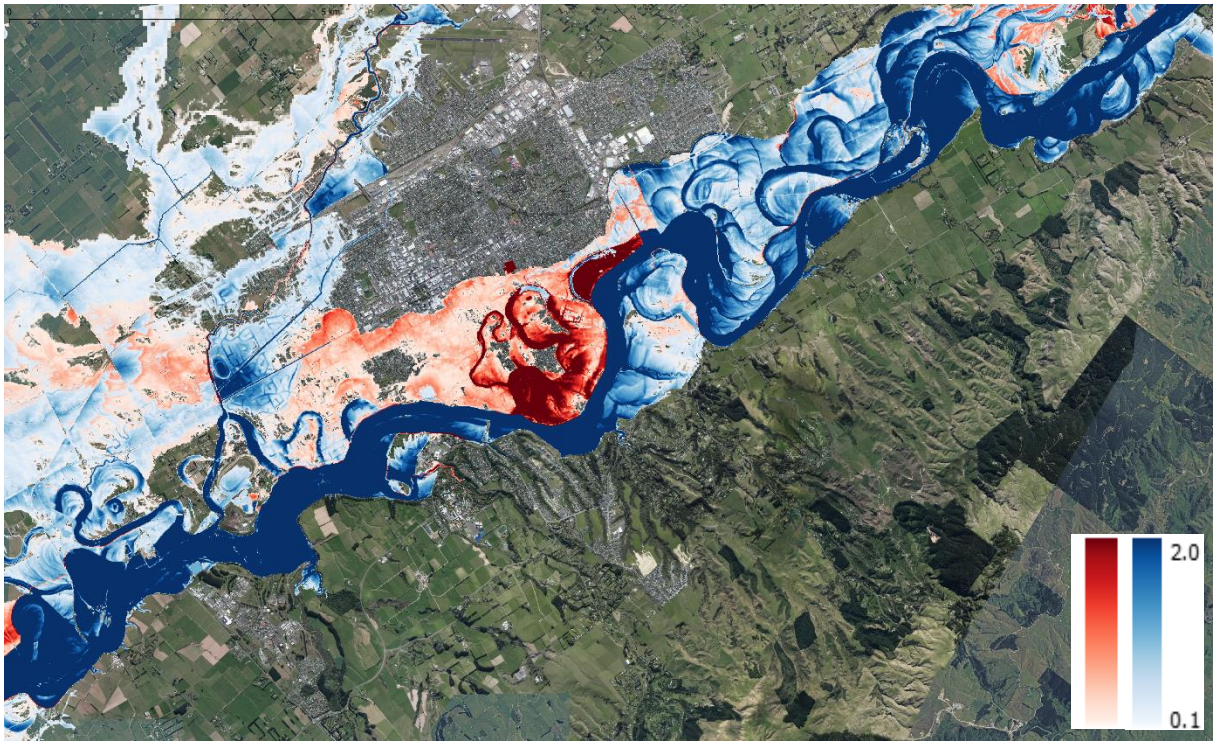


Figure 3-7: Stopbanks up (blue) vs stopbanks down (red) for the fluvial flooding in Palmerston North from the Manawatū River and Mangaone Stream for a 0.5% AEP event in a +3˚C future climate. Flood depth is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

Figure 3-7 represents the effect of stopbanks for Palmerston North during a 0.5% AEP +3˚C event: all the areas flooded in red are protected from fluvial flooding by the actual flood protection scheme but would be flooded without it. Some higher water levels are observed along the Mangaone stream, from Tremaine Ave in particular, due to the small stream size compared to the modelling resolution (problematic especially in the stopbanks up configuration).

4 Conclusion

Earth Sciences NZ and WSP New Zealand Ltd are collaborating to inform Horizons Regional Council's flood vulnerability assessment. Previously, Earth Sciences NZ (NIWA at the time) provided a region-wide fluvial and pluvial flood assessment (Harang et al. 2025). The flood maps developed were then used for a region-wide flood risk assessment which identified the following four urban areas as most vulnerable to flood damage: Palmerston North, Whanganui, Feilding and Levin. In order to better understand the origin of the flooding to inform the council response, fluvial flood models were developed for these locations. The four fluvial flood models were generated based on the fluvial flooding in the pluvial-fluvial models to facilitate the comparison between the two set of maps by extracting hydrographs upstream of the urban area from the region-wide flood outputs and injecting them (without rainfall in the modelling domain or other small stream injection points) in the fluvial model. For each model, a set of scenarios similar to the region-wide flood assessment have been generated: 5%, 2%, 1%, 0.5% AEP for actual climate conditions and 0.5% AEP for future climate corresponding to +1˚C , +2˚C , +3˚C global mean temperature increase above actual conditions (or +2˚C, +3˚C and +4˚C above pre-industrial temperatures). These rainfall scenarios were generated for stopbanks up and down configurations. We also modelled overdesign events for the stopbanks up configuration corresponding to 0.2% and 0.1% AEP rainfall for current climate conditions and future climate conditions corresponding to a temperature increase of 1, 2, 3˚C above current conditions.

In Levin, a preliminary analysis of the fluvial modelling results confirmed the absence of fluvial flooding across the full range of scenarios explored, indicating that previously observed flooding in the fluvial–pluvial regional hazard assessment is of pluvial origin. In Fielding, a major part of the flooding observed, particularly in the town centre, was also identified as pluvial, with no overbank flow from the Makino Stream. Only localised fluvial flooding from the Oroua River is observed in the southern part of the town (south of South Street), and only under the more extreme scenarios. In Whanganui, for the more extreme scenarios, a large proportion of the flooding observed is fluvial in origin, resulting from the Whanganui River, whereas pluvial flooding is dominant for less extreme scenarios. In Palmerston North, a combination of fluvial and pluvial flooding is observed. The regional models don't show any major failure of the Manawatū River stopbanks for any tested rainfall scenario, including the 0.1% AEP +3˚C scenario, whereas failure of these stopbanks is observed in the high-resolution model for the 0.5% AEP +3˚C scenario. The regional model shows fluvial flooding in the town centre from the Mangaone Stream. This result should be treated with caution given the stream morphology and the model resolution, and the fact that no overtopping of this stream is observed in the high-resolution model. We are expecting the high-resolution model to be more accurate in both situations.

5 Acknowledgements

This study builds upon the workflow and tools developed for the MBIE-funded Endeavour Programme Mā te Haumaru ō ngā puna wai ō Rākaihautū ka ora mō ake tonu. We would like to thank the programme team for their contributions. This project was also developed in collaboration with the WSP team, whose support was central, and in complement to the work presented in Harang et al. (2025). We gratefully acknowledge the Horizons Regional Council for their insightful discussions and the provision of essential data, which were critical for the creation of these maps. Finally, the author(s) acknowledge the use of the New Zealand eScience Infrastructure (NeSI) high-performance computing facilities for this research. These national facilities are provided by NeSI and funded jointly by NeSI's collaborator institutions and the Ministry of Business, Innovation and Employment's Research Infrastructure programme.

6 References

Harang, A., Pearson, R., Lane, E., Singh, S. (2025) Regional flood modelling for Horizons Flood Vulnerability Assessment. *NIWA Client Report*, 2025133CH.

WSP. (2025) Horizons Regional Council Flood Vulnerability Assessment. (In Preparation)

Appendix A List of files provided

The delivered set of inundation maps consists of 2D maps, saved in .tiff format, on an 8 m x 8 m resolution grid, in a NZTM2000/NZVD2016 datum. The stopbanks up and stopbanks down scenarios were applied to 7 different design storm intensities corresponding to: 5%, 2%, 1%, 0.5% AEP (20-, 50-, 100-, 200-year return period) in actual conditions and 0.5% AEP (200-year return period) for +1˚, +2˚, +3˚ C above actual conditions. The 0.2%, 0.1% AEP (500, 1000-year return period) +0˚, +1˚, +2˚, +3˚ C above actual conditions was also included. In the following table and file naming process, the "return period" convention is used.

Table A-1: List of scenarios explored for each domain.

Domain name	Urban area included	Stopbanks up *20,50,100,200-year +0˚C 200-year +1˚,2˚,3˚C*	Stopbanks down *20,50,100,200-year +0˚C 200-year +1˚,2˚,3˚C*	Stopbanks up *500, 1000-year +0˚,1˚,2˚,3˚C*
Manawatū	Palmerston North Feilding	✓	✓	✓
Ōhau-Levin	Levin	✓	✓	✓
Whanganui	Whanganui	✓	✓	✓

For each of these scenarios, different fields extracted from computational results were:

- Maximum_Water_Depth (m) calculated at each time step in the simulation (and not from hourly snapshots outputs), reprojected on an 8 m × 8 m grid.
- Maximum_Elevation (m): maximum of water surface elevation, calculated at each time step in the simulation (and not from hourly snapshots outputs), reprojected on an 8 m × 8 m grid.
- Maximum_Depth_times_Velocity (m^2s^{-1}): maximum of water depth times water velocity (amplitude) calculated at each time step in the simulation (and not from hourly snapshot outputs), reprojected on an 8 m × 8 m grid. This is a specific variable output for risk assessment.
- Rising_Rate_to_1.2 m (mh^{-1}): water rising rate up to 1.2 m, calculated from the 1-hour snapshot outputs (water depth field h(m)), reprojected on an 8 m × 8 m grid. This is a specific variable output used to assess risk to people.

All filenames follow a similar structure, for example:

"Manawatu_20y_0c_Fluvial_ Stopbank_down _Inundation_Floodmap_Maximum_Elevation.tif",

which begins with the domain name "Manawatu", then the design storm characteristics "20y_0c" for 20-year return period and 0˚C of climate change above actual conditions, "Fluvial" to differentiate from pluvial-fluvial maps, "Stopbank_down" added if it is the case (default being stopbanks up) and then the field "Maximum_Elevation" for maximum of water surface elevation.

By default, "Nan" (not a number) values are allocated to area in the domain where there is no water or that are outside of the high-resolution local domain.

The input files used to model these scenarios will also be provided to Horizons separately to this report. Shape files of the rectangle which the flood output is cropped to will be also provided so that the matching information from the combined fluvial and pluvial modelling can be extracted allowing the difference to be calculated between the two models and both the hazard and risk outputs to be compared.

Appendix B Comparison with Horizons level B Lower Manawatū fluvial model developed by WSP

The results from the fluvial flooding, stopbanks up scenarios, have been compared to "level B" models built by WSP for the Lower Manawatū area. These two models follow similar methodologies as they are both focussed on fluvial flooding. The area covered is larger for the level B model, going from Pohangina to the river mouth compared to the Palmerston North model which is concentrated on the urban area. The level B model is forced using hydrographs extracted from hydrological model whereas the Palmerston North model uses extracted results from the 2D fluvial-pluvial modelling. These models both rely on similar LiDAR and stopbanks database but may present differences in their DEM, roughness map, stopbanks implementation and local resolution because different techniques were used to process the raw data and the Lower Manawatū model is 2 m resolution compared to the 8 m resolution of the Palmerston North model.

The results show more flooding for similar scenarios in the level B model compared to Palmerston North fluvial flood model. For the scenario 0.5% AEP event in current climate condition, presented in Figure B-1, the difference between the two models is shown visually and there can be up to a 1 m difference in the river water surface. On the western side of the town, overflows from the Mangaone Stream are observed in the fluvial flood maps but not on the Level B Lower Manawatū model. At least part of it can be explained by the small size of the stream compared to the grid resolution and stopbanks alignment, especially from Tremaine Avenue in this model.

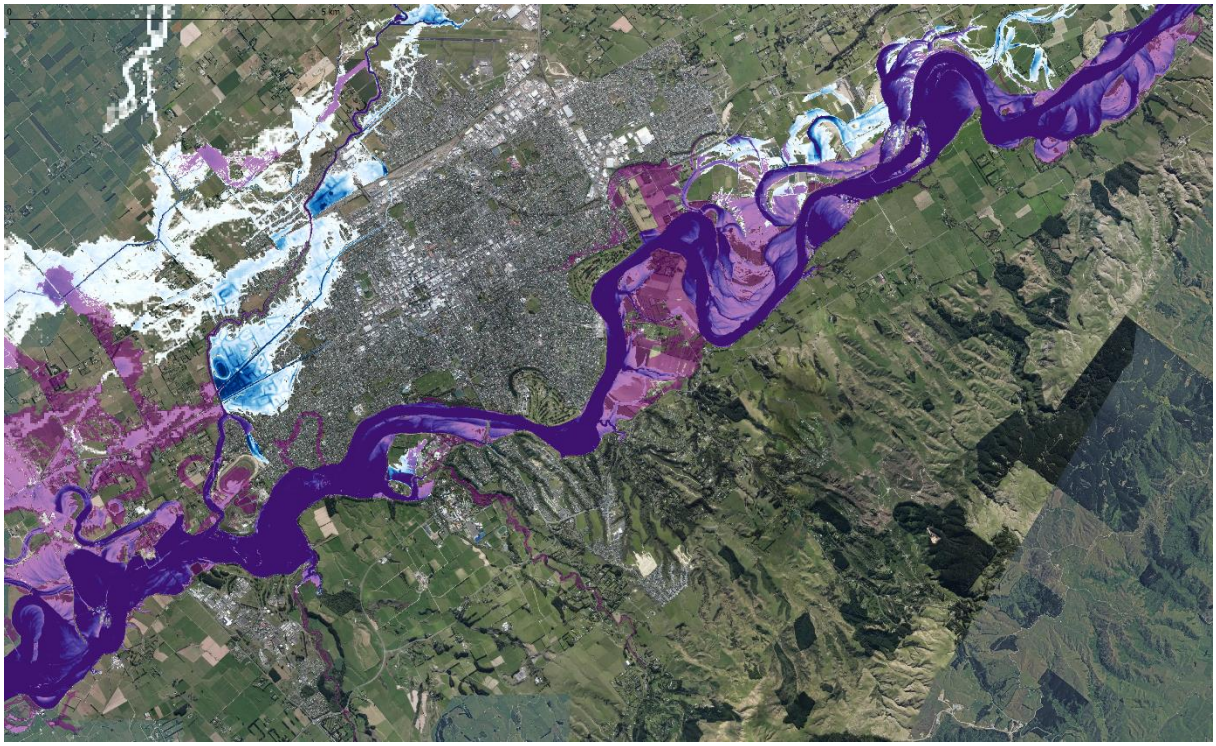


Figure B-1: Fluvial flood maps generated by the local Palmerston North model (blue). Level B Lower Manawatū model (purple overlay) for a 0.5% AEP event for actual climate. Flood depth is indicated by

the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

For the 0.5% AEP +3˚C of climate change scenario presented Figure B-2, a 1 m to 1.5 m difference in water elevation in the river is observed between the two different models, leading to considerable overtopping of the Palmerston North stopbanks for the level B model whereas most of flow is still contained in the river channel in the local Palmerston North fluvial model. This causes large differences in the flooded areas between the two models.

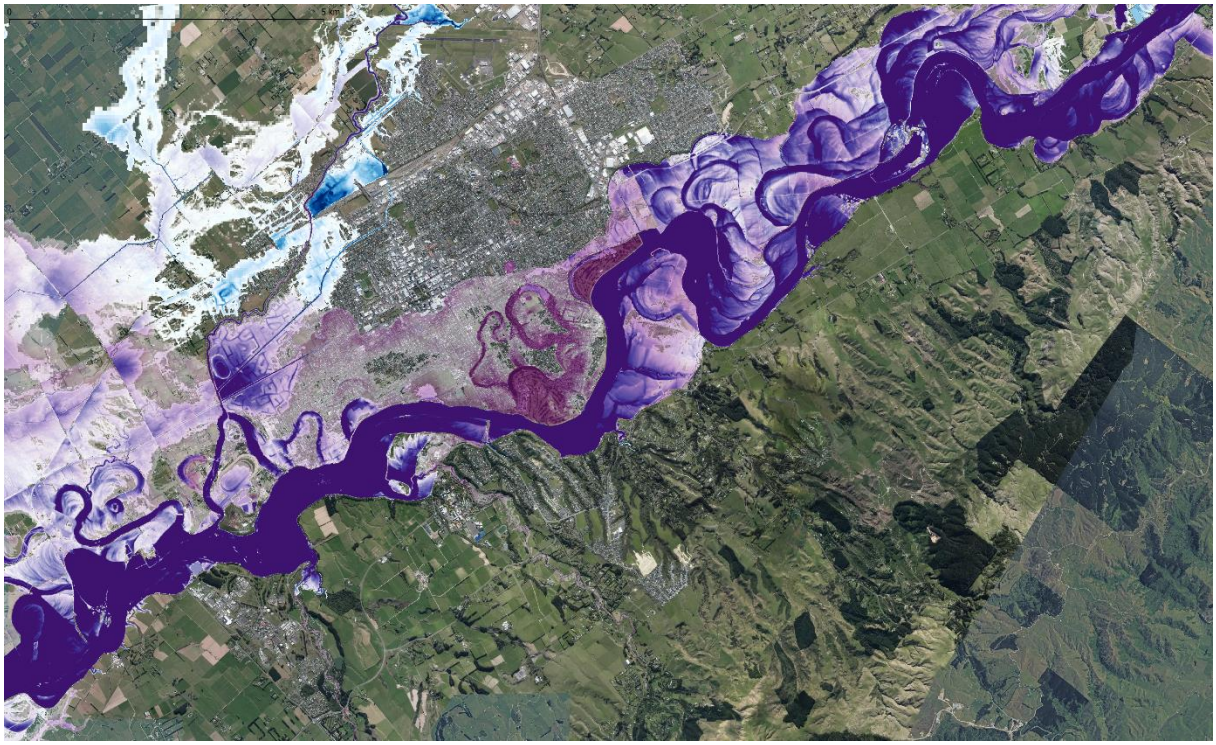


Figure B-2: Fluvial flood maps generated by the local Palmerston North model (blue). Level B Lower Manawatū model (purple overlay) for a 0.5% AEP +3˚C of climate change scenario. Flood depth is indicated by the darkness of the colour. Dark colour indicates flooding of 2 m or more. Flood depths of 0.1 m or less are masked out.

These differences between the two models can originate from the topography, the forcing or the modelling method. At the topographic level, the same underlying DEM and LiDAR data have been used in the two models but the processing techniques, the river bathymetry treatment and the stopbanks enforcement (or even stopbanks database) may differ. The hydrographs used to force the rivers are likely to differ as the level B model used hydrological input when the local Palmerston North model used 2D inundation model outputs. As hydrological model does not consider riverbank overtopping and overland flow paths, they might present differences, more specifically the maximum discharge from 2D inundation model cross-section hydrographs may be lower and occur later compared to hydrological results. Last, using two different software, using different flow modelling option (roughness implementation, resolution, numerical solver) may lead to some differences in the results.

To further investigate these differences and their origins, more information on the models and their underlying data would be needed, such as a complete set of model inputs and outputs. Comparison of DEMs, roughness maps, cross sections, velocity fields would be the first steps to deepen this analysis.

APPENDIX I – RESULTS MEMO FOR DIFFERENTIATING FLUVIAL AND PLUVIAL FLOODING

MEMORANDUM

To	Jon Roygard, Group Manager Natural Resources and Partnerships
Copy	Julia Jung, Team Leader Design & Investigations
From	Richard Woods, Service Line Leader Risk & Resilience
Office	Auckland
Date	11 February 2026
Subject	Results Memo for Differentiating Fluvial and Pluvial Flooding

1. Introduction

The purpose of this memo is to present the results comparing the fluvial (river-based) against the combined fluvial and pluvial (rainfall/surface water) flooding in regional flood modelling outputs to support Horizons Regional Council's flood protection planning. This distinction is critical for informing stopbank management and funding decisions, ensuring that flood protection schemes are appropriately targeted.

The combined pluvial and fluvial results have been derived from the Level A flood modelling which provides a regional-scale vulnerability assessment and comparative risk analysis for the entire Horizons' Region. The following should be considered when reviewing the results:

- The study methodology assumes a uniform flood event across the region incorporating multiple flood scenarios. This means results may be overstated, and do not represent actual flood events.
- The results have not been calibrated against historic flood events and are not suitable for direct comparison.

2. Results

Detailed results for each of the case study locations can be found in Appendix I1. The results presented below are for a study area within each town and settlement. Therefore, the number of buildings will not match to the full number within the town and settlement that is presented within Appendix D1-7.

Under current climate conditions all areas are dominated by pluvial flooding, with fluvial flooding contributing only a small proportion of total exposure and reinstatement cost. This pattern changes under climate warming. Palmerston North and Whanganui become increasingly influenced by fluvial flooding as river depths and extents grow, and fluvial impacts begin to dominate total reinstatement cost at higher warming scenarios. In contrast, Levin and Feilding retain a pluvial dominated profile across all climate conditions, with only modest changes in fluvial influence. Overall, warming increases the role of fluvial flooding in the larger urban centres while pluvial flooding continues to dominate in the smaller towns.

Table 1 presents the results for the 0.5% AEP event with flood defences up under current climate for all four case study locations. Figures 1, 2 and 3 present the results, compared to regional flood vulnerability study results, for the number of buildings exposed, the number of buildings that contribute to reinstatement cost, and their reinstatement costs respectively.

Table 1: Summary of the number of buildings exposed and total reinstatement costs due to pluvial and fluvial flooding for the four case studies for a 0.5% AEP event with current climate conditions and defences up.

Case Study Location		Pluvial and Fluvial			Fluvial		
	Total No. buildings	No. buildings exposed	No. buildings that contribute to reinstatement cost	Total building reinstatement cost (000's NZD)	No. buildings exposed	No. buildings that contribute to reinstatement cost	Total building reinstatement cost (000's NZD)
Palmerston North	51,584	13,883	8,472	860,872	6,255	5,054	486,067
Whanganui	35,239	8,198	4,442	403,575	581	570	85,657
Levin	18,156	7,630	1,377	109,615	8	3	221
Feilding	12,553	2,221	422	54,990	175	132	17,560

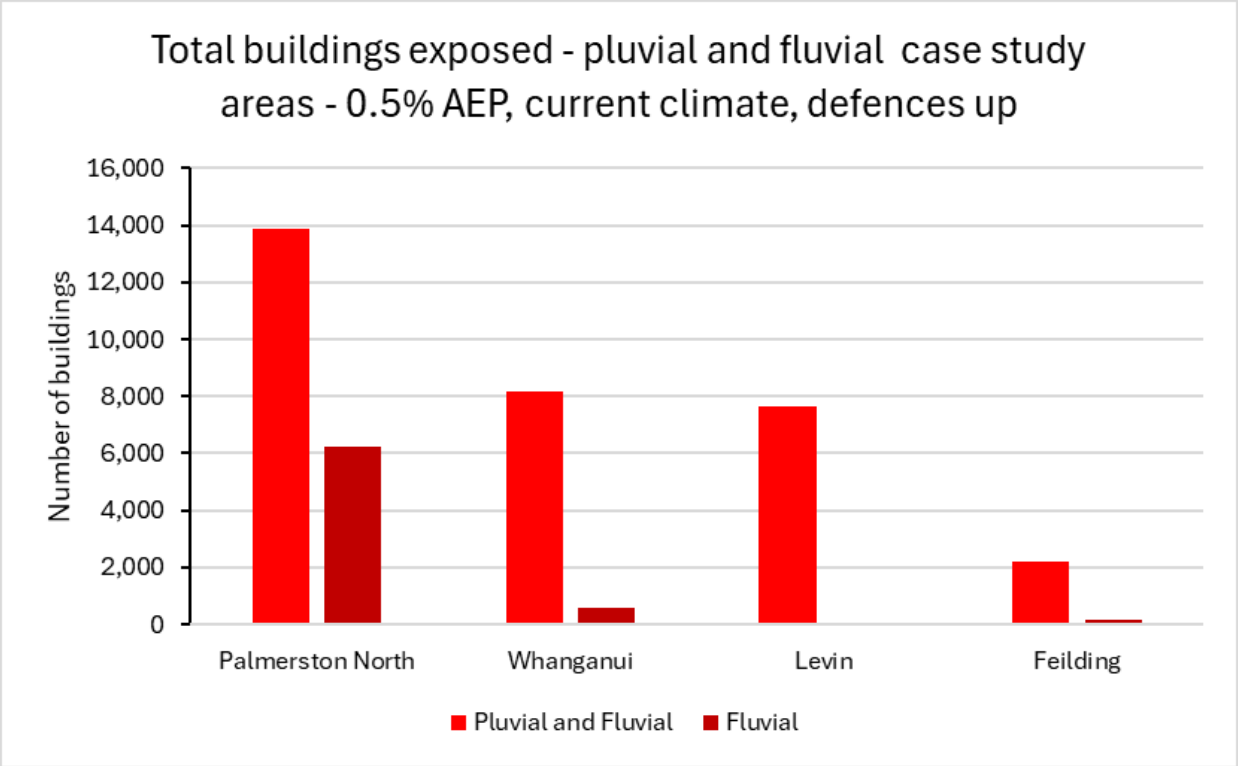


Figure 1: Number of buildings exposed due to pluvial and fluvial (light red) and fluvial flooding (dark red).

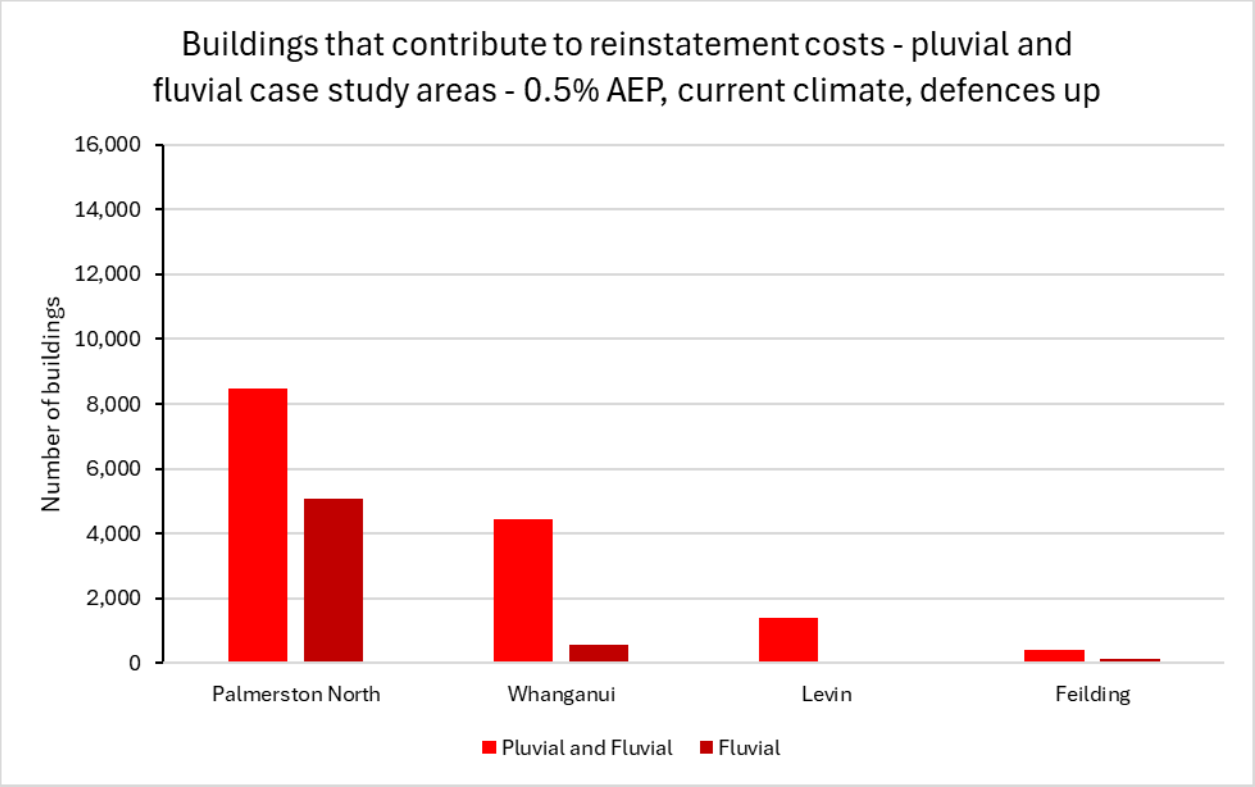


Figure 2: Number of buildings that contribute to reinstatement costs due to pluvial and fluvial (light red) and fluvial flooding (dark red).

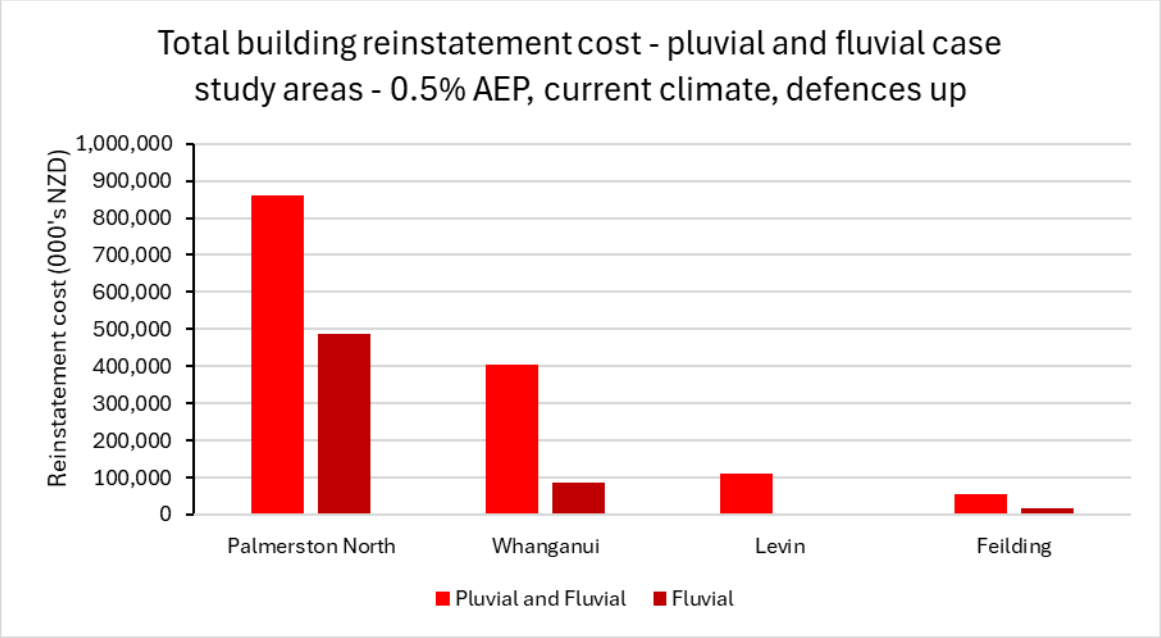


Figure 3: Total building reinstatement cost due to pluvial and fluvial (light red) and fluvial flooding (dark red).

The following section provides a summary of results and trends for the different flood modelling scenarios. Appendix I1 provides the detailed tabulated results.

2.1 Current Climate with Defences Up

At the 5% AEP event, Palmerston North records more than 11,300 buildings exposed to flooding, and fluvial flooding accounts for almost half of this exposure. In contrast, Levin has almost no fluvial influence, and exposure there is almost entirely driven by pluvial flooding. Whanganui and Feilding have mixed profiles, although pluvial flooding remains the primary driver of exposure in both areas at this event scale.

At the 0.5% AEP event, the contribution of fluvial flooding becomes more pronounced in Palmerston North and Feilding. In these areas, more than half of total reinstatement cost is associated with fluvial flooding. Whanganui continues to show a small proportion of buildings influenced by fluvial processes, but the fluvial affected buildings have higher reinstatement costs when compared with pluvial affected buildings. Levin remains almost completely influenced by pluvial flooding, with only minimal fluvial exposure across all events.

2.2 Climate Warming with Defences Up

Under a 3°C warming scenario, both fluvial and pluvial exposure increase throughout the study areas. Palmerston North experiences an increase in fluvial flooding, contributing to reinstatement costs rising to approximately $1.38B. This represents a 60% increase relative to current climate conditions.

Results from the comparison suggest that Whanganui is the most sensitive to increased rainfall intensity. While pluvial exposure does increase under climate warming scenarios, the largest change occurs in fluvial flooding. Fluvial reinstatement costs increase by almost 150% under the 3°C warming scenario, indicating that river flooding becomes much more dominant in flooding in Whanganui as event magnitude increases.

Levin and Feilding also experience increases in exposure and cost, though the influence of fluvial flooding remains small in Levin and moderate in Feilding.

2.3 Current Climate with Defences Down

Removing flood defences increases the influence of fluvial flooding in Palmerston North and Feilding. In Palmerston North, higher fluvial overflow leads to an increase of about 25% in reinstatement cost at the 0.5% AEP event. Feilding shows an even stronger shift toward fluvial dominance, with reinstatement costs more than doubling when defences are removed.

Whanganui and Levin show very little change because flooding in these areas is driven mainly by pluvial processes. The removal of defences does not significantly increase fluvial flooding in either district.

2.4 Climate Warming with Defences Down

Under a 3°C warming scenario with defences removed, exposure and reinstatement costs increase further across all areas. Palmerston North and Feilding show the largest proportional increases, with reinstatement costs rising to more than 170% above the current climate results with defences in place. Much of this increase is associated with higher fluvial flooding under larger events.

Whanganui also experiences strong increases in reinstatement cost under this combined scenario, driven mainly by increased fluvial flooding as river levels rise under more intense rainfall. Levin shows the smallest relative change, consistent with its pluvial dominated flood regime and lower sensitivity to changes in river flooding.

Appendix I1: Detailed Results

With existing flood defences in place and no climate change impacts

*Table 2: **Pluvial and Fluvial** building vulnerability metrics for 5%, 2% and 1% AEP events with existing flood defences in place and no climate change impacts.*

AREA	5% AEP FLOOD – CURRENT CLIMATE (0°C)			2% AEP FLOOD – CURRENT CLIMATE (0°C)			1% AEP FLOOD – CURRENT CLIMATE (0°C)		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	11,385	6,545	671,405	12,452	7,383	770,722	13,150	7,898	790,436
WHANGANUI	6,559	3,203	264,256	7,051	3,540	304,176	7,594	3,916	342,219
LEVIN	6,752	896	74,940	7,133	1,123	90,560	7,409	1,282	102,055
FEILDING	1,745	293	38,543	1,937	339	43,867	2,110	387	49,307

*Table 3: **Fluvial** building vulnerability metrics for 5%, 2% and 1% AEP events with existing flood defences in place and no climate change impacts.*

AREA	5% AEP FLOOD – CURRENT CLIMATE (0°C)			2% AEP FLOOD – CURRENT CLIMATE (0°C)			1% AEP FLOOD – CURRENT CLIMATE (0°C)		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	4,384	3,566	331,187	4,913	4,004	373,367	5,345	4,350	407,062
WHANGANUI	8	7	892	118	115	14,436	359	347	50,260
LEVIN	0	0	0	2	2	120	4	3	234
FEILDING	56	32	1,720	101	54	3,792	118	80	7,940

*Table 4: **Pluvial and Fluvial** building vulnerability metrics for 0.5%, 0.2% and 0.1% AEP events with existing flood defences in place and no climate change impacts.*

AREA	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)			0.2% AEP FLOOD – CURRENT CLIMATE (0°C)			0.1% AEP FLOOD – CURRENT CLIMATE (0°C)		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	13,883	8,472	860,872	14,283	8,838	896,228	14,773	9,254	945,456
WHANGANUI	8,198	4,442	403,575	10,445	6,958	636,050	11,578	8,200	792,447
LEVIN	7,630	1,377	109,615	7,903	1,512	126,188	8,090	1,559	147,829
FEILDING	2,221	422	54,990	2,398	494	60,229	2,530	544	67,947

*Table 5: **Fluvial** building vulnerability metrics for 0.5%, 0.2% and 0.1% AEP events with existing flood defences in place and no climate change impacts.*

AREA	0.5% AEP FLOOD – CURRENT CLIMATE (0°C)			0.2% AEP FLOOD – CURRENT CLIMATE (0°C)			0.1% AEP FLOOD – CURRENT CLIMATE (0°C)		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	6,255	5,054	486,067	6,766	5,625	547,745	7,416	6,223	624,244
WHANGANUI	581	570	85,657	3,194	3,010	302,080	4,644	4,435	481,183
LEVIN	8	3	221	10	7	405	14	8	460
FEILDING	175	132	17,560	248	187	29,862	285	227	35,284

With existing flood defences in place and climate change impacts

*Table 6: **Pluvial and Fluvial** building vulnerability metrics for 0.5% AEP event with existing flood defences in place and climate change impacts.*

AREA	0.5% AEP FLOOD – 1°C CLIMATE WARMING			0.5% AEP FLOOD – 2°C CLIMATE WARMING			0.5% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	14,843	9,259	972,567	15,962	10,278	1,120,382	17,753	11,994	1,378,868
WHANGANUI	9,787	6,189	556,696	11,340	7,875	752,323	13,078	9,831	1,004,010
LEVIN	7,973	1,526	125,206	8,271	1,661	147,522	8,606	1,816	161,539
FEILDING	2,374	476	59,000	2,528	532	66,308	2,697	592	77,750

*Table 7: **Fluvial** building vulnerability metrics for 0.5% AEP event with existing flood defences in place and climate change impacts.*

AREA	0.5% AEP FLOOD – 1°C CLIMATE WARMING			0.5% AEP FLOOD – 2°C CLIMATE WARMING			0.5% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	7,080	5,806	592,224	8,303	6,994	745,111	10,001	8,579	945,427
WHANGANUI	2,477	2,258	237,135	4,257	4,157	437,925	7,108	6,727	741,300
LEVIN	11	7	437	18	11	482	22	15	614
FEILDING	218	169	21,853	272	218	36,088	315	248	36,916

*Table 8: **Pluvial and Fluvial** building vulnerability metrics for 0.2% AEP event with existing flood defences in place and climate change impacts.*

AREA	0.2% AEP FLOOD – 1°C CLIMATE WARMING			0.2% AEP FLOOD – 2°C CLIMATE WARMING			0.2% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	14,971	9,381	951,239	15,760	9,972	1,012,465	16,481	10,544	1,094,321
WHANGANUI	11,767	8,370	827,720	13,988	10,865	1,138,215	15,864	12,954	1,453,695
LEVIN	8,230	1,652	151,982	8,568	1,827	169,173	8,913	1,978	192,112
FEILDING	2,574	546	69,594	2,756	624	80,555	2,940	694	85,733

*Table 9: **Fluvial** building vulnerability metrics for 0.2% AEP event with existing flood defences in place and climate change impacts.*

AREA	0.2% AEP FLOOD – 1°C CLIMATE WARMING			0.2% AEP FLOOD – 2°C CLIMATE WARMING			0.2% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	7,692	6,480	659,568	9,002	7,799	819,498	12,199	10,465	1,148,823
WHANGANUI	5,031	4,790	521,731	8,387	8,119	919,881	10,538	10,354	1,214,850
LEVIN	18	10	460	22	15	610	26	18	777
FEILDING	291	232	34,850	370	283	47,636	474	364	65,366

*Table 10: **Pluvial and Fluvial** building vulnerability metrics for 0.1% AEP event with existing flood defences in place and climate change impacts.*

AREA	0.1% AEP FLOOD – 1°C CLIMATE WARMING			0.1% AEP FLOOD – 2°C CLIMATE WARMING			0.1% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	15,543	9,867	1,005,202	16,312	10,431	1,069,785	17,075	11,103	1,181,803
WHANGANUI	13,834	10,667	1,123,979	15,811	12,914	1,434,498	16,954	14,110	1,750,132
LEVIN	8,421	1,767	159,227	8,769	1,940	187,122	9,110	2,101	211,308
FEILDING	2,720	613	79,554	2,902	689	85,567	3,076	782	100,044

*Table 11: **Fluvial** building vulnerability metrics for 0.1% AEP event with existing flood defences in place and climate change impacts.*

AREA	0.1% AEP FLOOD – 1°C CLIMATE WARMING			0.1% AEP FLOOD – 2°C CLIMATE WARMING			0.1% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	8,824	7,603	796,455	11,517	9,947	1,090,213	16,377	14,203	1,606,316
WHANGANUI	8,236	7,942	893,107	10,670	10,479	1,248,586	12,051	11,902	1,564,344
LEVIN	20	13	505	26	16	638	35	21	1,396
FEILDING	357	278	45,980	467	361	65,500	544	412	78,808

With existing flood defences down and no climate change impacts

*Table 12: **Pluvial and Fluvial** building vulnerability metrics with existing flood defences down and no climate change impacts.*

AREA	5% AEP FLOOD – CURRENT CLIMATE (0°C)			2% AEP FLOOD – CURRENT CLIMATE (0°C)			1% AEP FLOOD – CURRENT CLIMATE (0°C)			0.5% AEP FLOOD – CURRENT CLIMATE (0°C)		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	9,299	4,319	482,074	10,804	5,482	598,517	12,702	7,115	806,097	14,733	9,083	1,077,528
WHANGANUI	6,482	3,107	248,867	7,005	3,483	289,062	7,557	3,863	328,478	8,188	4,420	398,886
LEVIN	6,752	896	74,940	7,133	1,124	90,568	7,409	1,282	102,055	7,630	1,377	109,613
FEILDING	2,496	523	71,367	2,788	687	85,859	2,959	817	98,732	3,112	913	113,299

*Table 13: **Fluvial** building vulnerability metrics with existing flood defences down and no climate change impacts.*

AREA	5% AEP FLOOD – CURRENT CLIMATE (0°C)			2% AEP FLOOD – CURRENT CLIMATE (0°C)			1% AEP FLOOD – CURRENT CLIMATE (0°C)			0.5% AEP FLOOD – CURRENT CLIMATE (0°C)		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	2,496	1,591	175,400	4,042	2,848	320,306	6,327	4,853	545,029	8,878	7,446	969,315
WHANGANUI	16	16	2,130	145	141	17,596	362	347	48,544	676	650	102,721
LEVIN	0	0	0	2	2	120	4	3	234	8	3	221
FEILDING	572	163	20,388	852	223	27,897	1,023	270	38,945	2,849	1,498	178,180

With existing flood defences down and climate change impacts

*Table 14: **Pluvial and Fluvial** building vulnerability metrics with existing flood defences down and climate change impacts.*

AREA	0.5% AEP FLOOD – 1°C CLIMATE WARMING			0.5% AEP FLOOD – 2°C CLIMATE WARMING			0.5% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	17,296	11,290	1,334,559	21,991	15,633	1,854,040	25,209	19,387	2,338,756
WHANGANUI	9,829	6,251	571,271	11,341	7,887	763,756	13,069	9,833	1,008,884
LEVIN	7,974	1,527	125,242	8,272	1,662	147,553	8,606	1,816	161,533
FEILDING	3,279	1,056	126,823	3,459	1,206	143,774	3,630	1,328	150,140

*Table 15: **Fluvial** building vulnerability metrics with existing flood defences down and climate change impacts.*

AREA	0.5% AEP FLOOD – 1°C CLIMATE WARMING			0.5% AEP FLOOD – 2°C CLIMATE WARMING			0.5% AEP FLOOD – 3°C CLIMATE WARMING		
	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)	NO. OF BUILDINGS EXPOSED	TOTAL NO. BUILDINGS FOR REINSTATEMENT COSTS	TOTAL BUILDING REINSTATEMENT COST (NZD 000'S)
PALMERSTON NORTH	11,842	9,354	1,110,664	16,903	13,829	1,637,292	19,690	17,276	2,062,676
WHANGANUI	2,564	2,355	258,247	4,197	4,096	434,292	7,497	7,236	789,546
LEVIN	12	8	446	18	12	490	22	15	612
FEILDING	1,317	388	56,013	1,488	476	70,483	1,668	547	83,784

Appendix I2: Case Study Area Maps

Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Palmerston North,
Palmerston North City

Scale 1:86,000 at A3

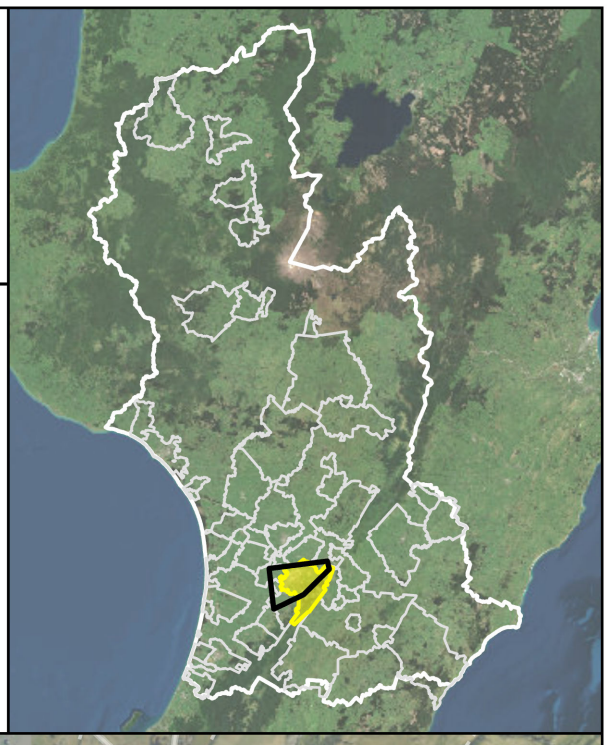
0 2.5 5 Km

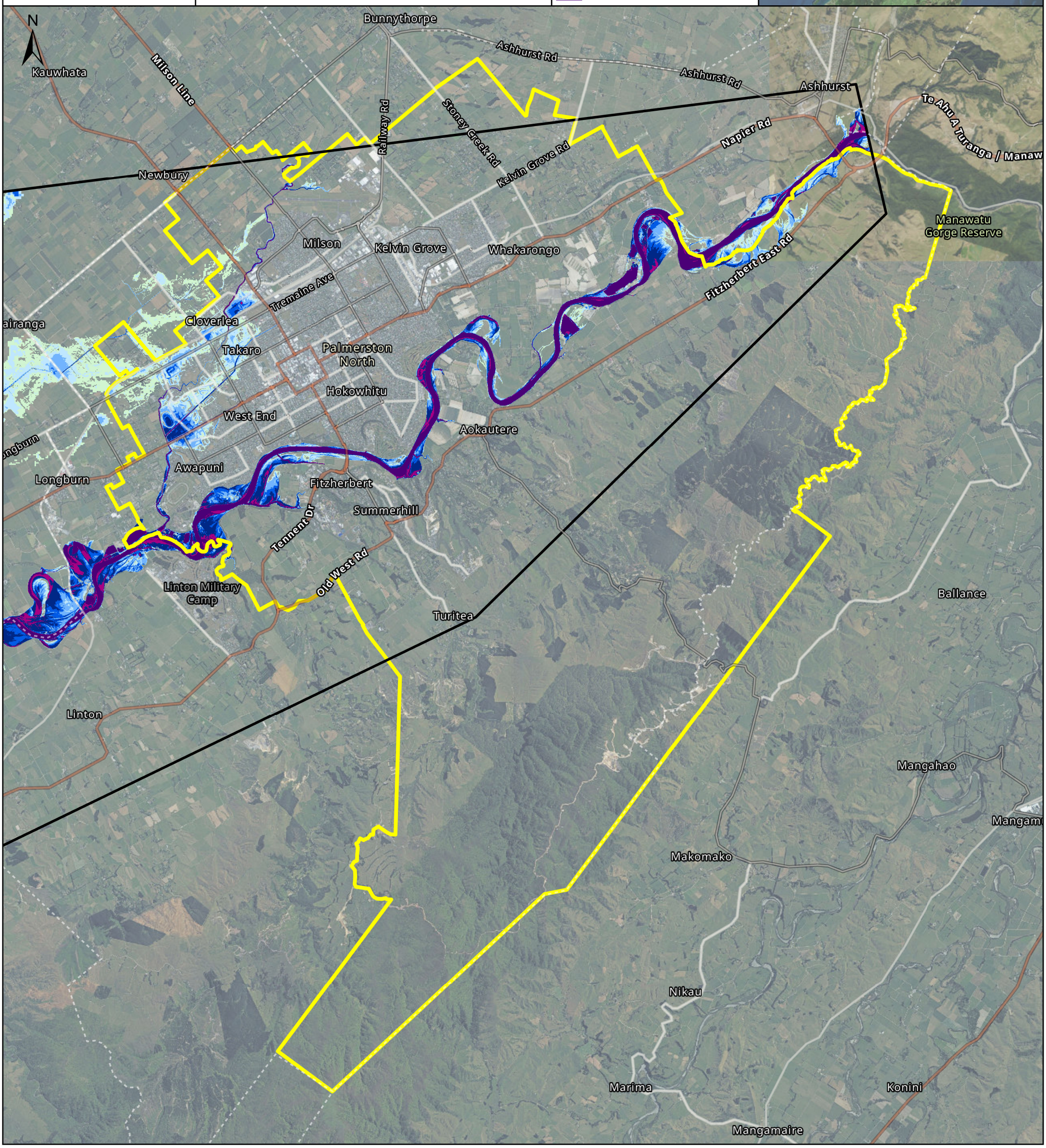
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

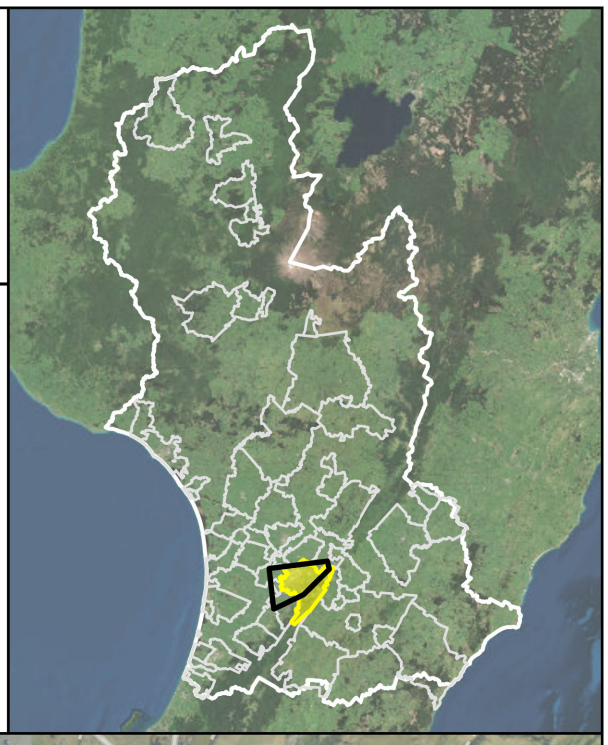
Community
Palmerston North,
Palmerston North City

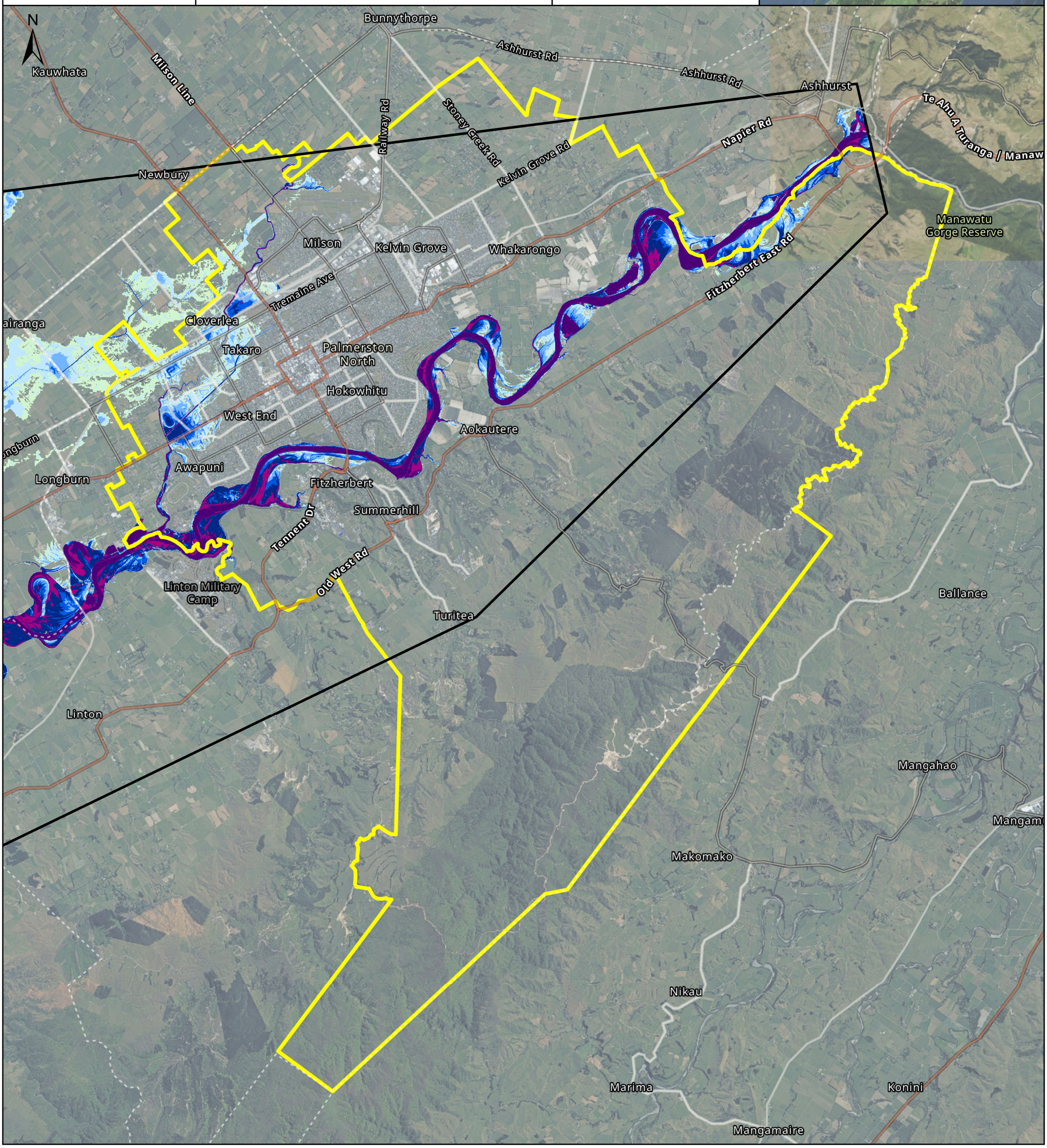
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Palmerston North,
Palmerston North City

Scale 1:86,000 at A3

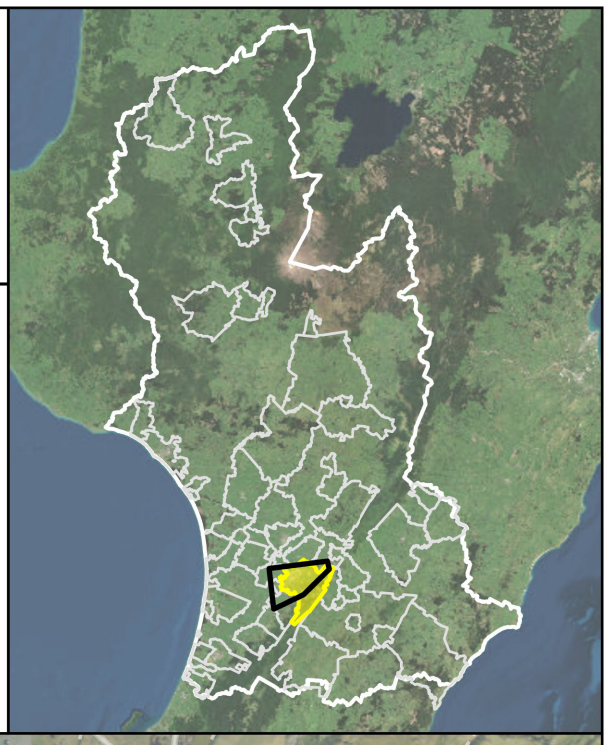
0 2.5 5 Km

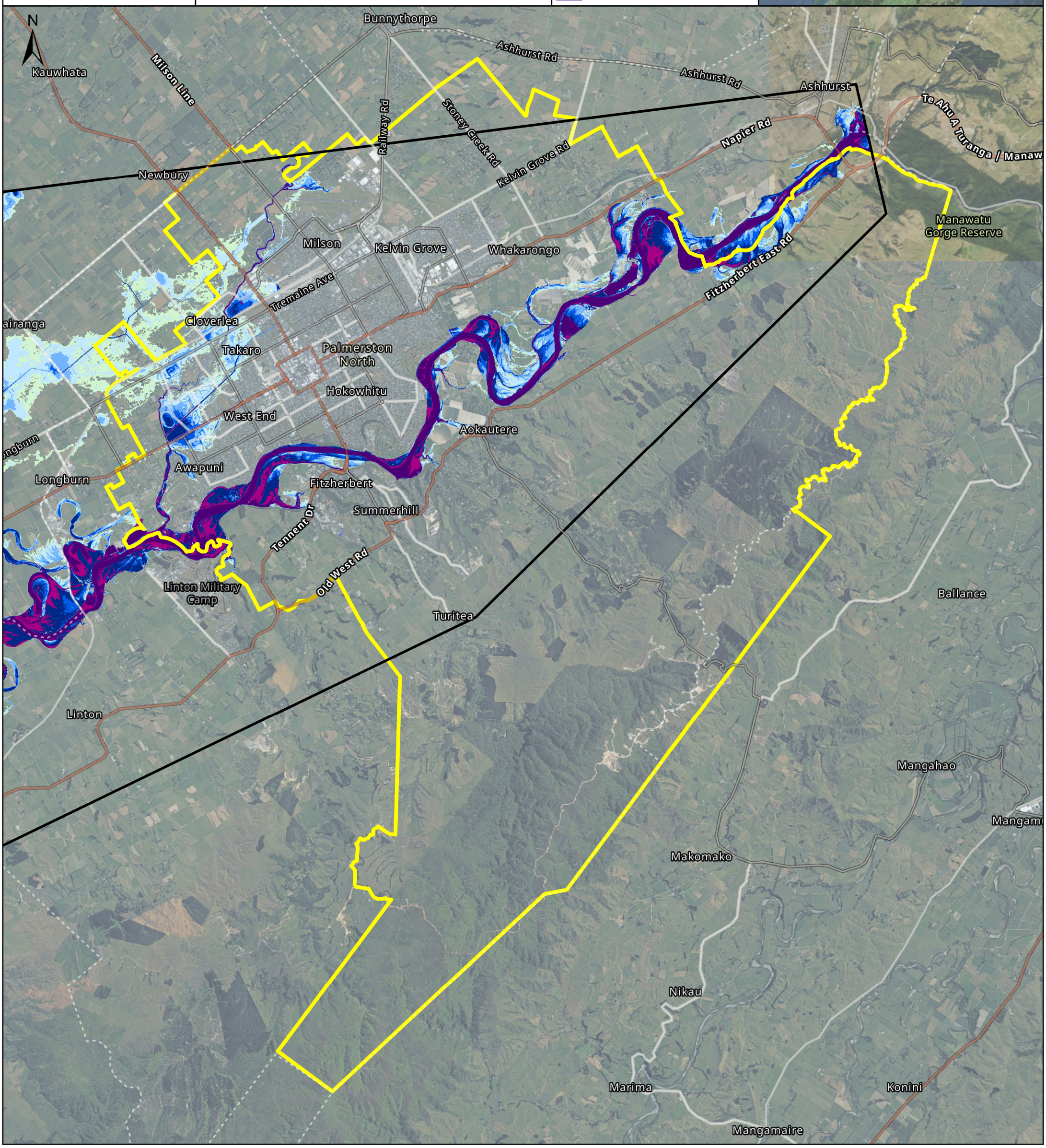
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

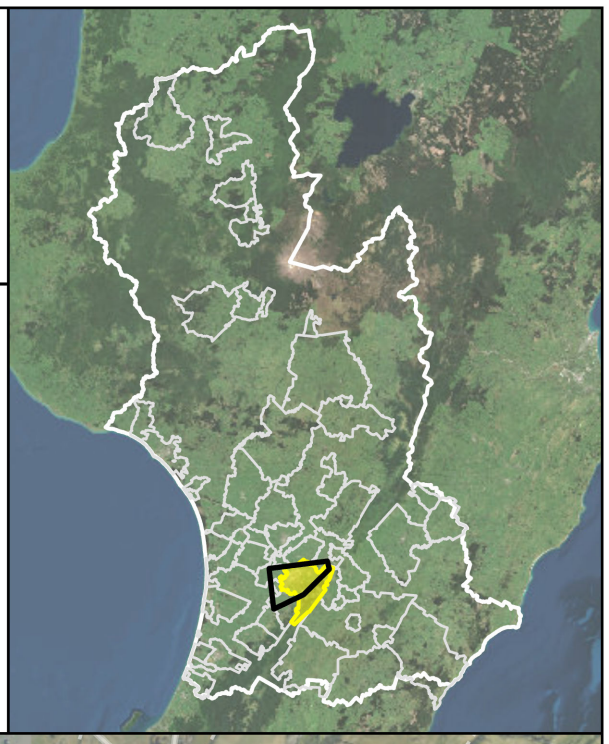
Community
Palmerston North,
Palmerston North City

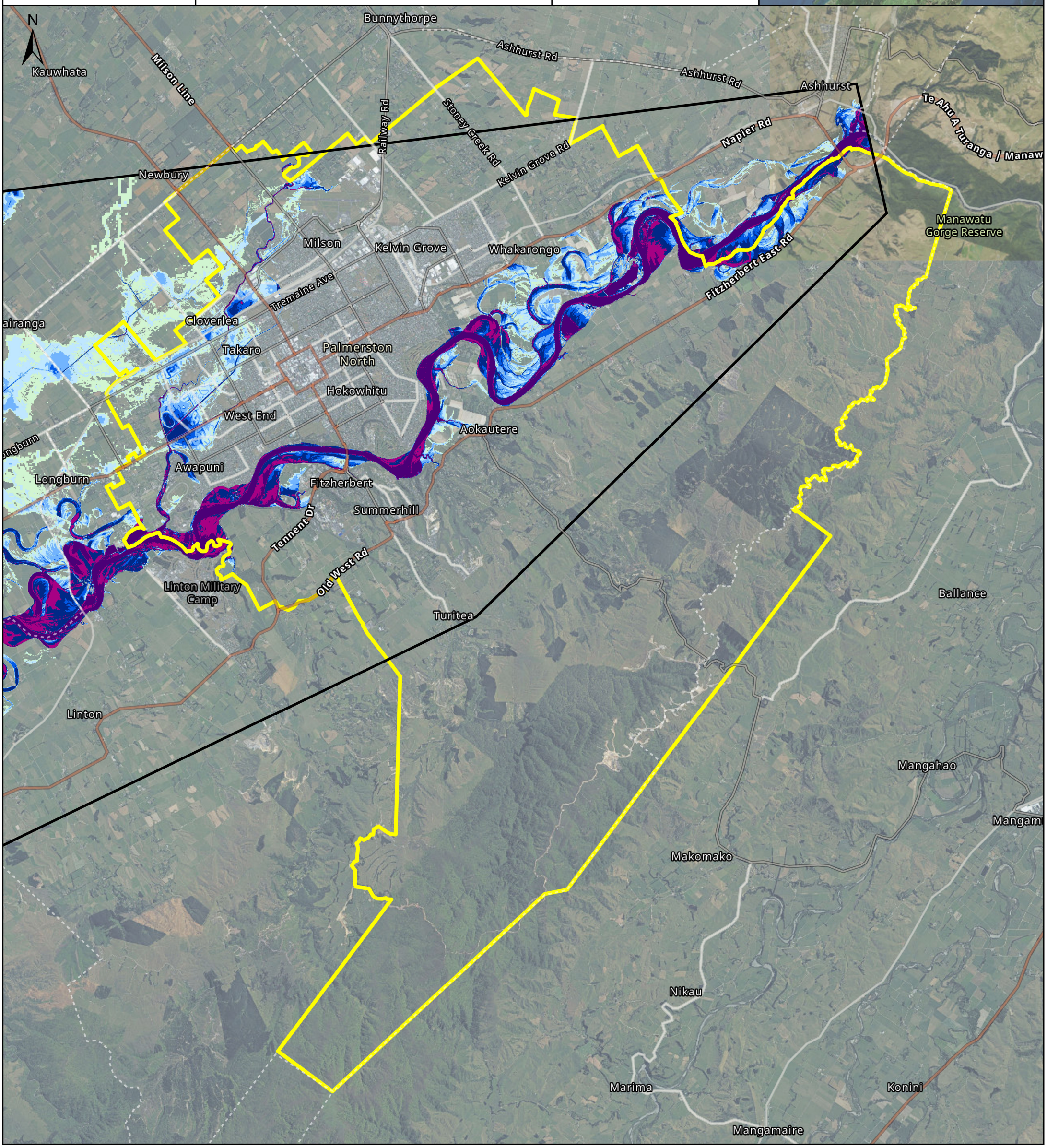
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

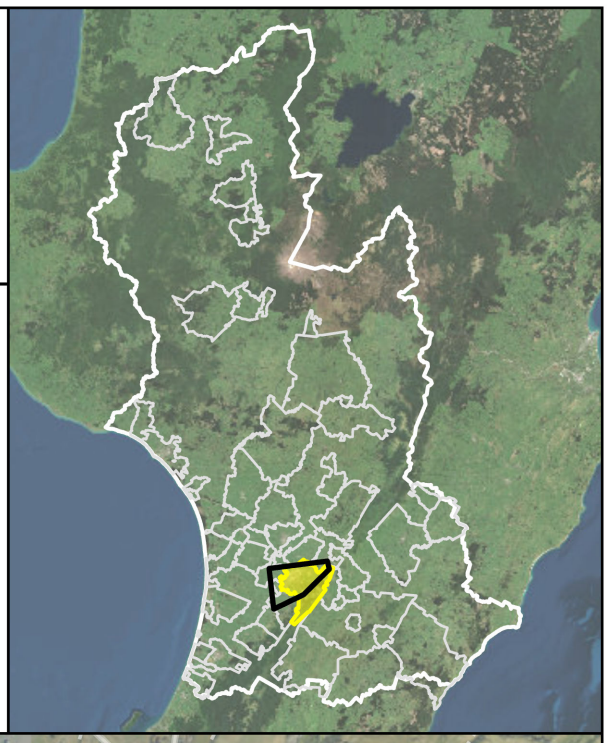
Community
Palmerston North,
Palmerston North City

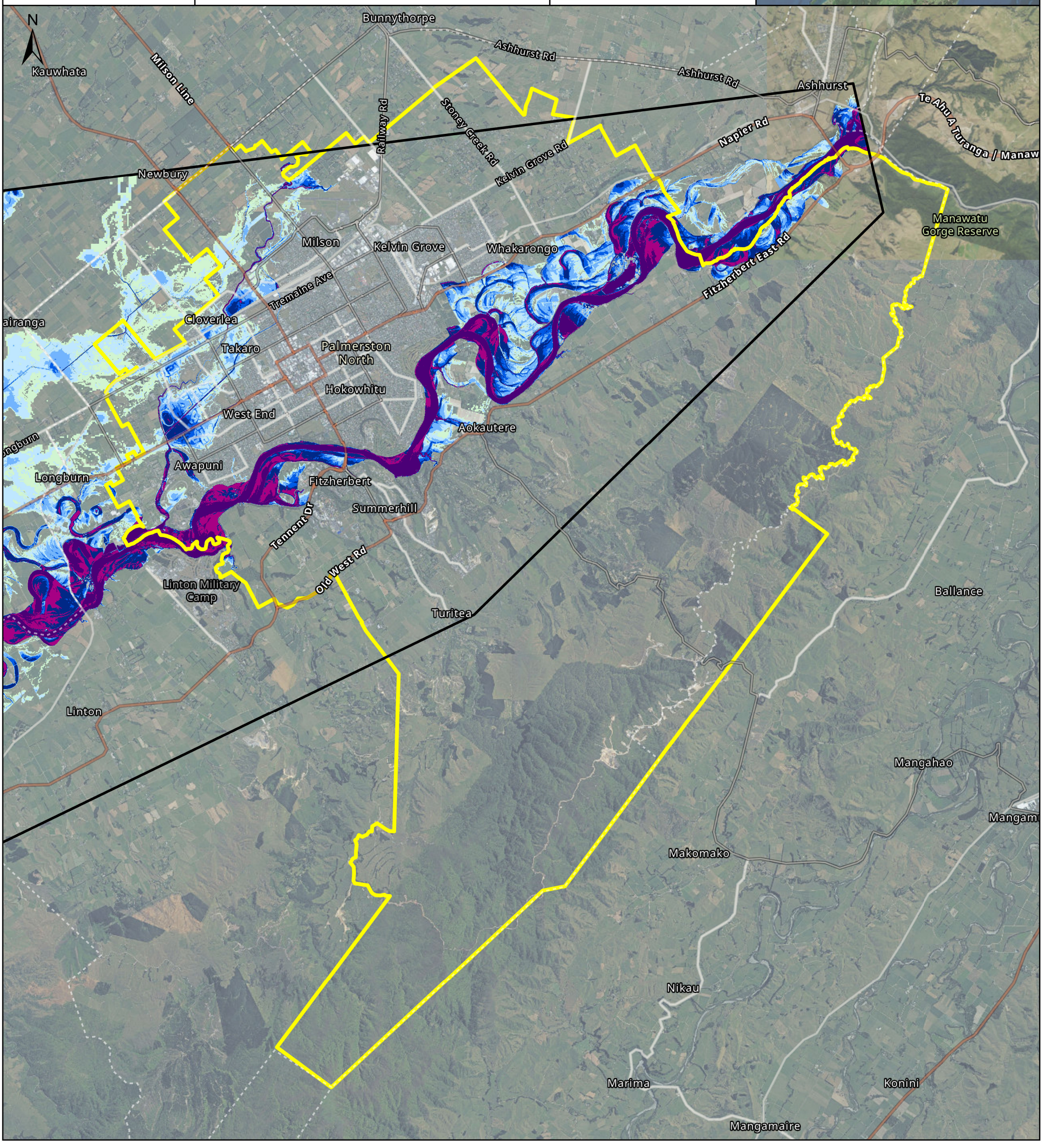
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

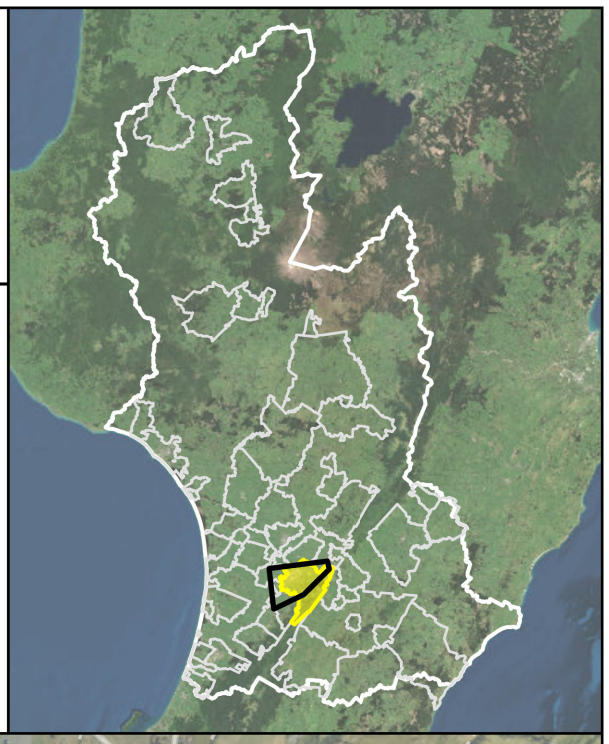
Community
Palmerston North,
Palmerston North City

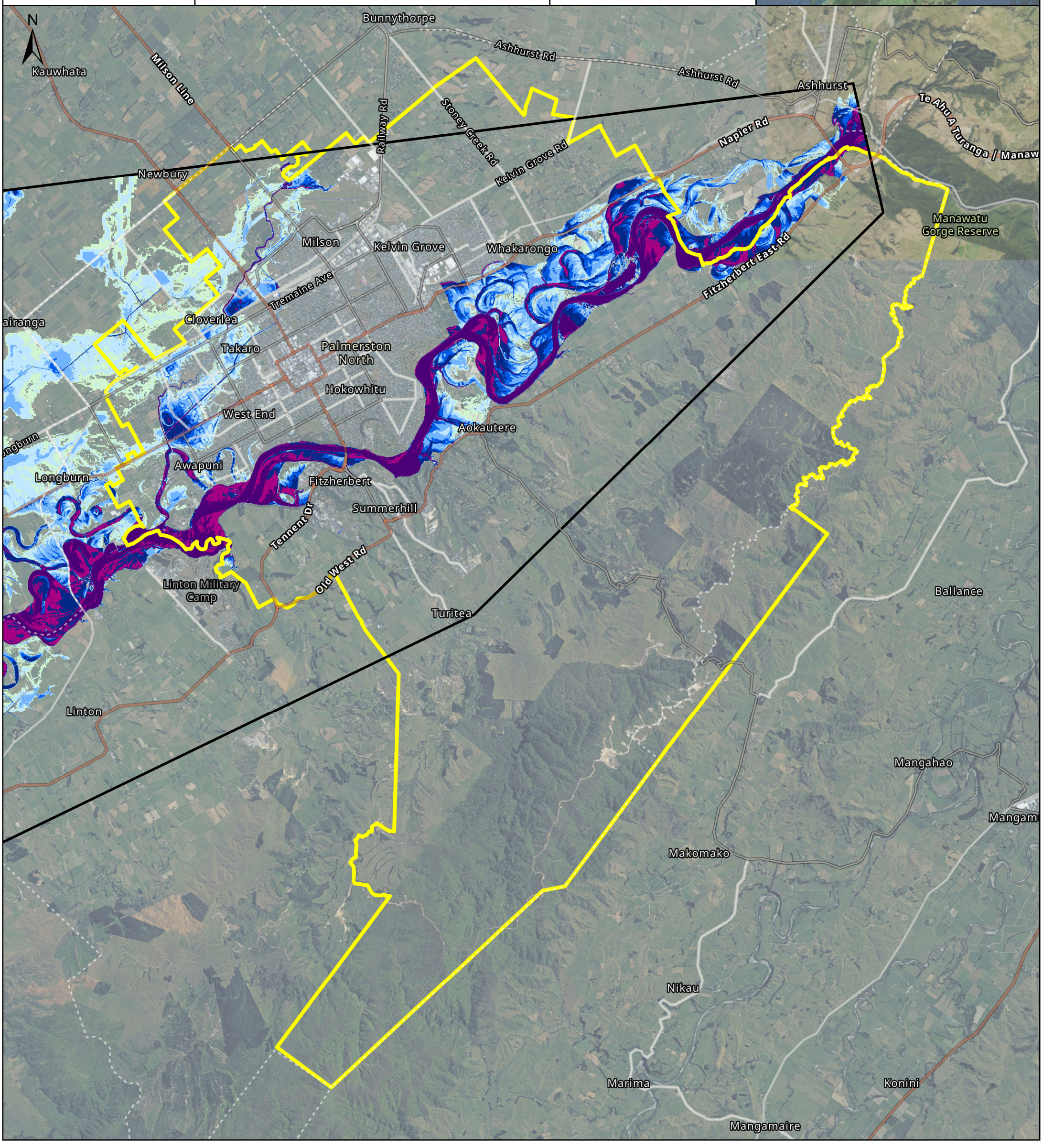
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

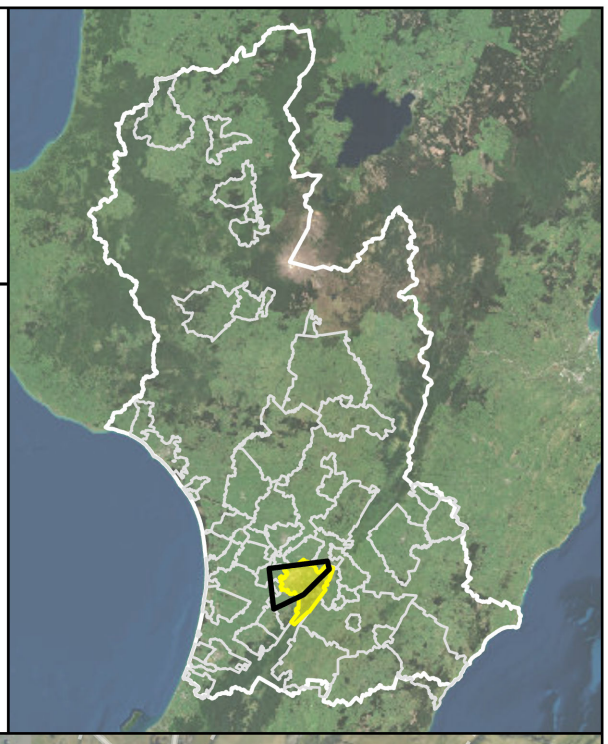
Community
Palmerston North,
Palmerston North City

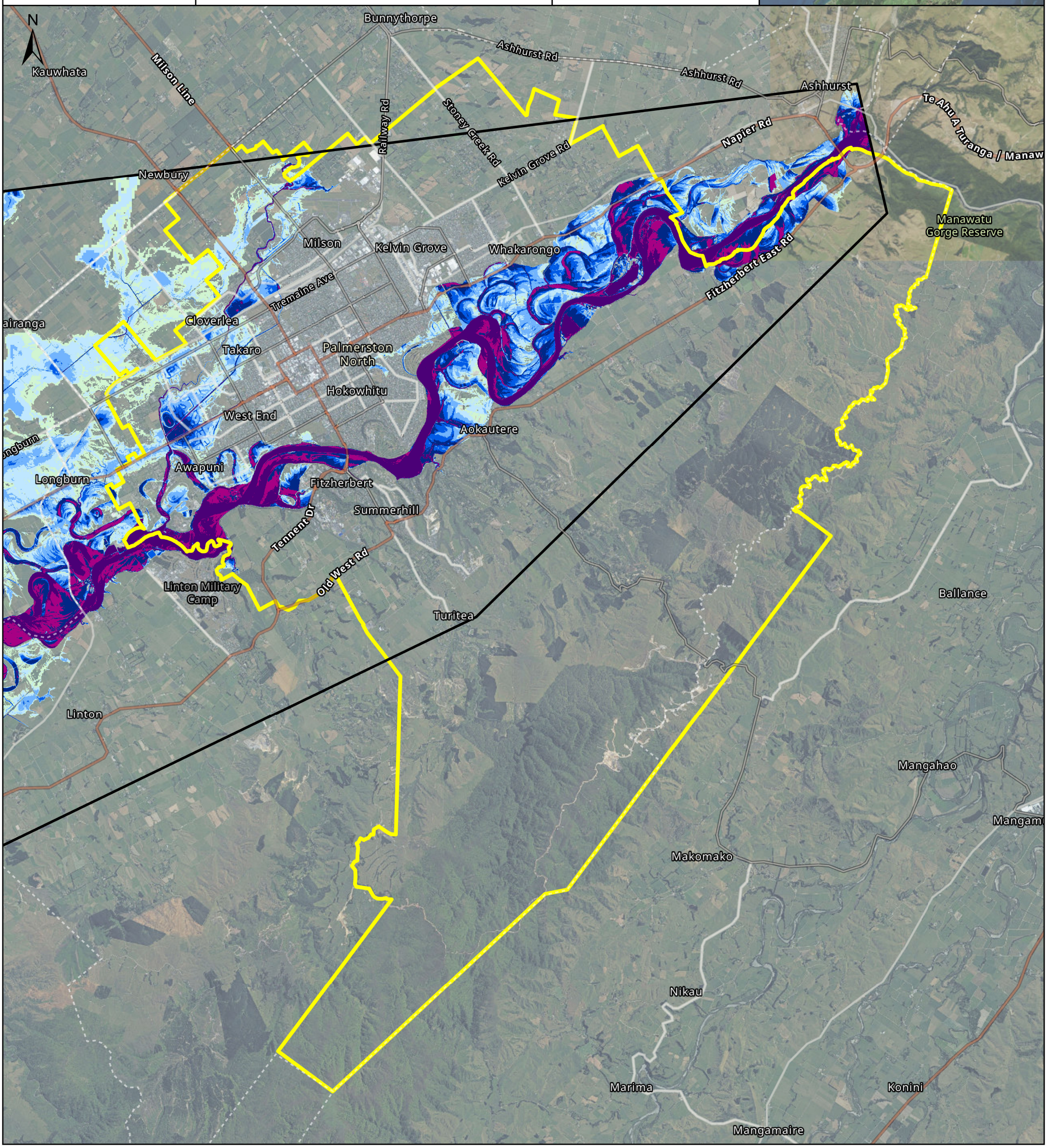
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

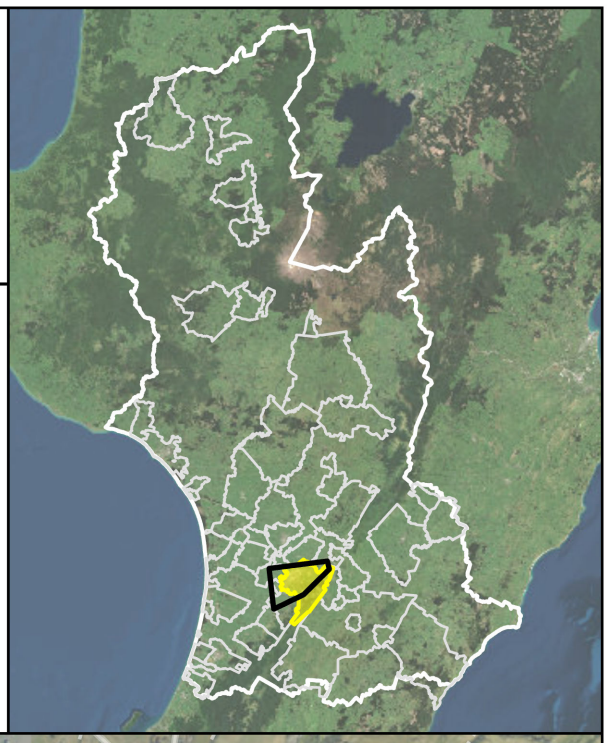
Community
Palmerston North,
Palmerston North City

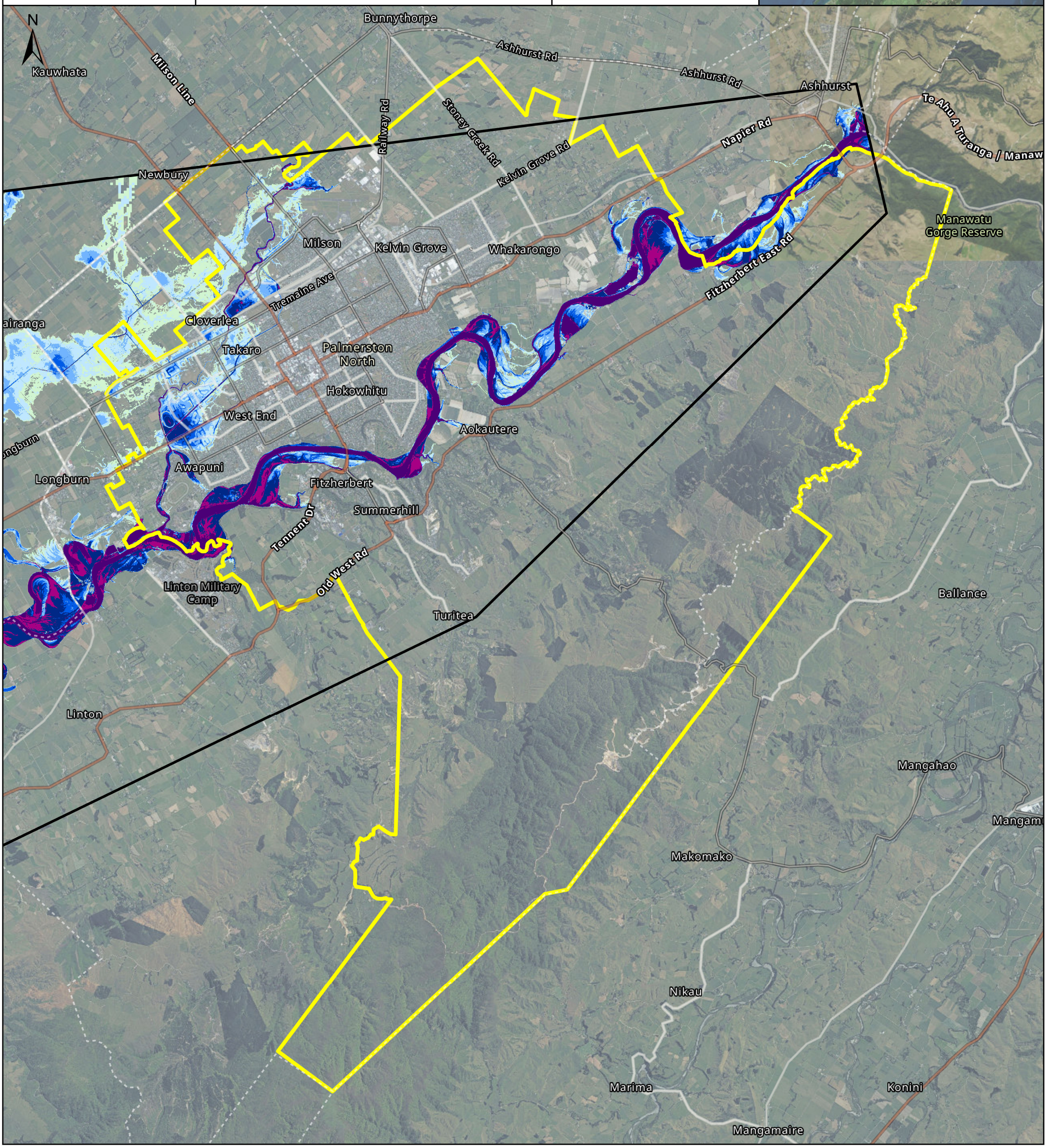
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

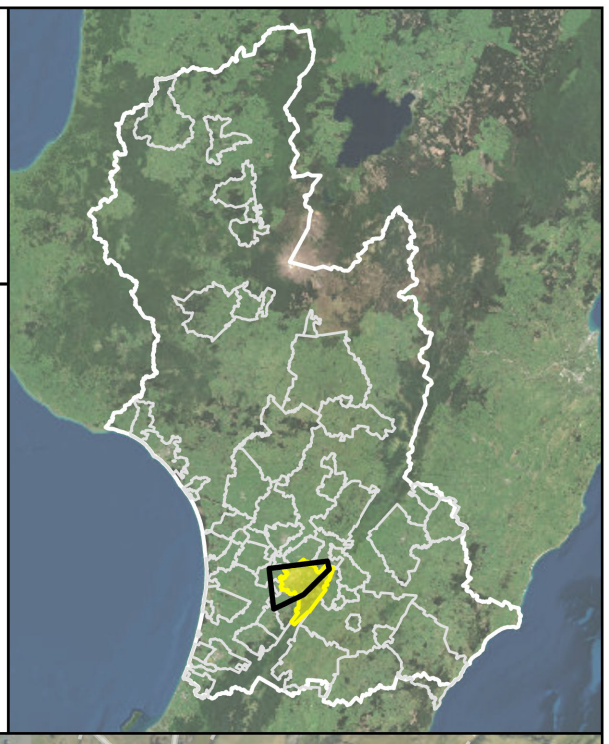
Community
Palmerston North,
Palmerston North City

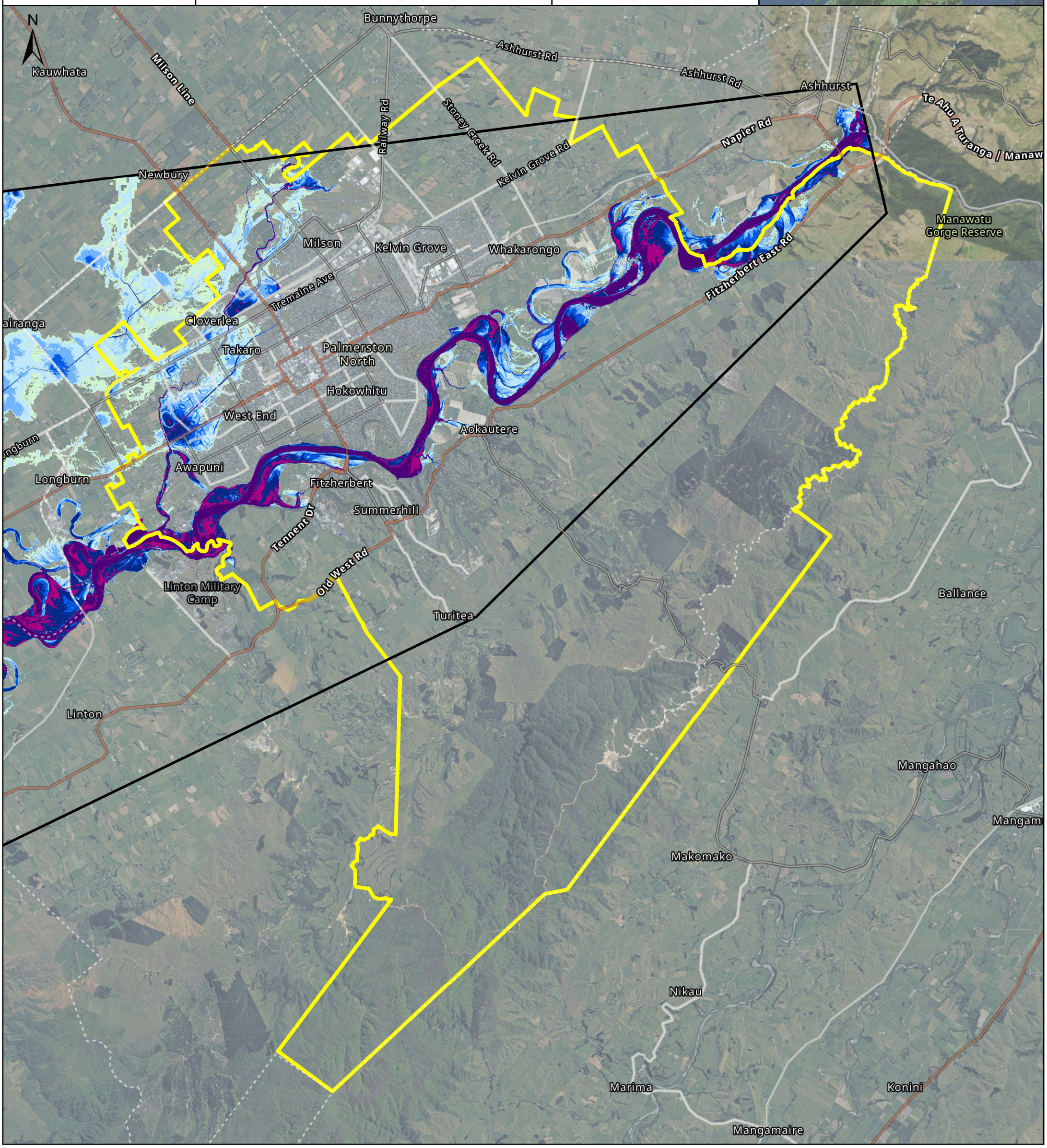
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

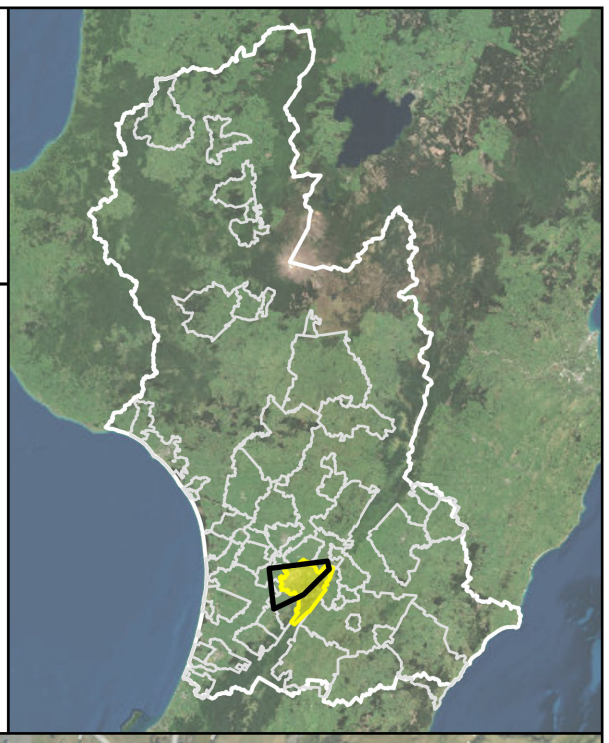
Community
Palmerston North,
Palmerston North City

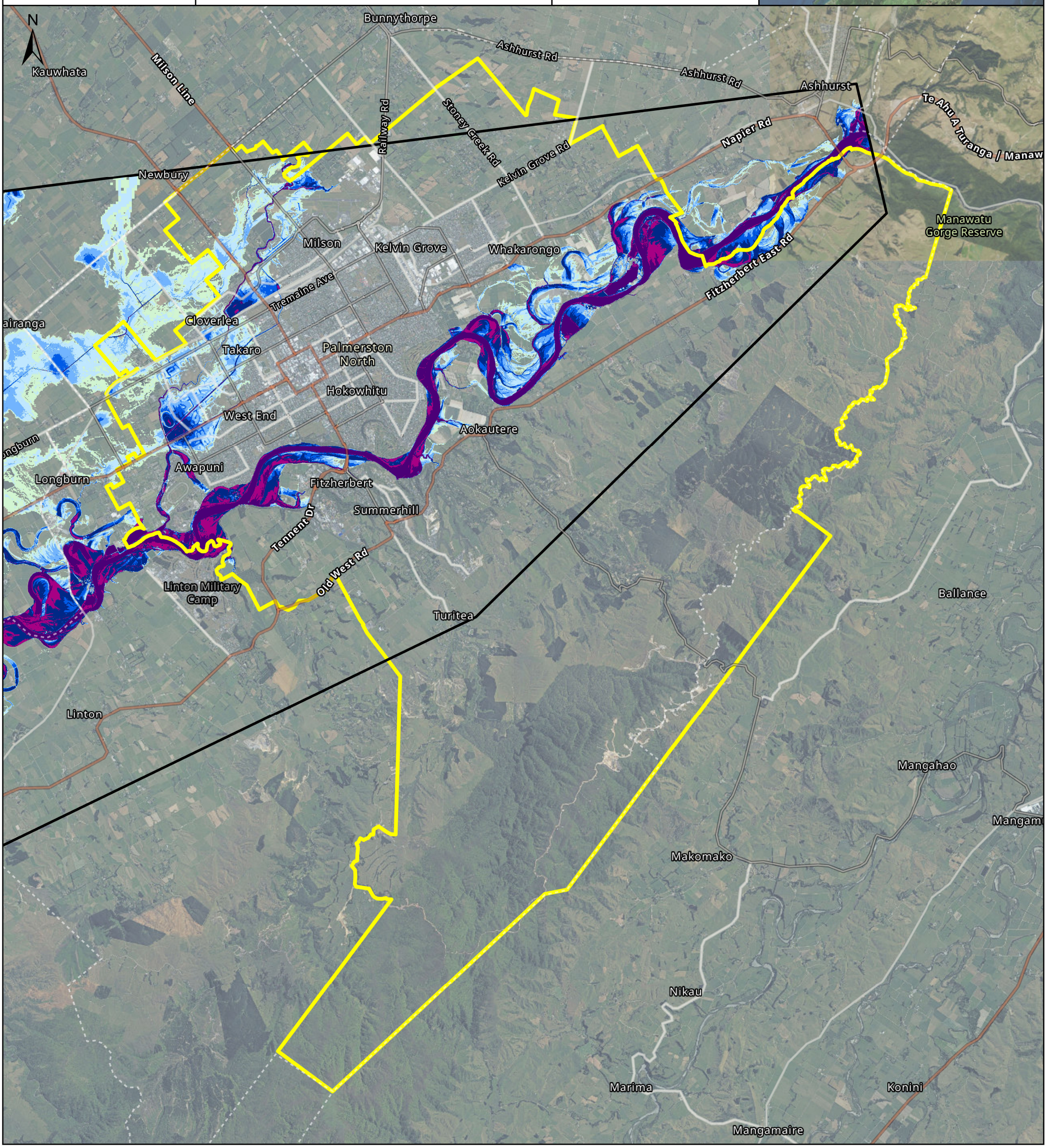
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community
Palmerston North,
Palmerston North City

Scale 1:86,000 at A3

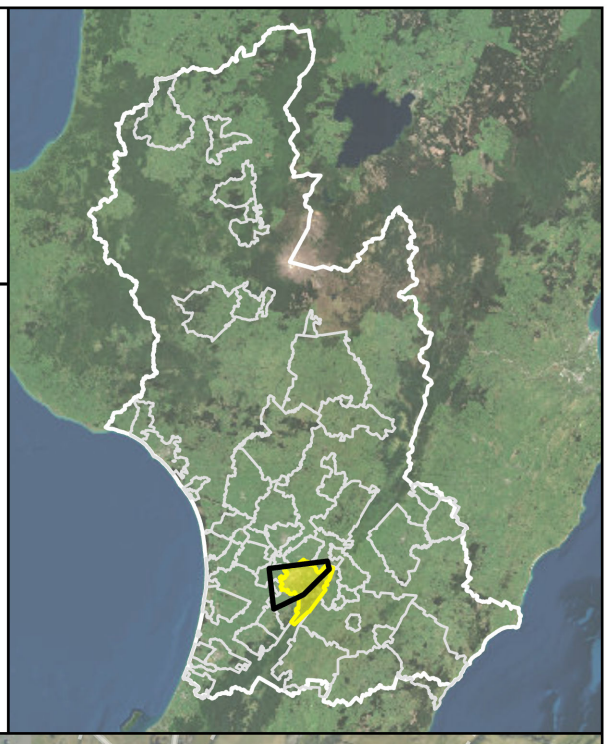
0 2.5 5 Km

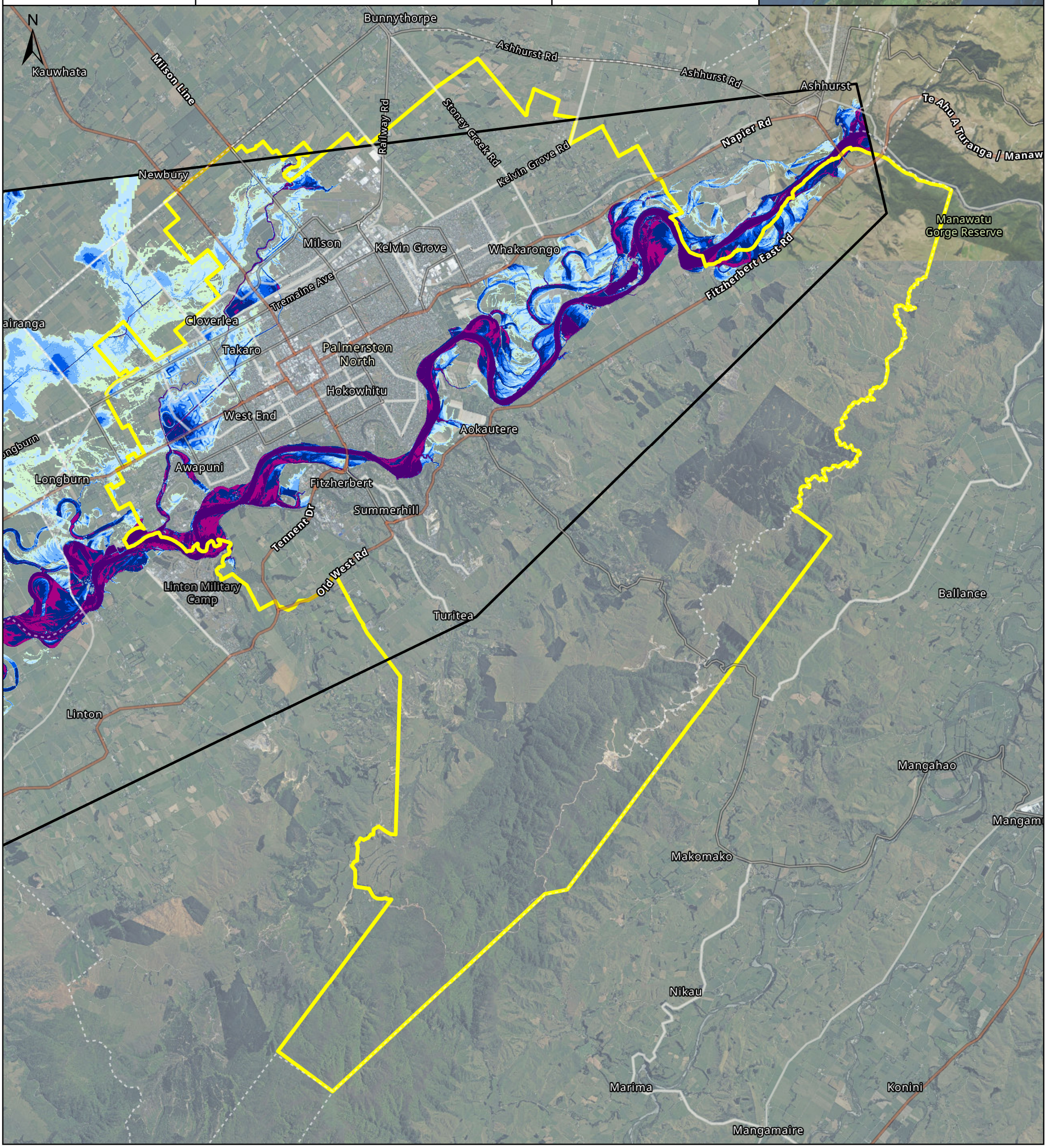
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

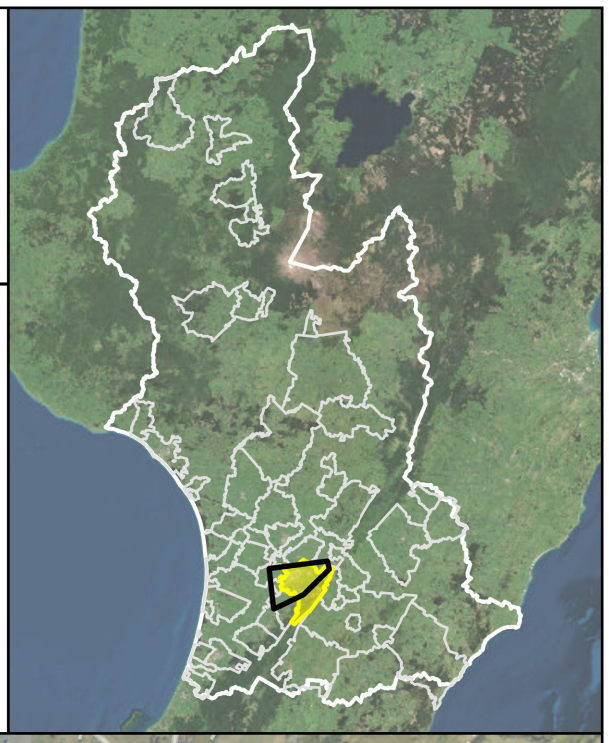
Community
Palmerston North,
Palmerston North City

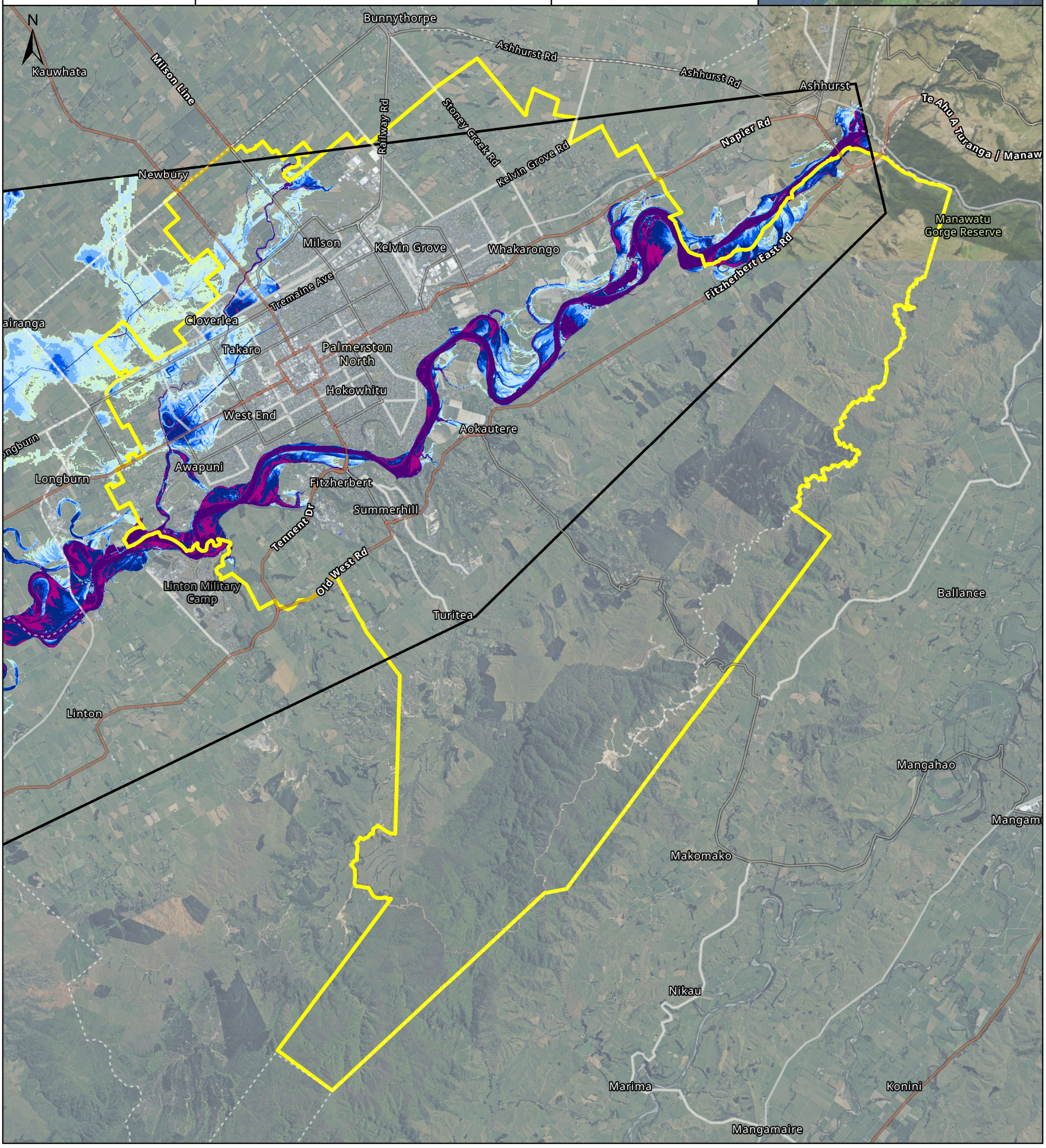
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community
Palmerston North,
Palmerston North City

Scale 1:86,000 at A3

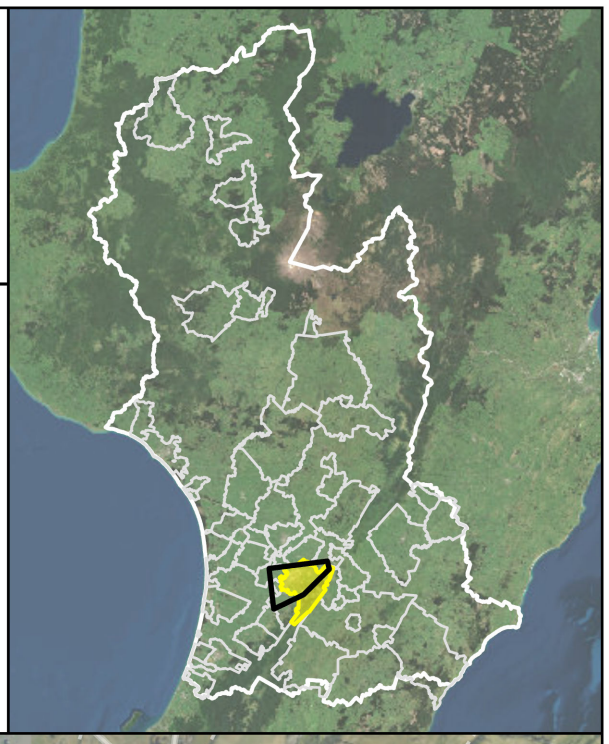
0 2.5 5 Km

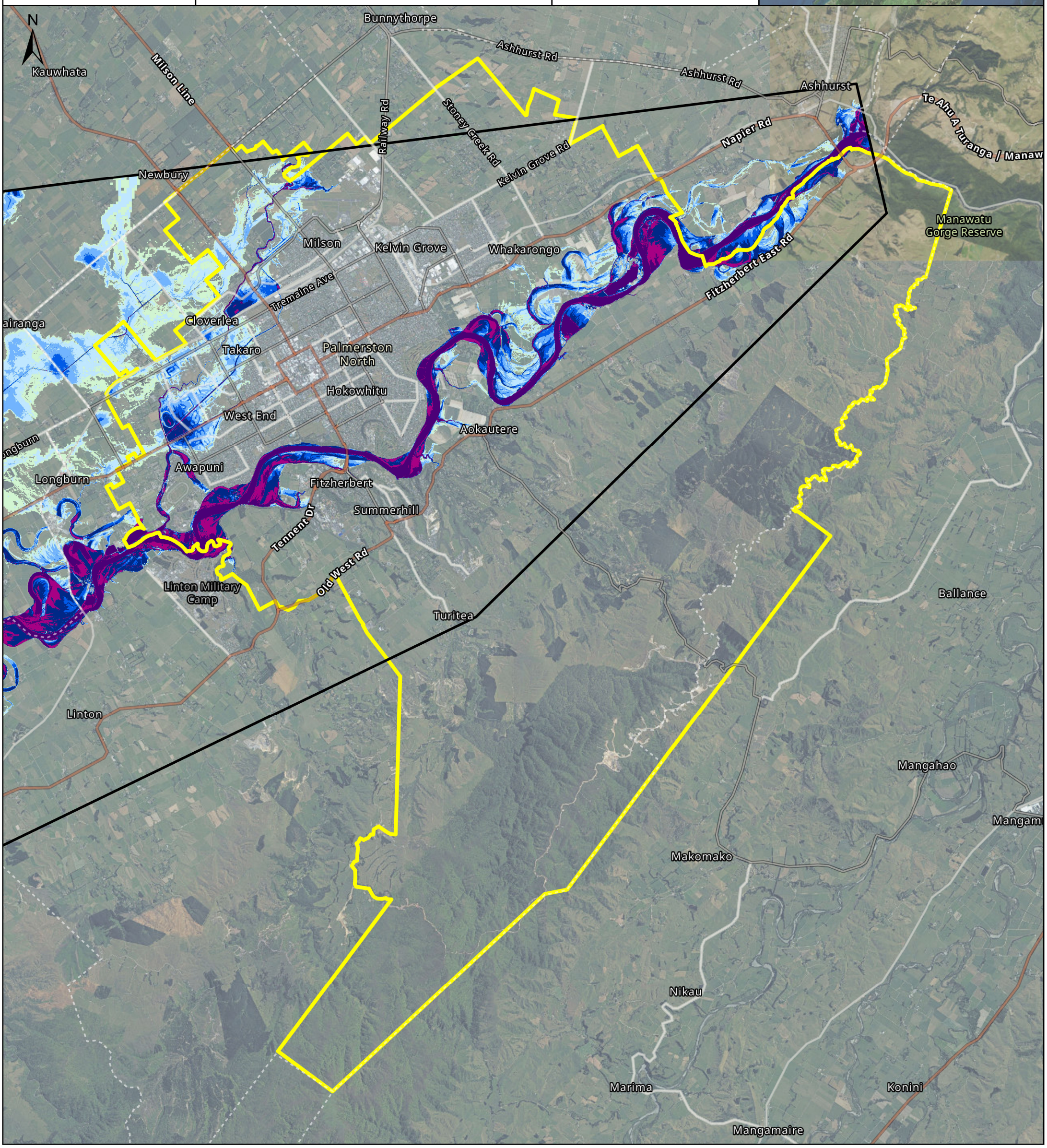
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community
Palmerston North,
Palmerston North City

Scale 1:86,000 at A3

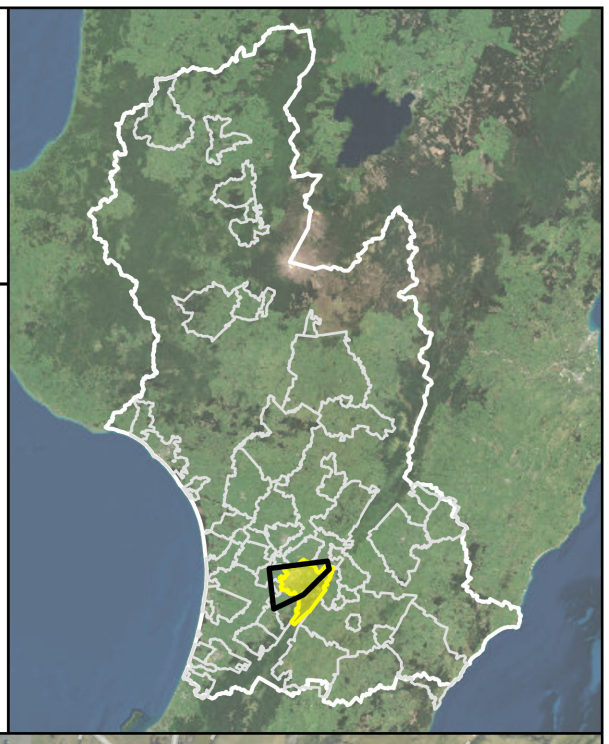
0 2.5 5 Km

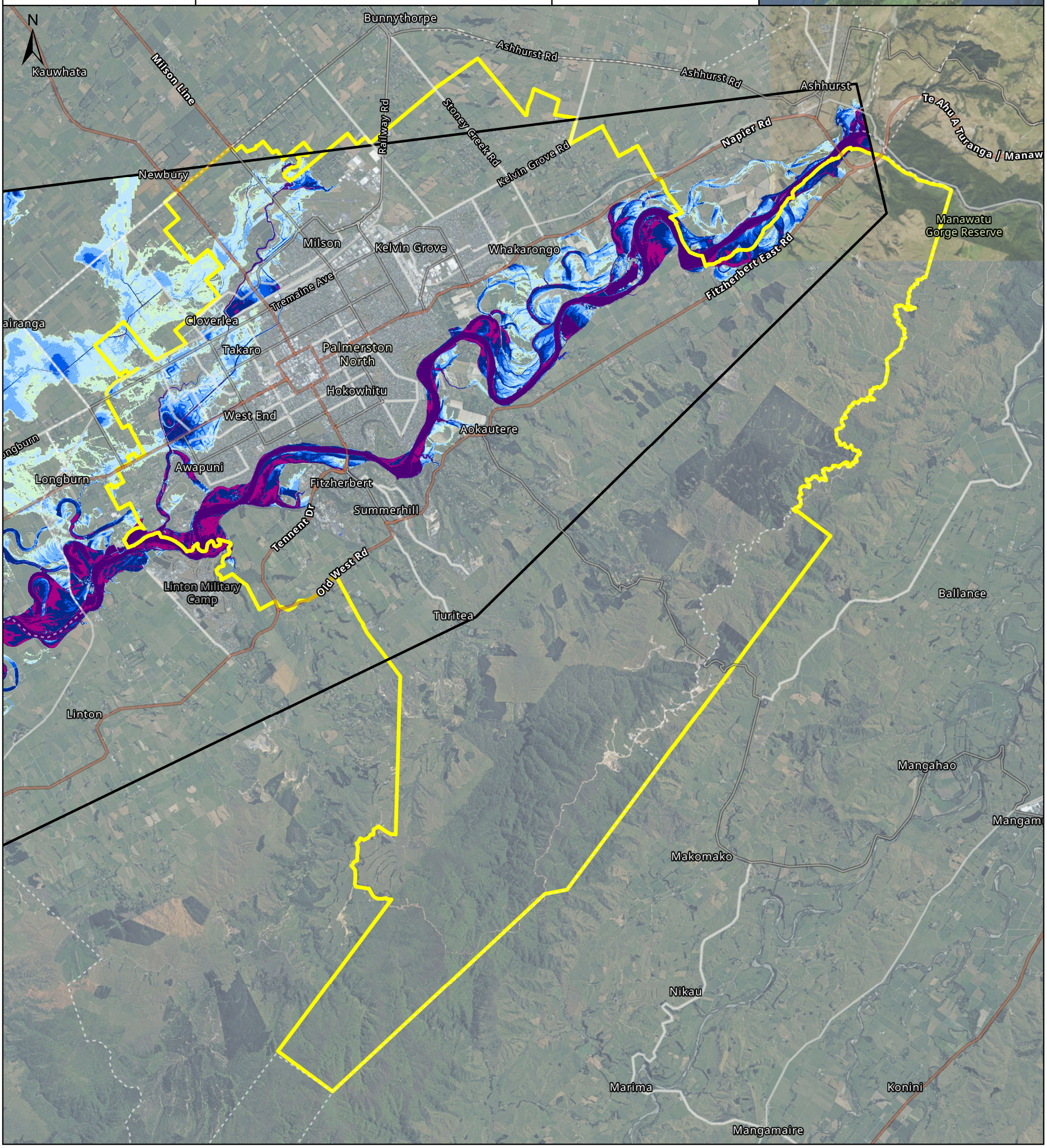
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

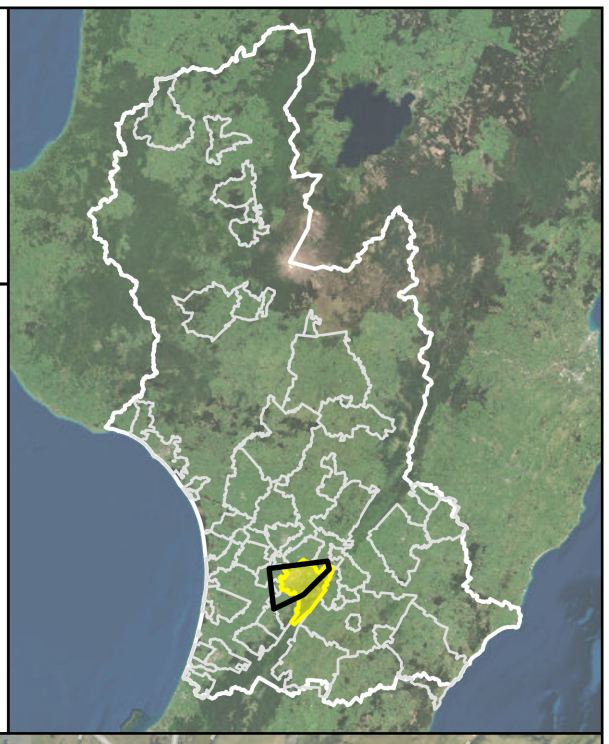
Community
Palmerston North,
Palmerston North City

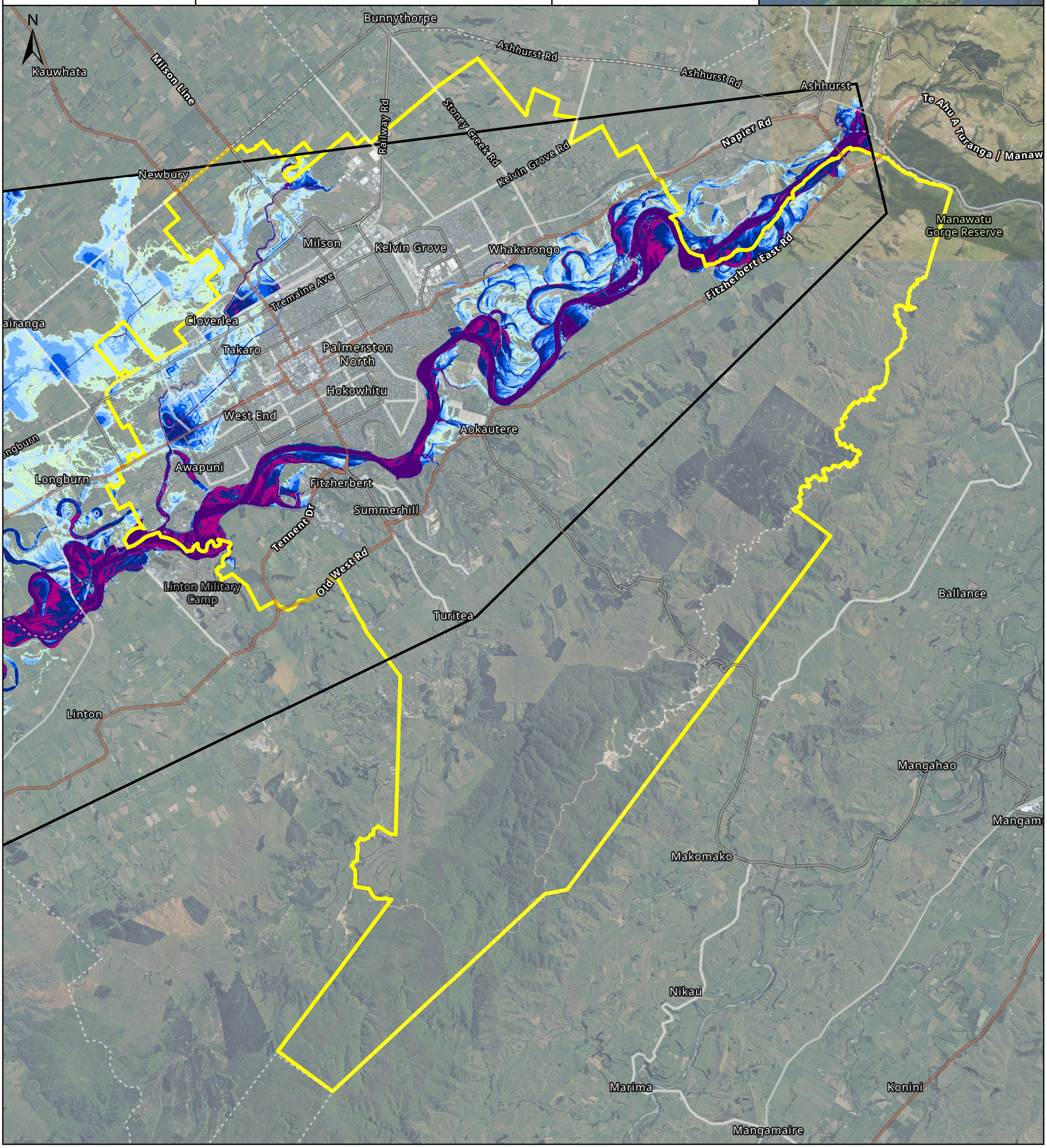
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

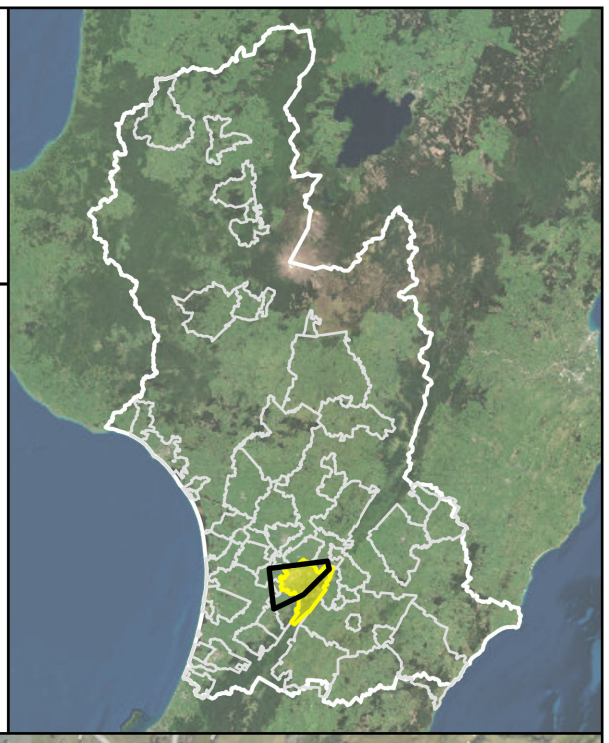
Community
Palmerston North,
Palmerston North City

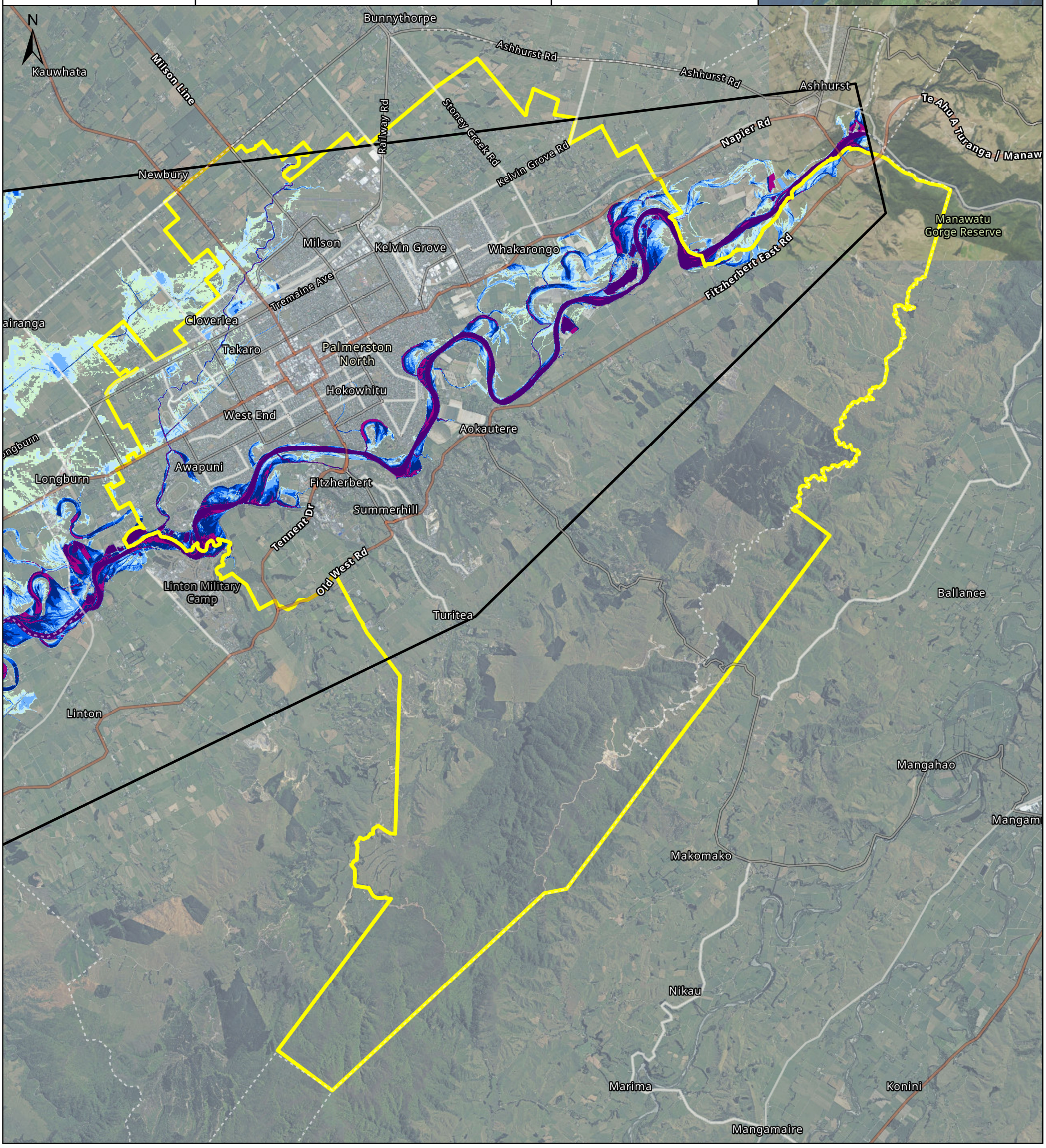
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

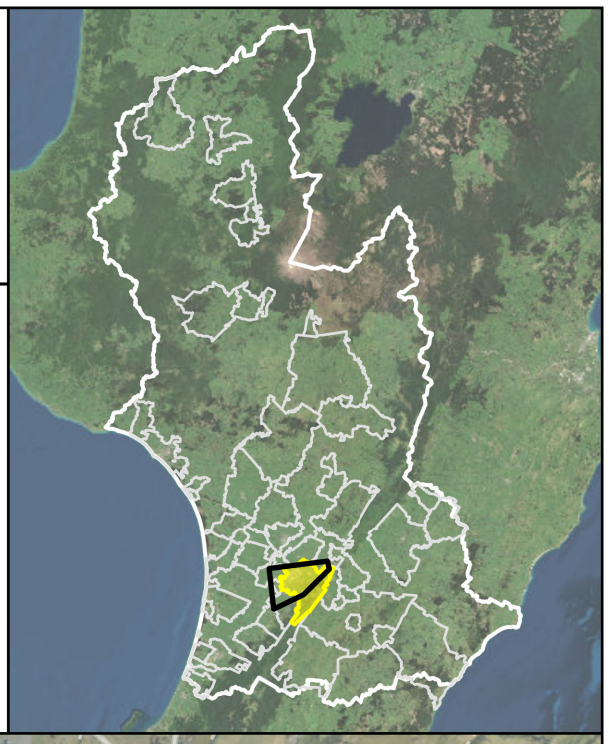
Community
Palmerston North,
Palmerston North City

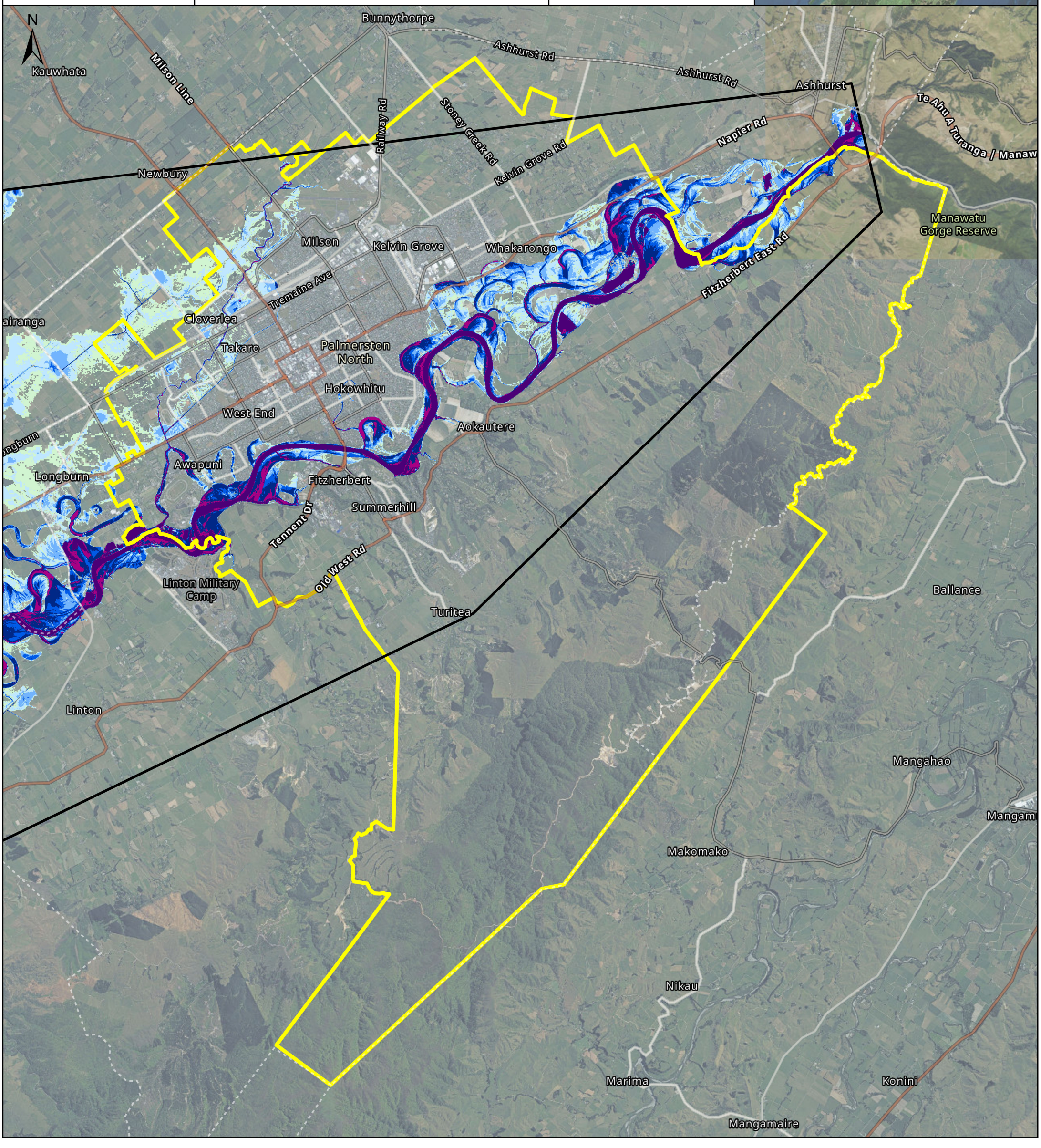
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

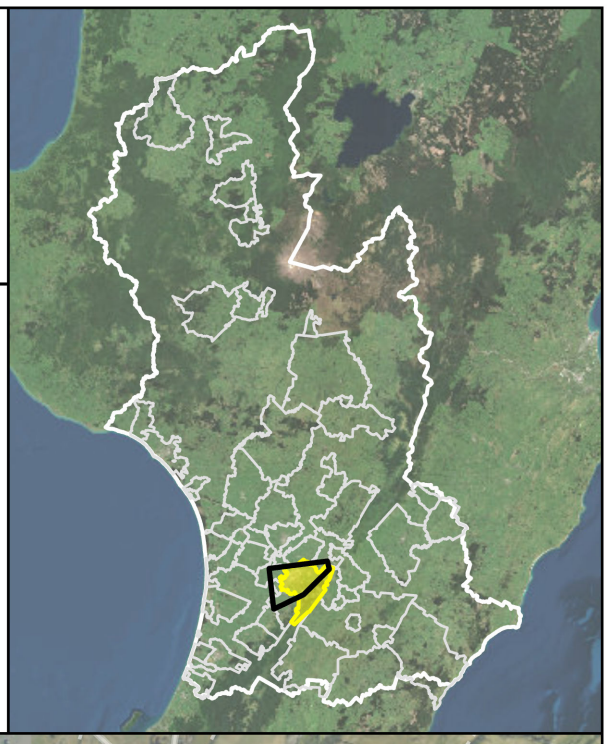
Community
Palmerston North,
Palmerston North City

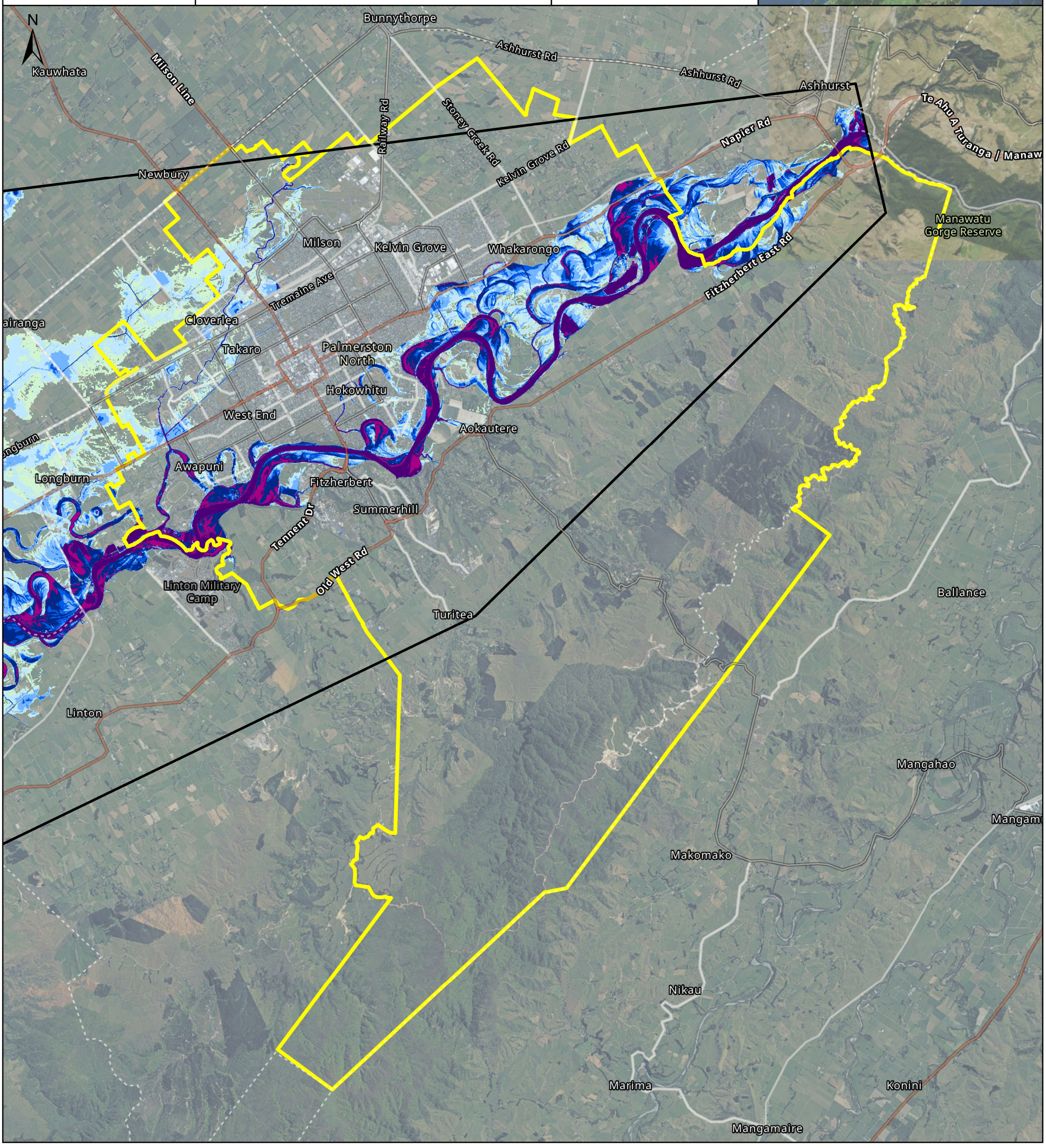
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

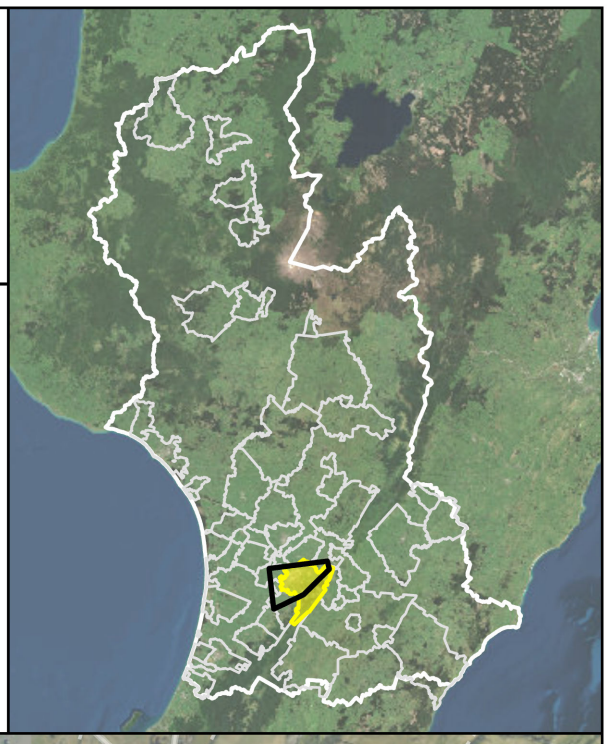
Community
Palmerston North,
Palmerston North City

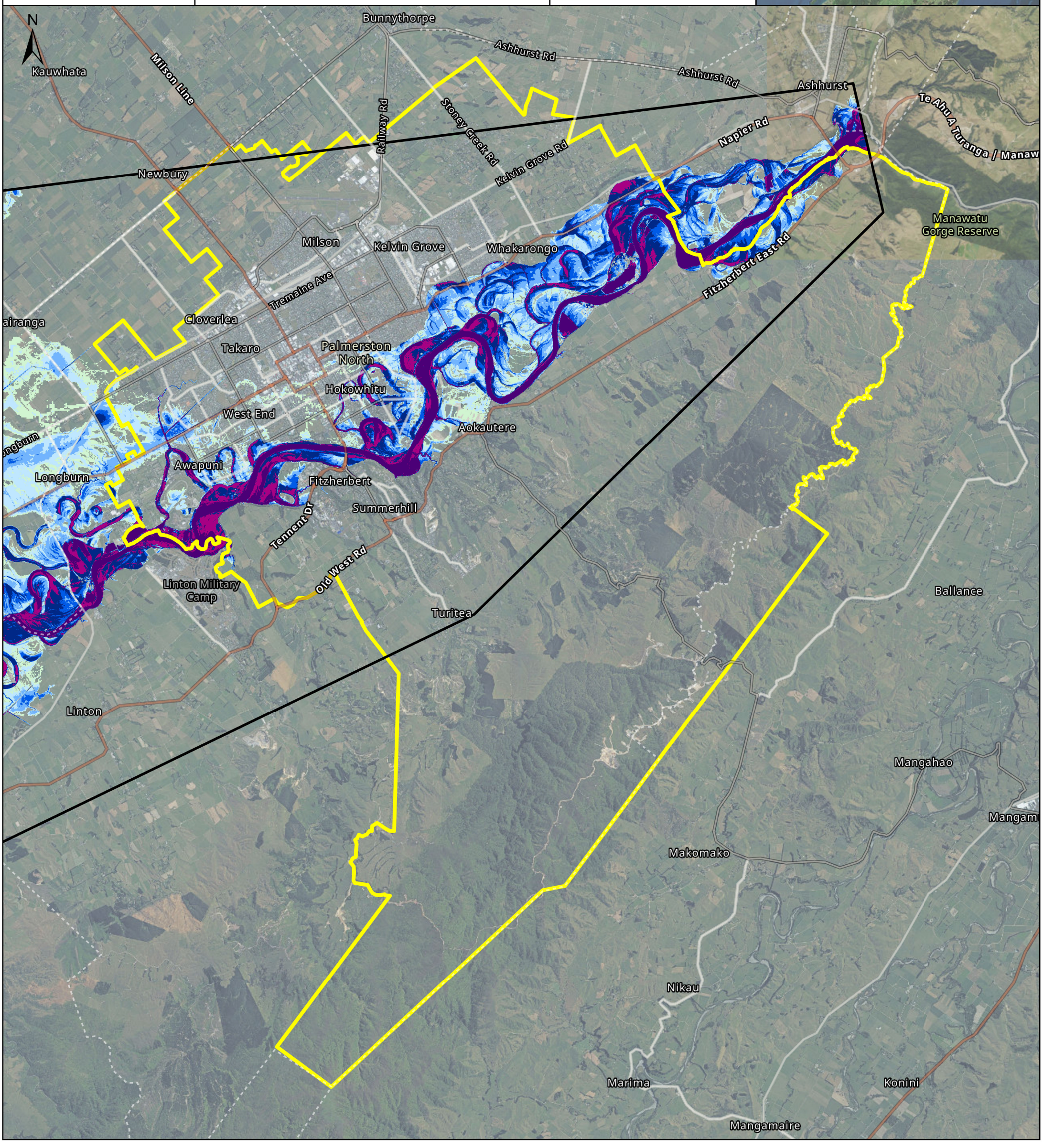
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 1 degree warming due to climate change, sea level rise excluded

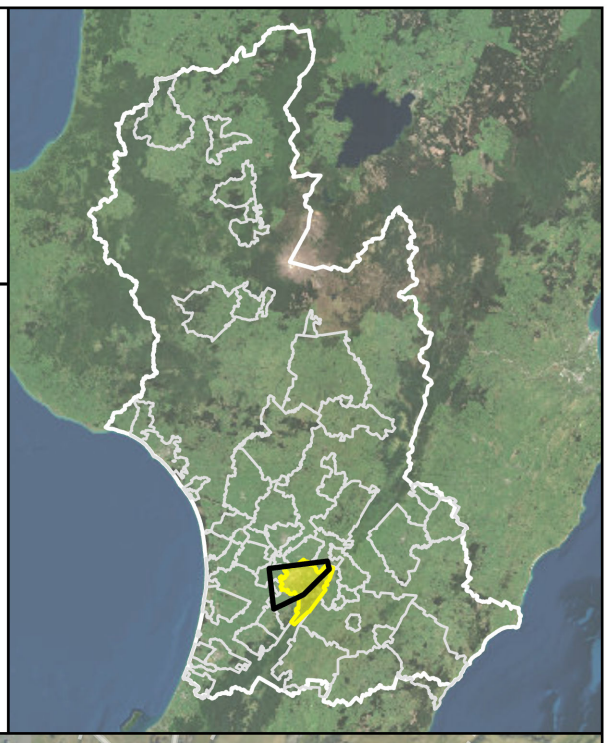
Community
Palmerston North,
Palmerston North City

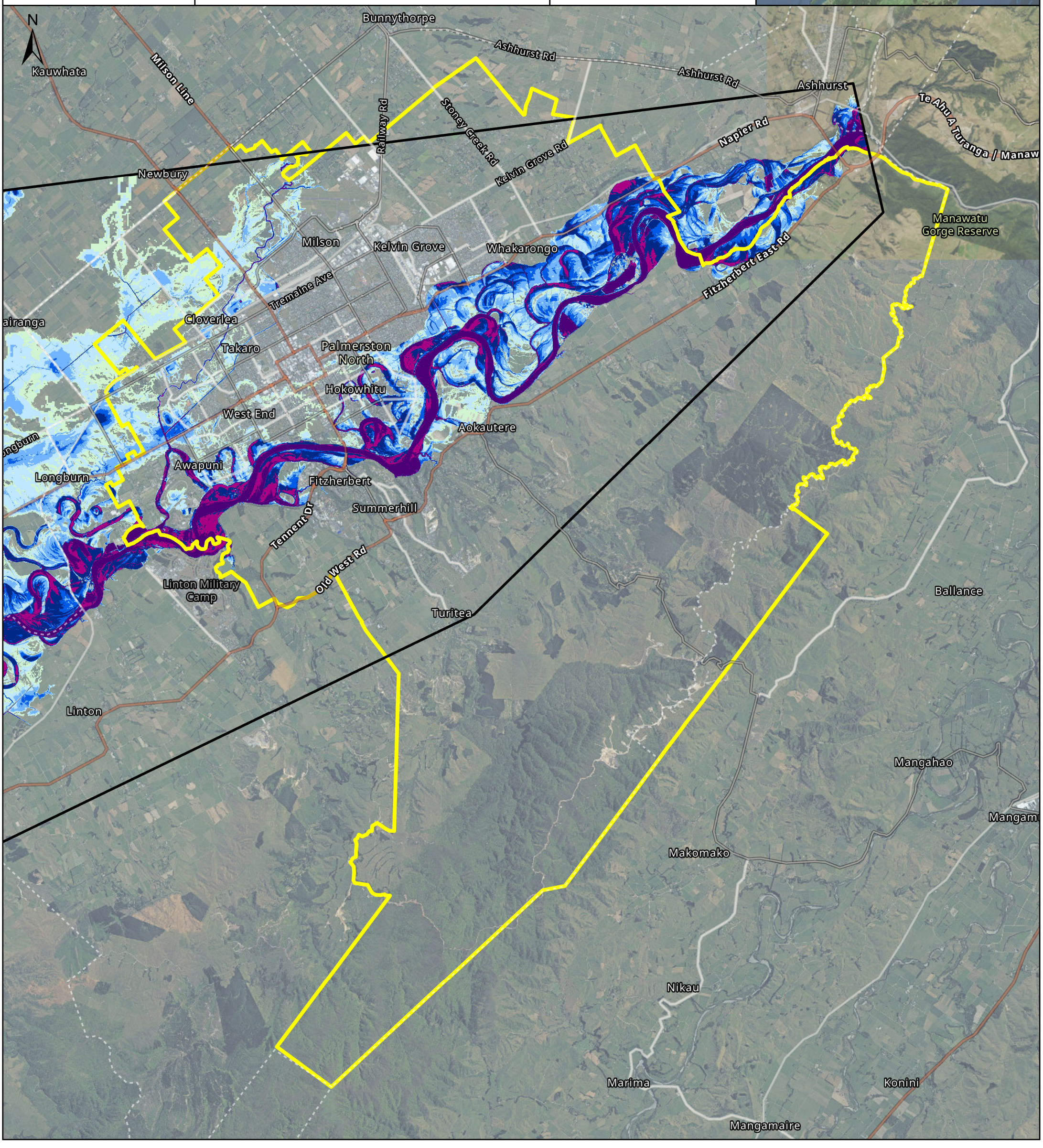
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 2 degrees warming due to climate change, sea level rise excluded

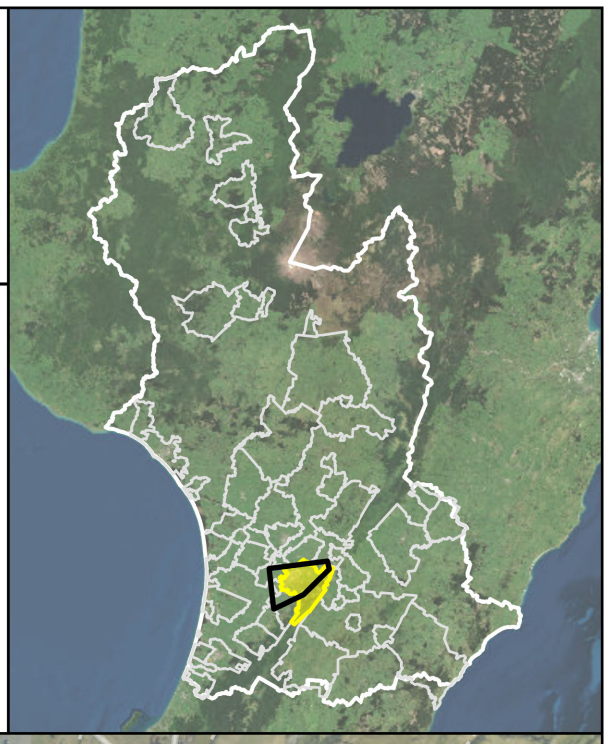
Community
Palmerston North,
Palmerston North City

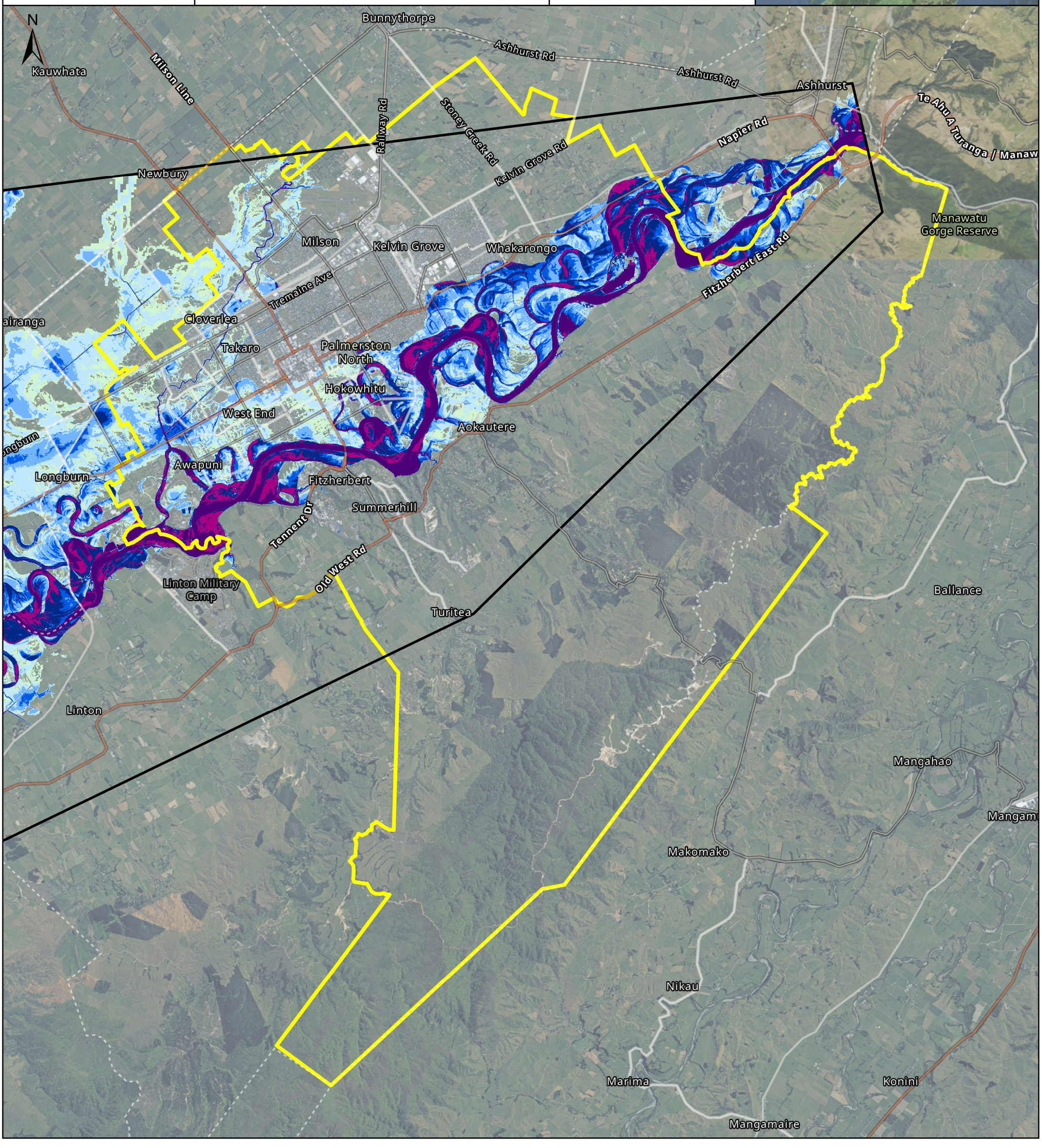
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 3 degrees warming due to climate change, sea level rise excluded

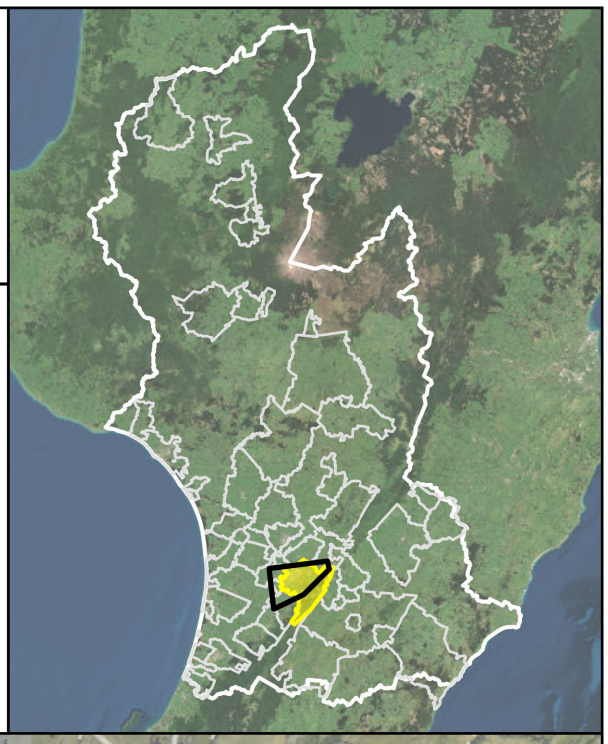
Community
Palmerston North,
Palmerston North City

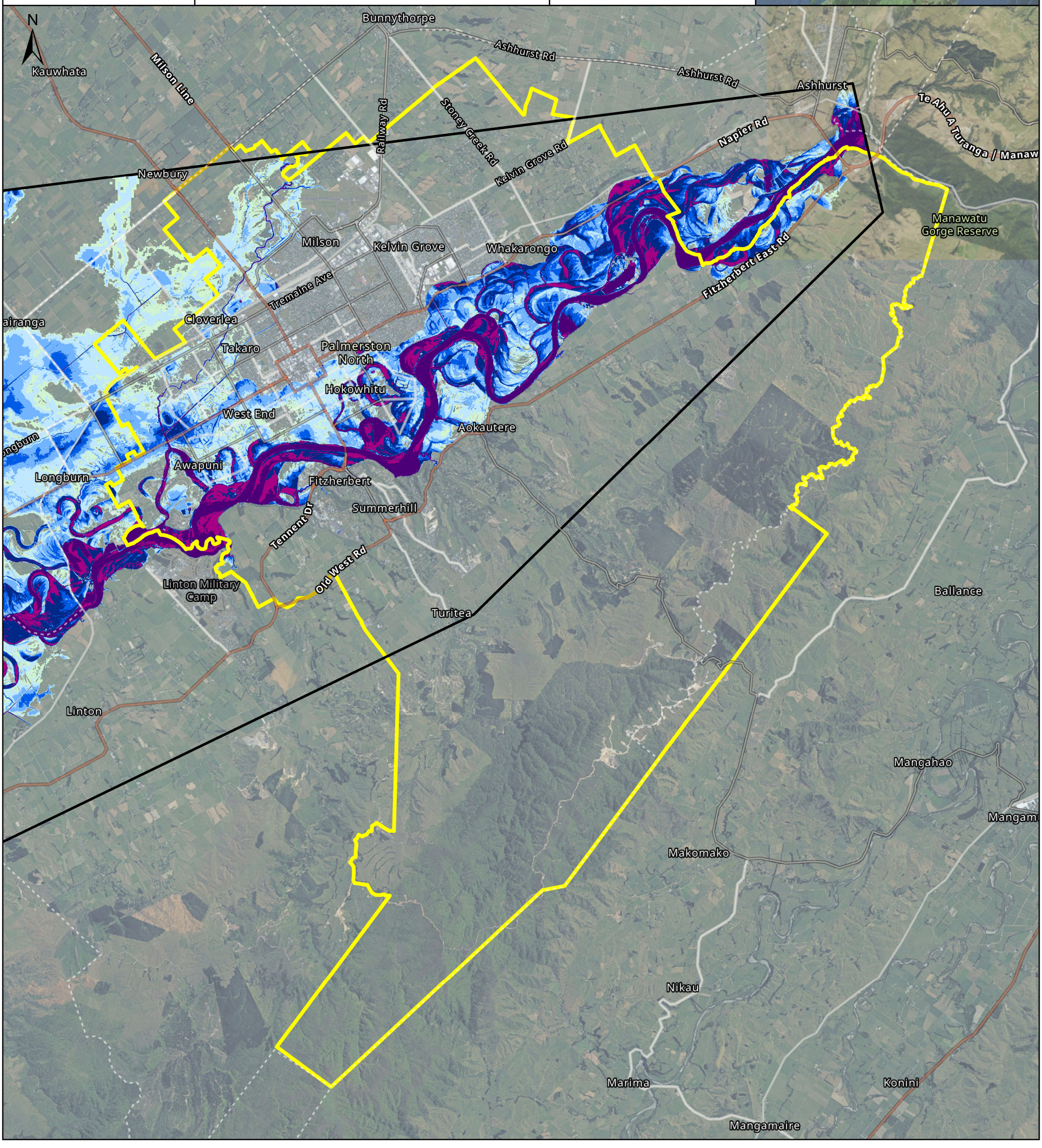
Scale 1:86,000 at A3

0 2.5 5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community
Whanganui,
Whanganui District

Scale 1:69,000 at A3

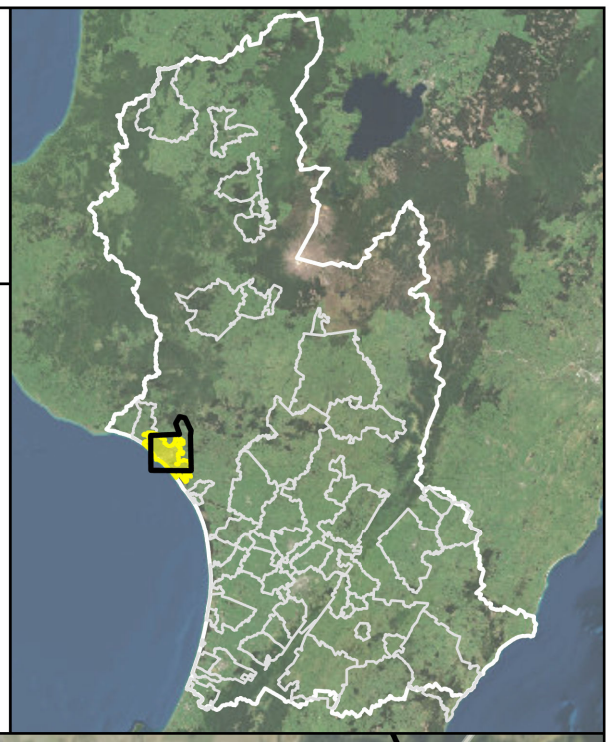
0 2 4 Km

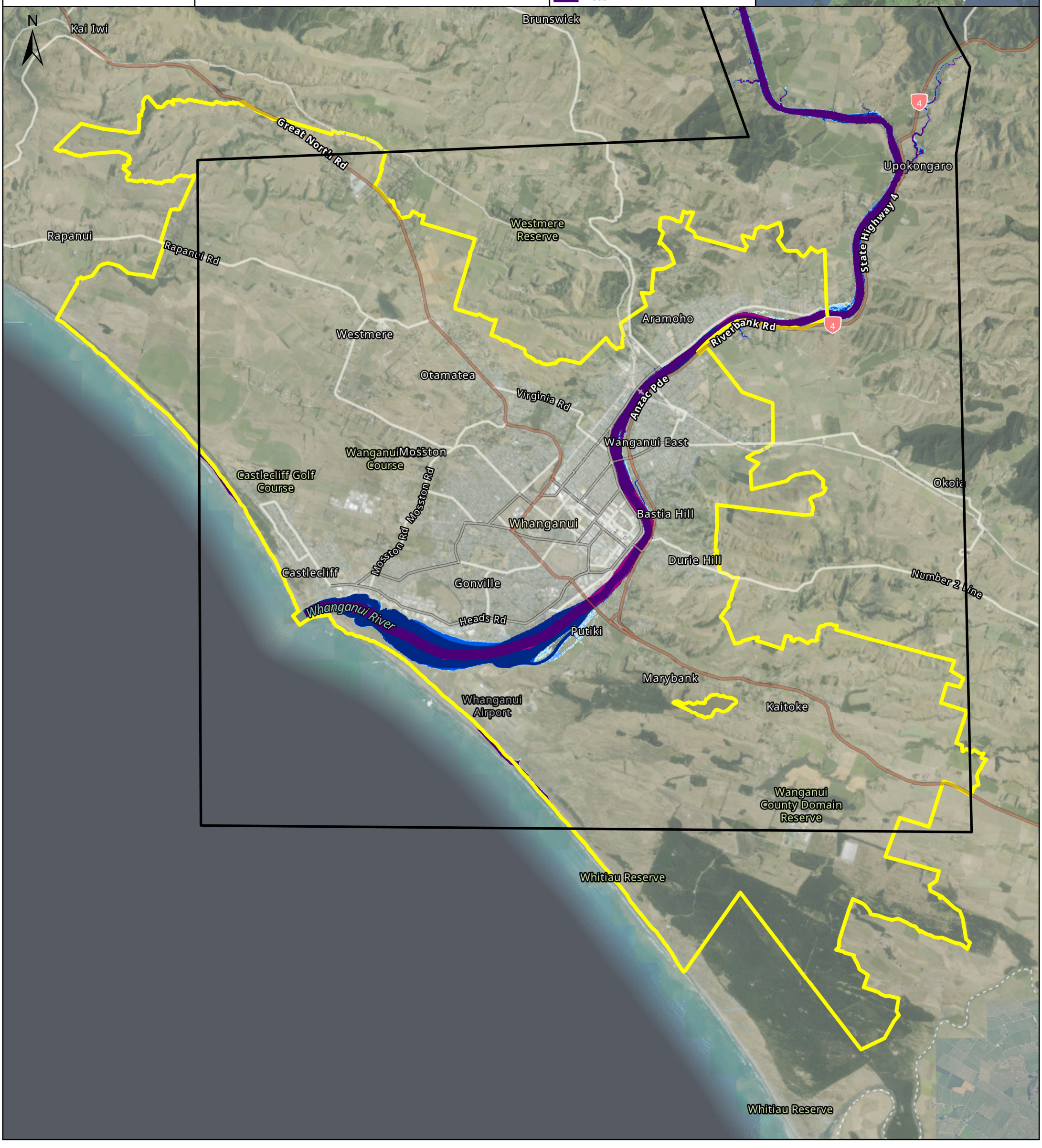
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

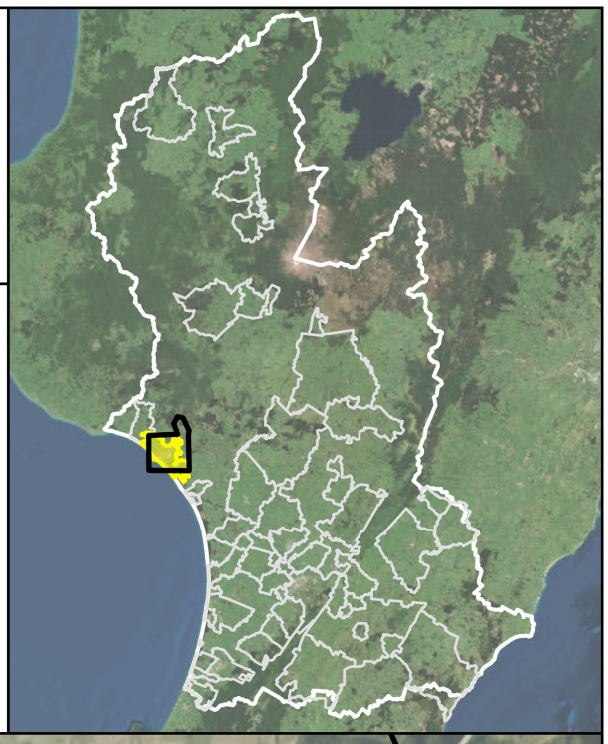
0 2 4 Km

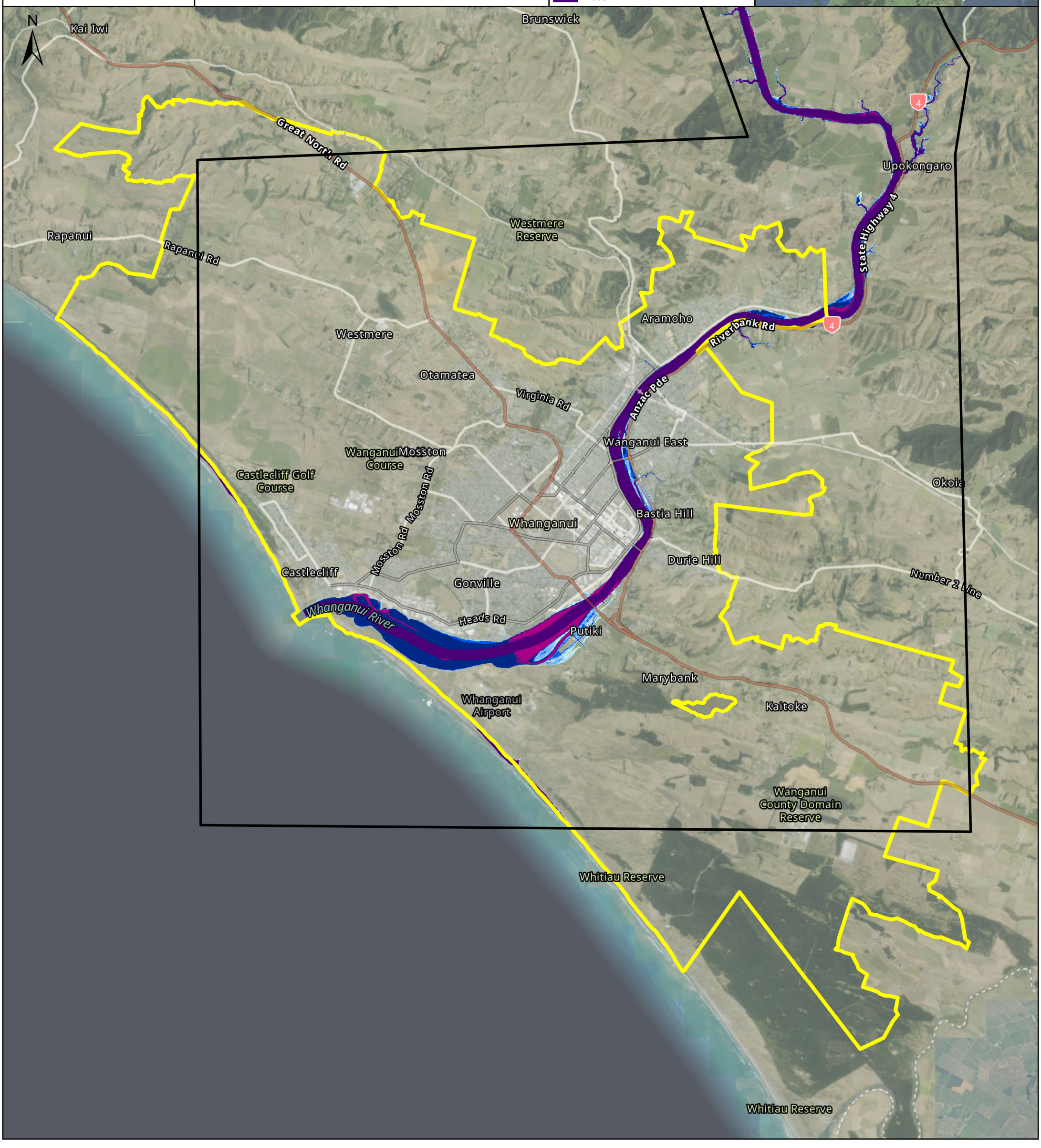
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

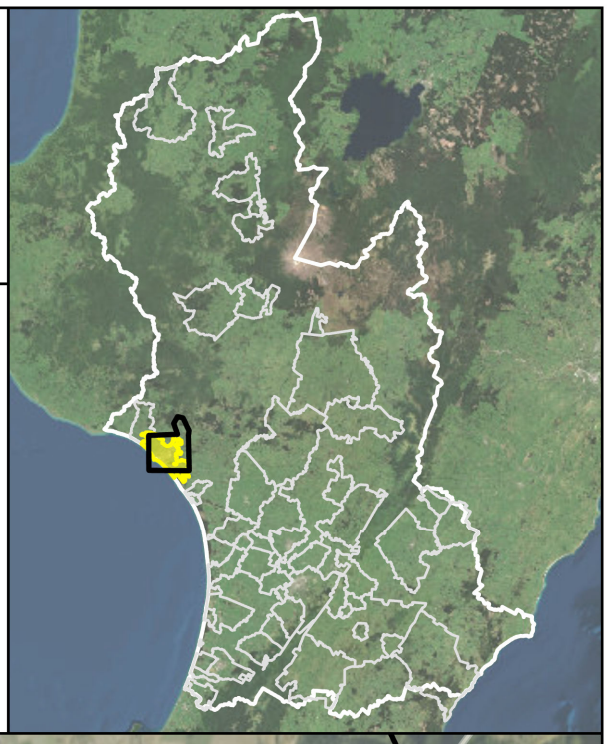
0 2 4 Km

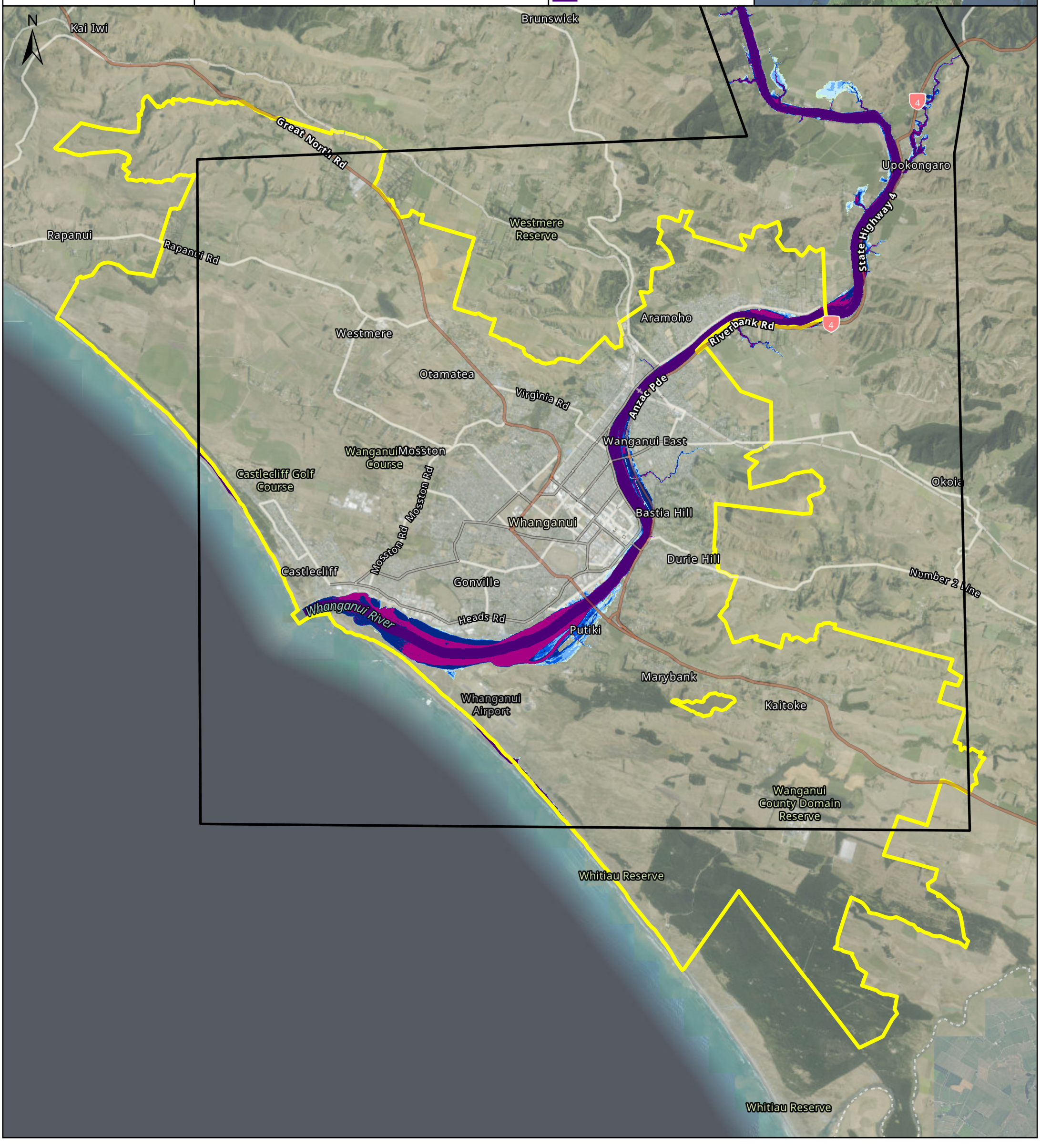
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

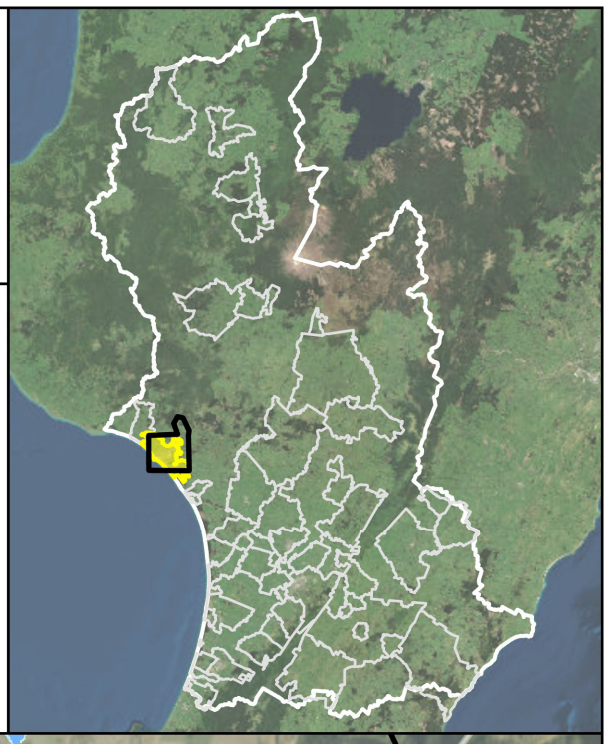
0 2 4 Km

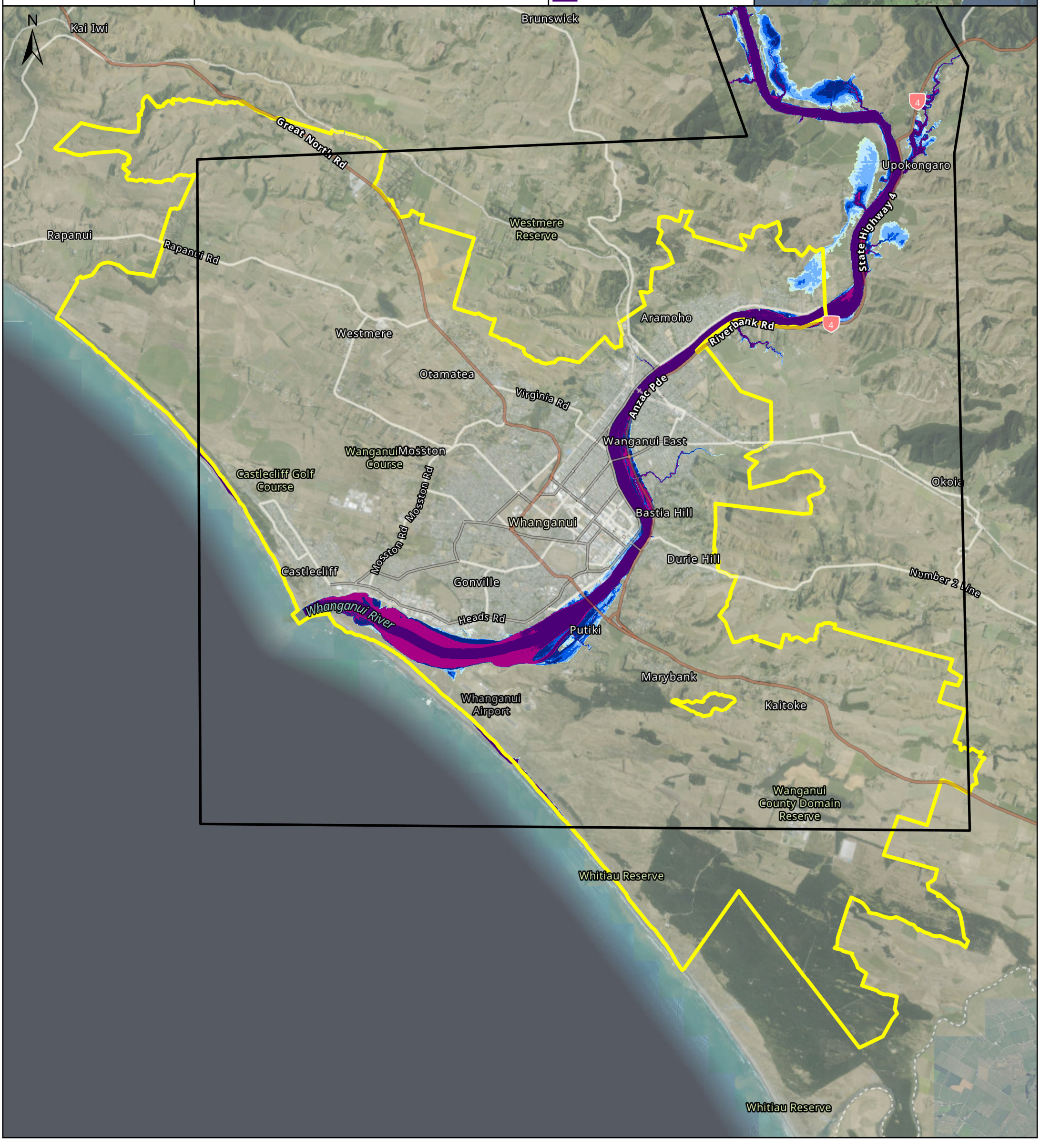
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

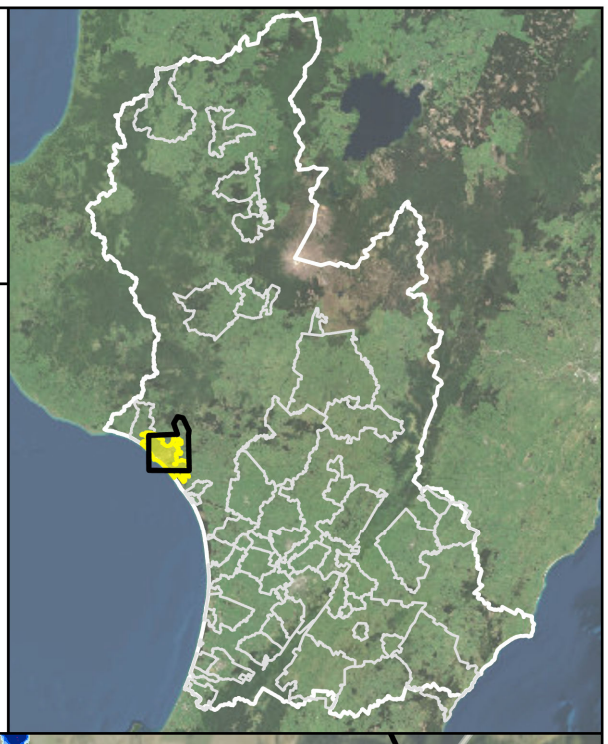
0 2 4 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

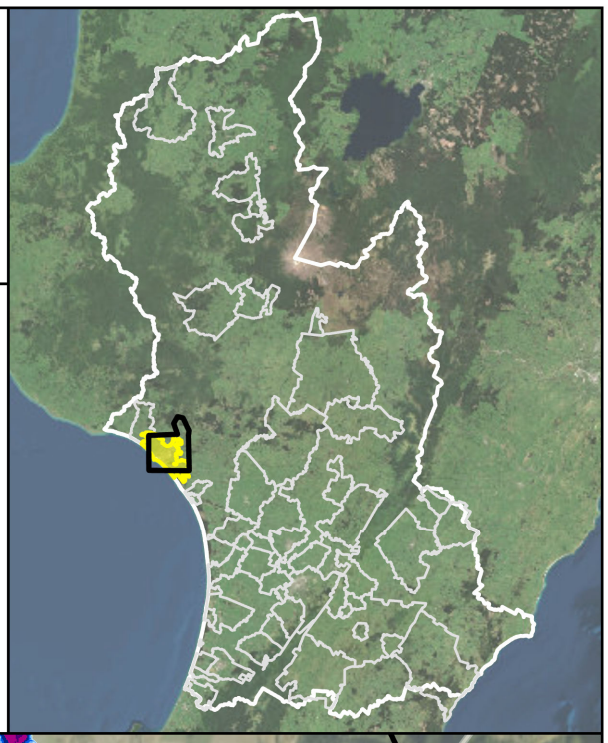
0 2 4 Km

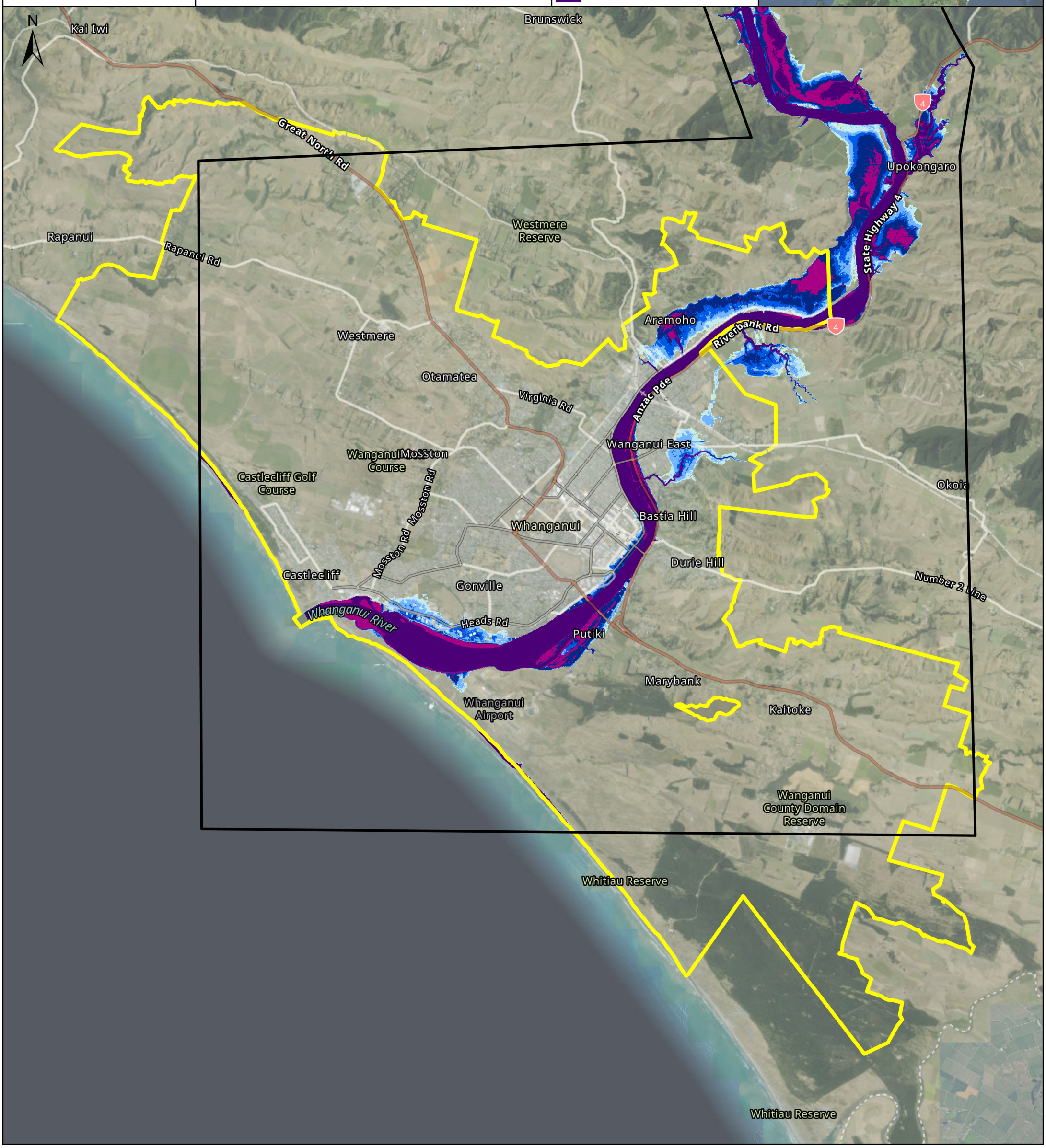
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

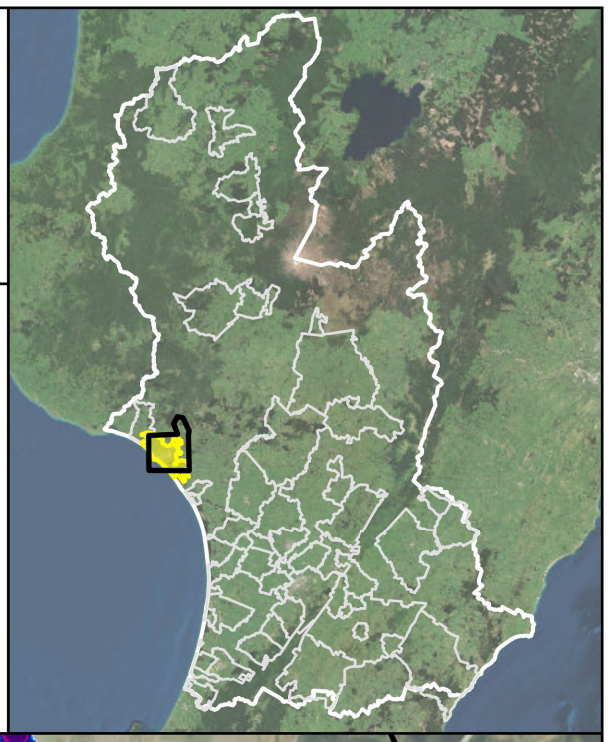
0 2 4 Km

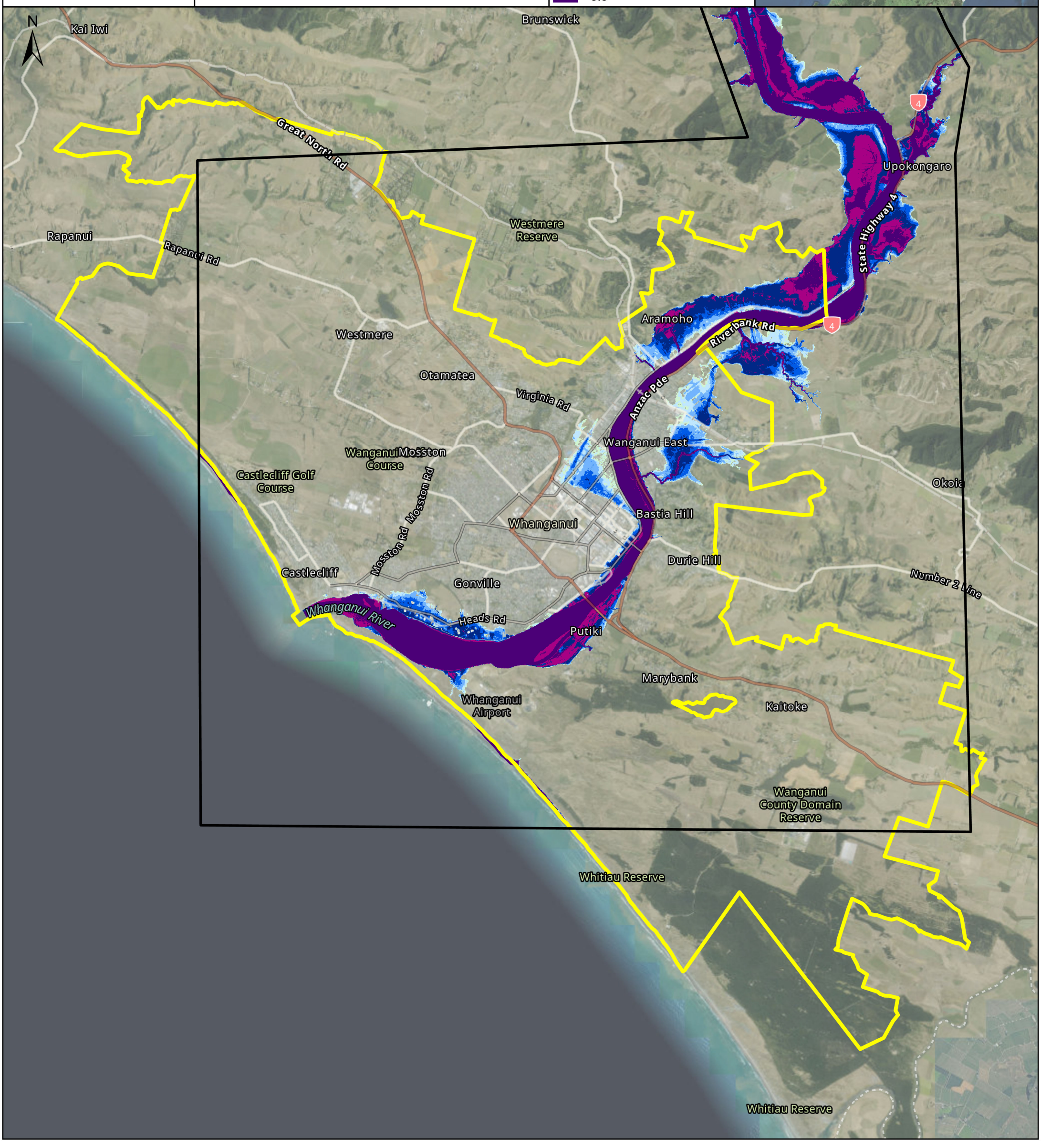
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

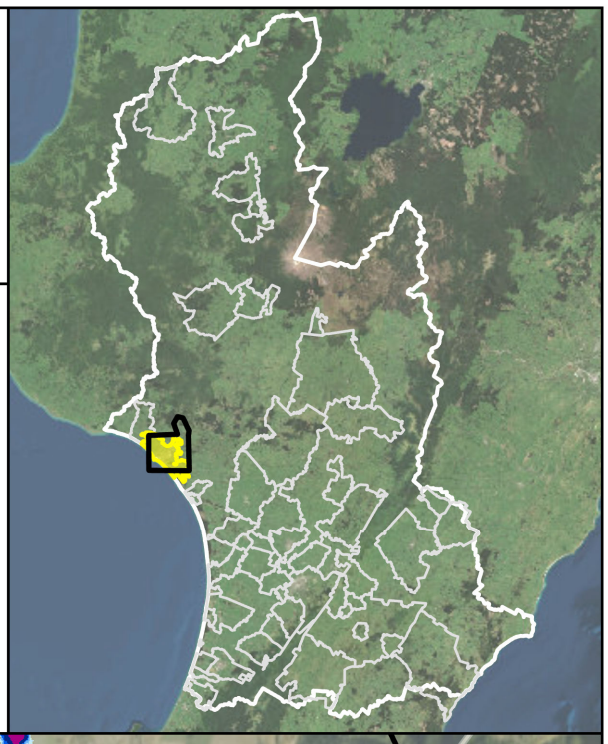
0 2 4 Km

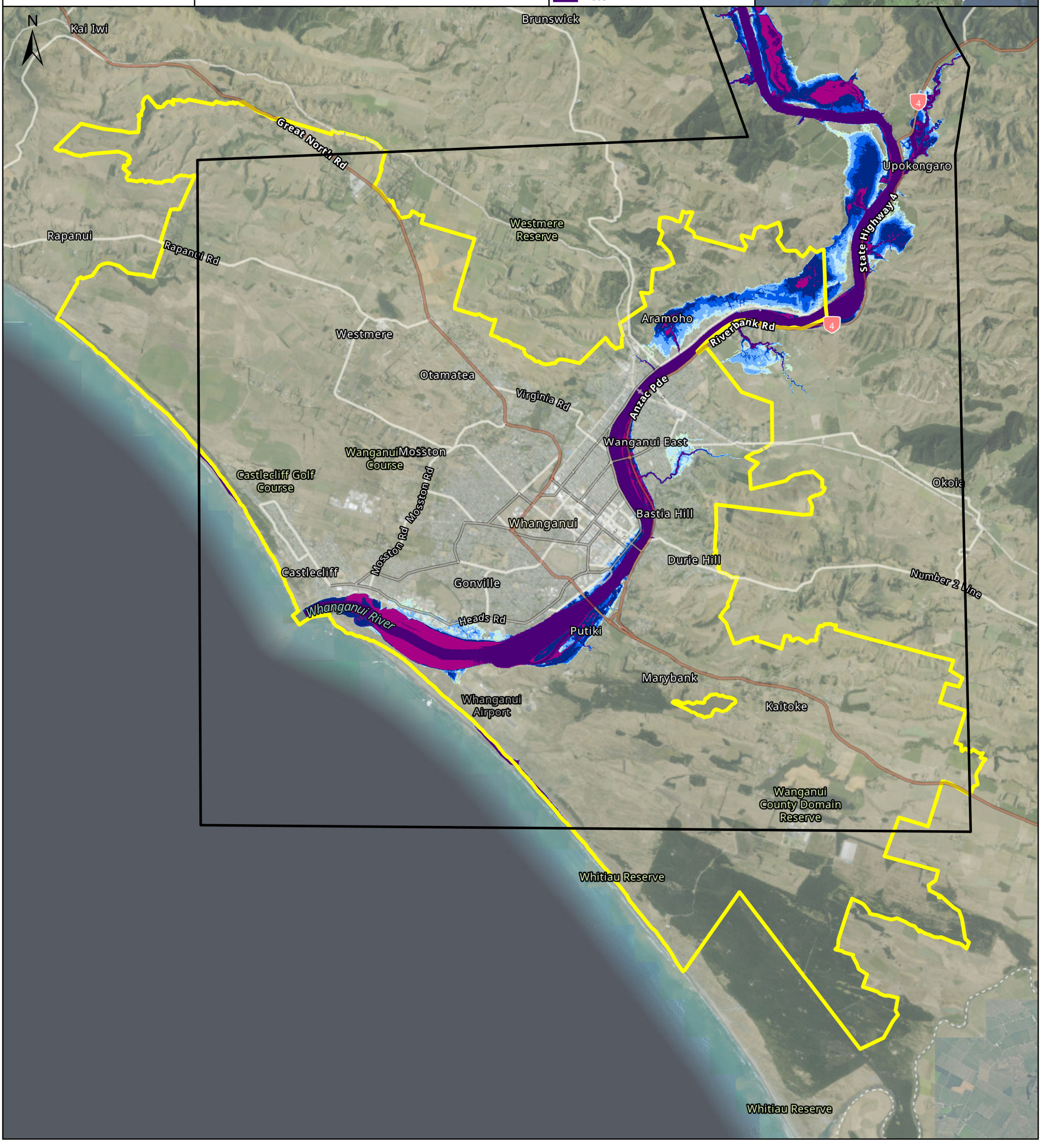
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

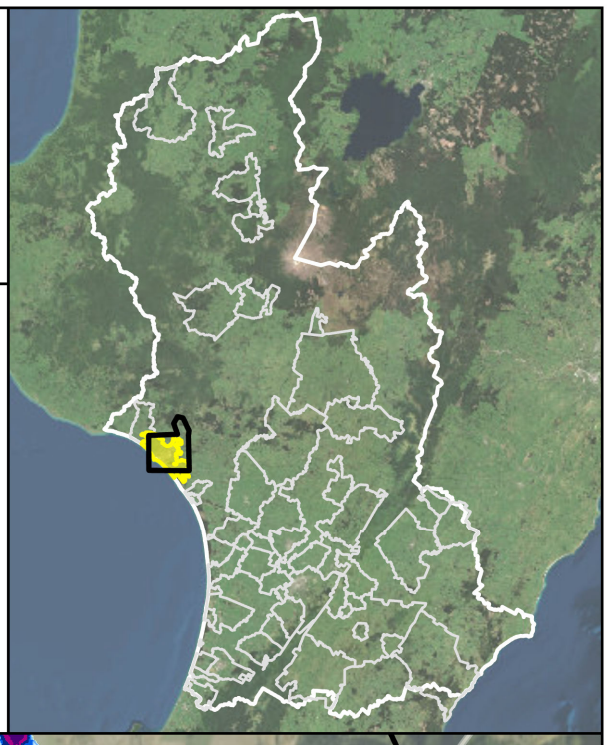
Community
Whanganui,
Whanganui District

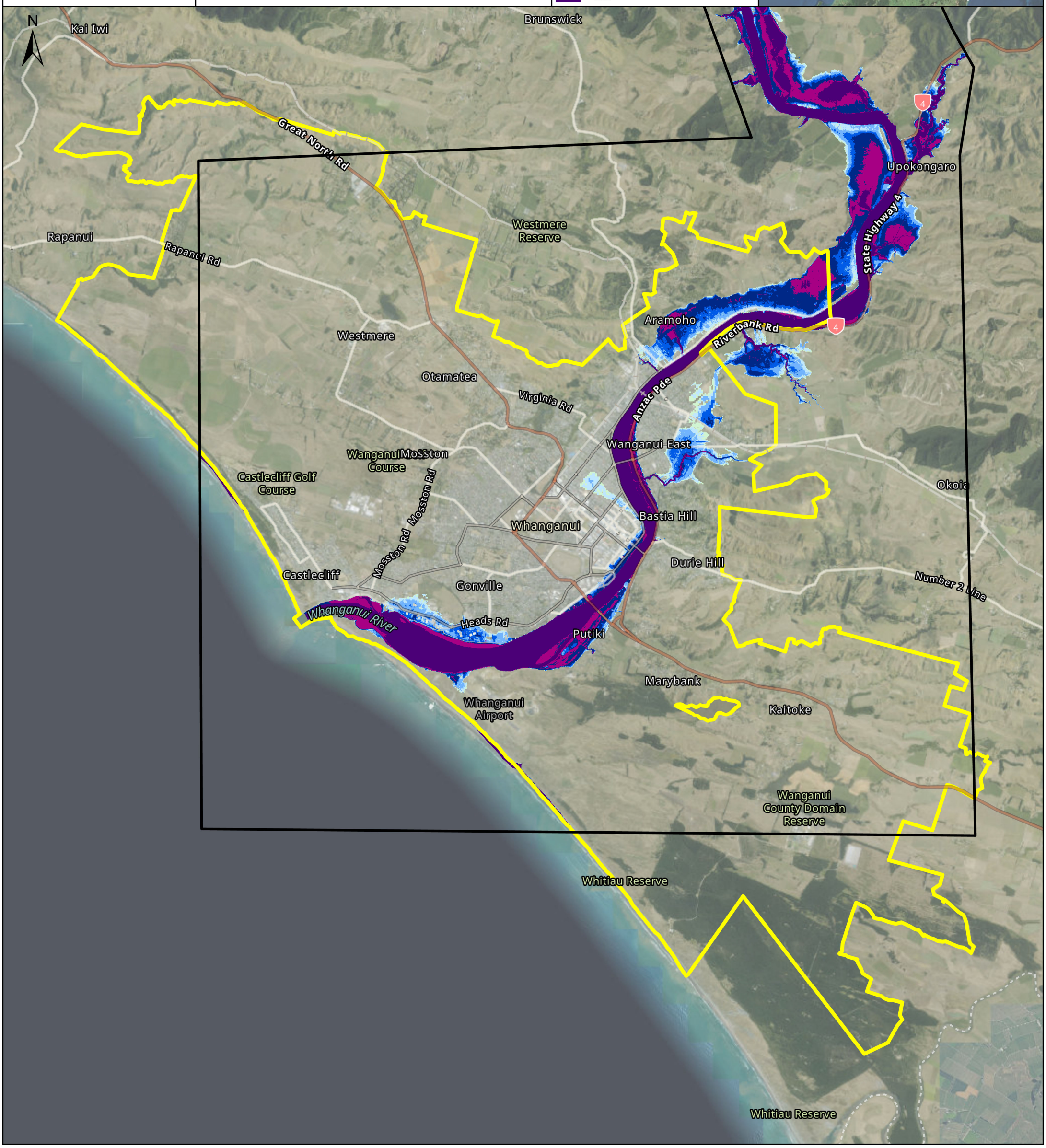
Scale 1:69,000 at A3

0 2 4 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

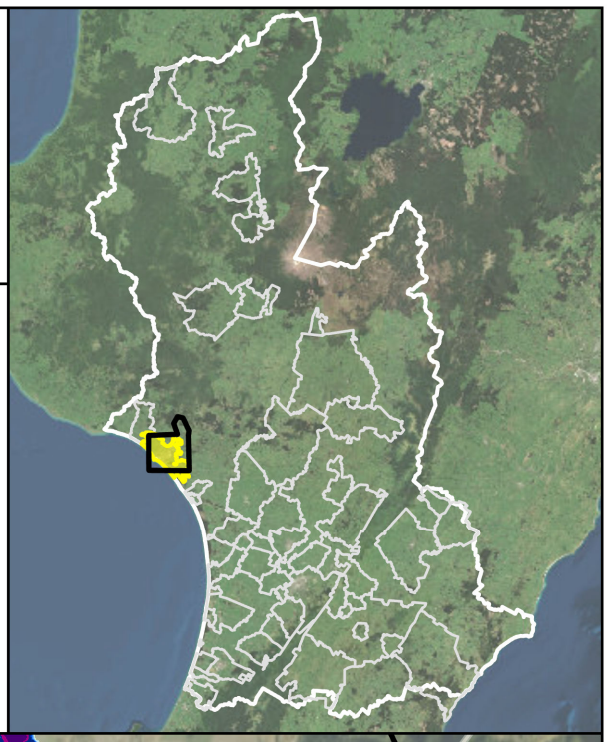
Community
Whanganui,
Whanganui District

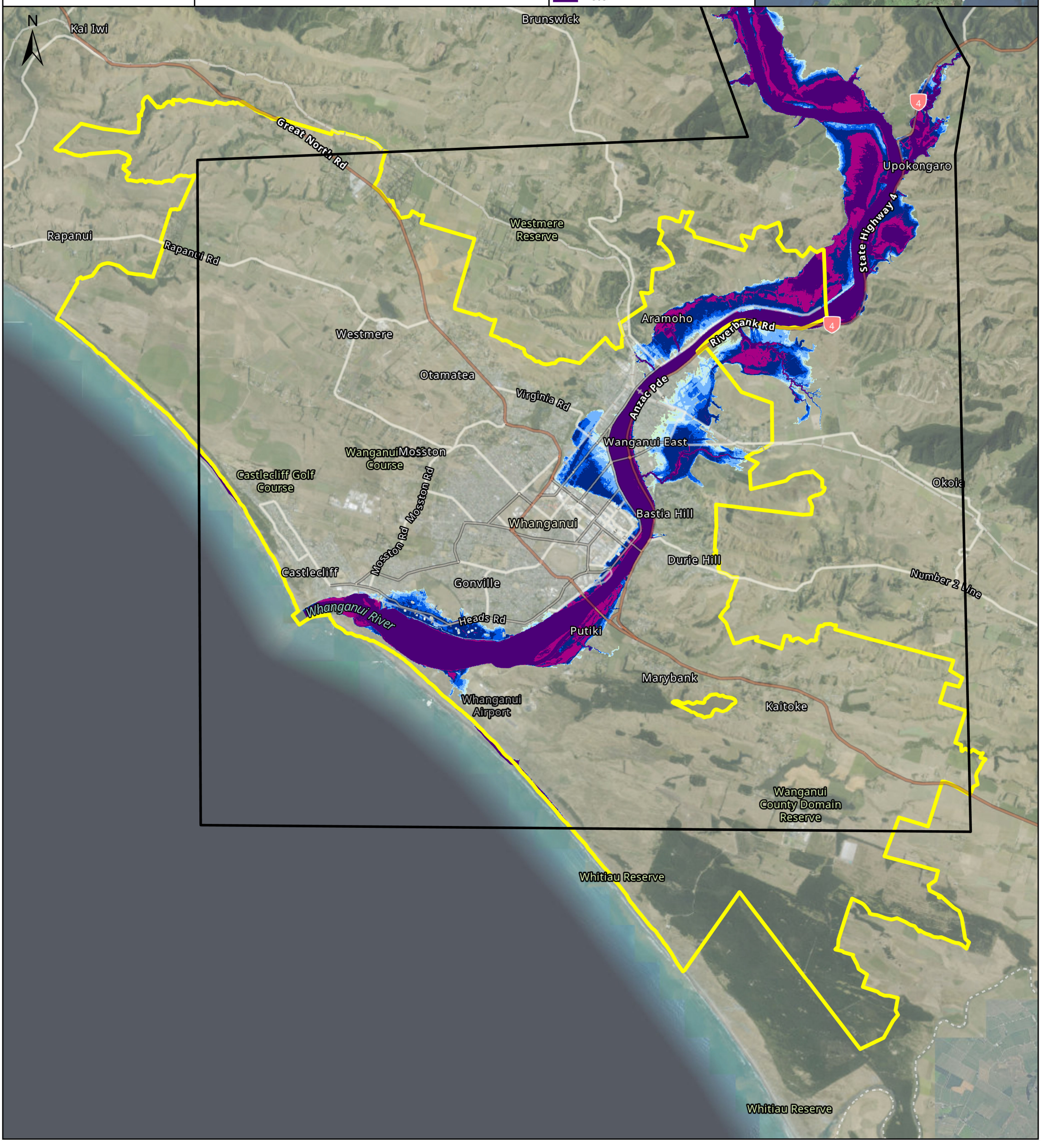
Scale 1:69,000 at A3

0 2 4 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

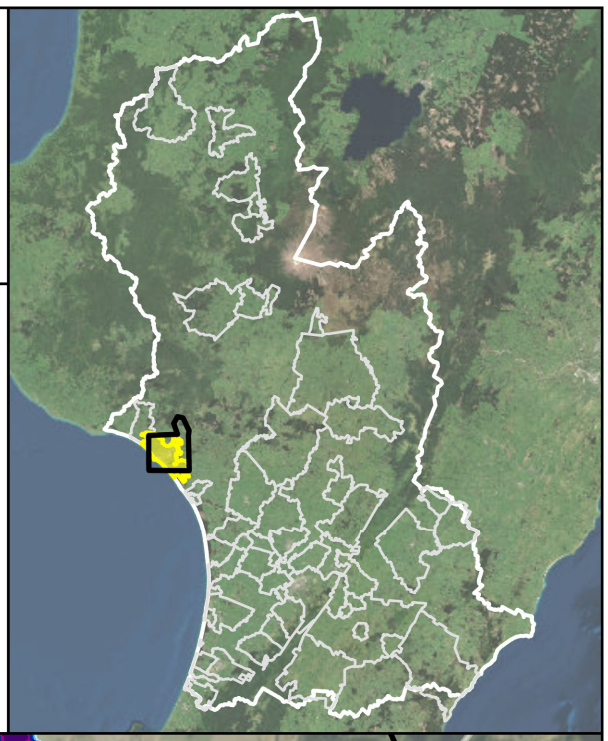
0 2 4 Km

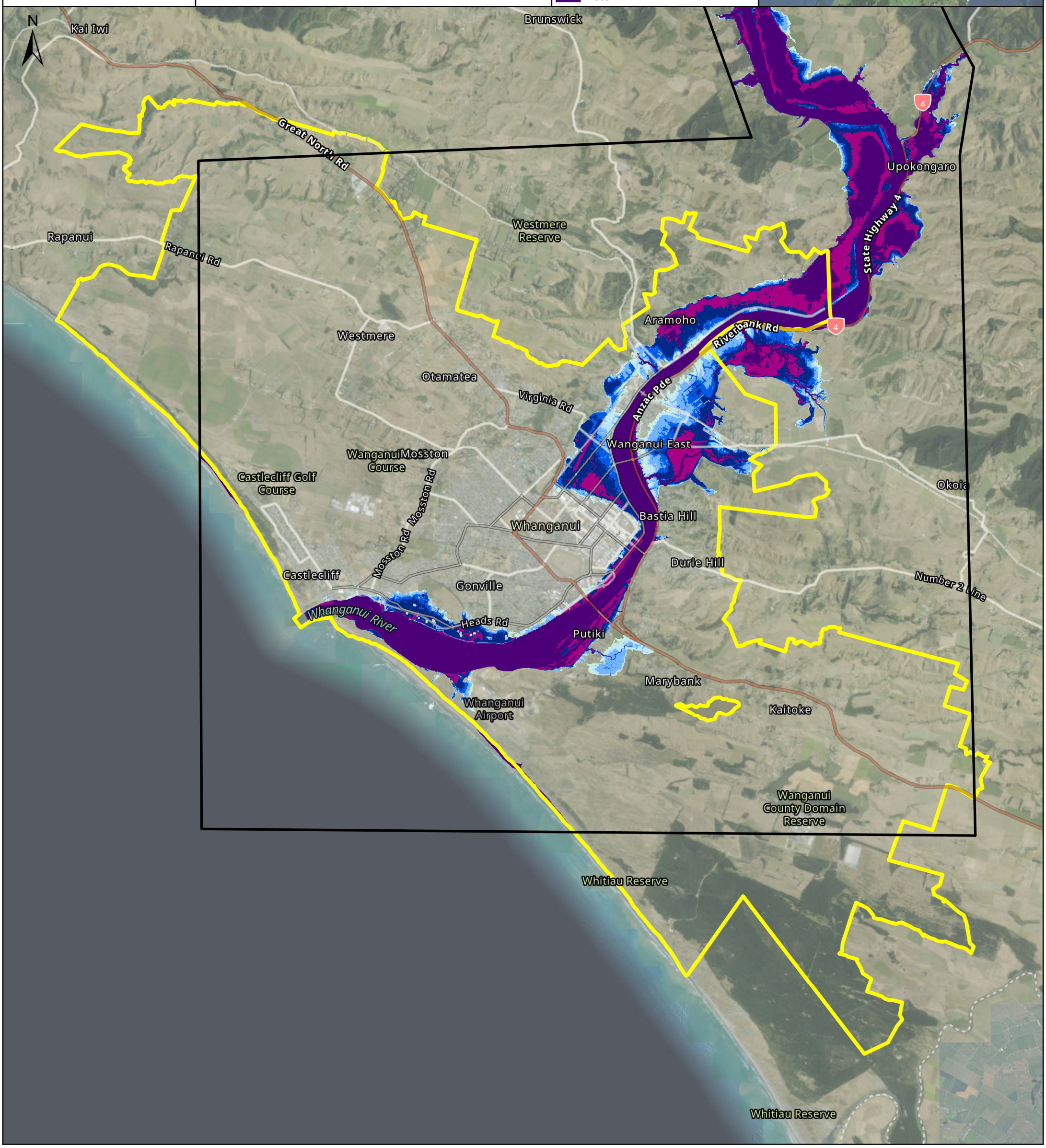
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

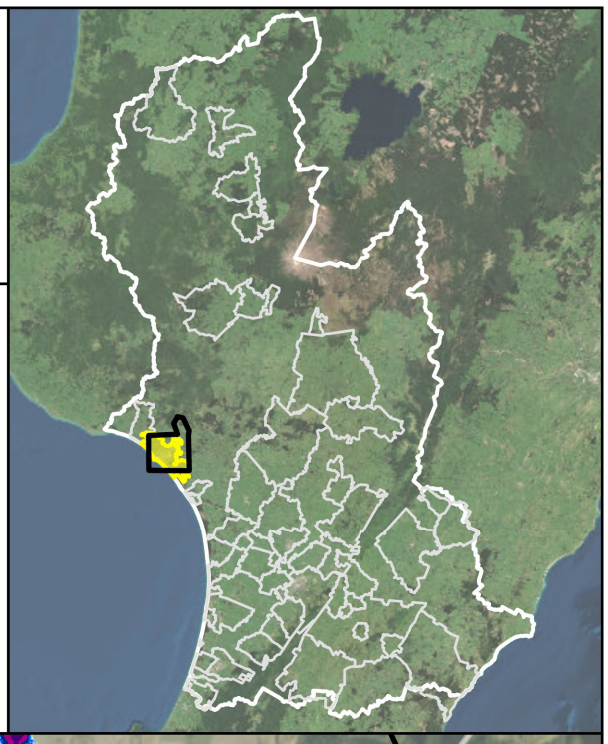
0 2 4 Km

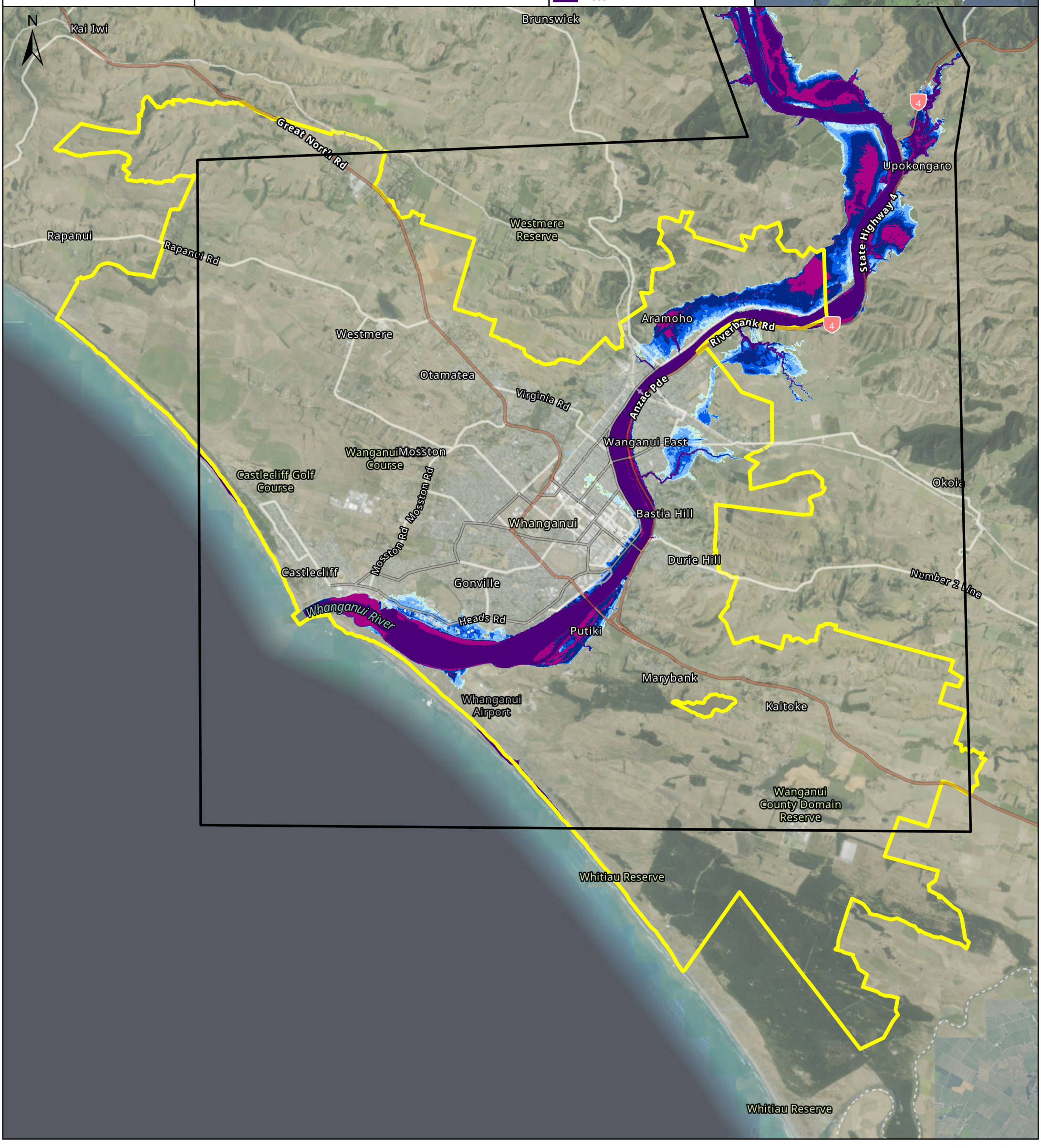
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

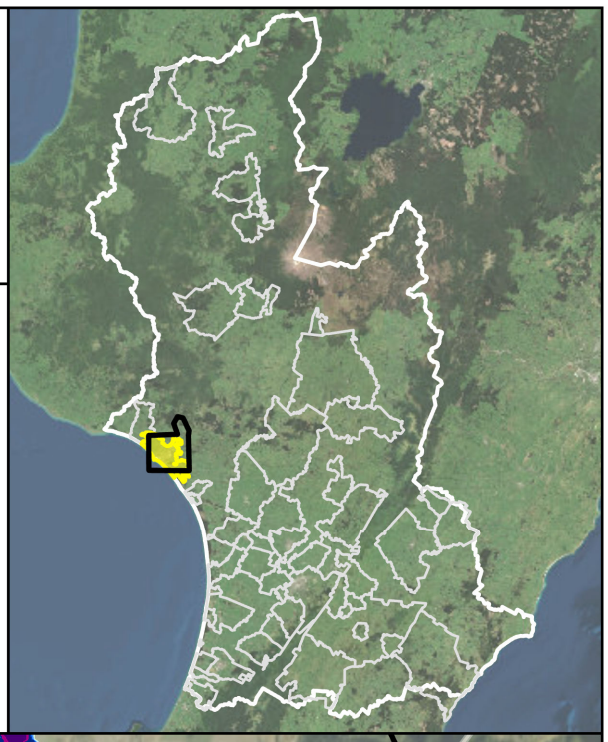
0 2 4 Km

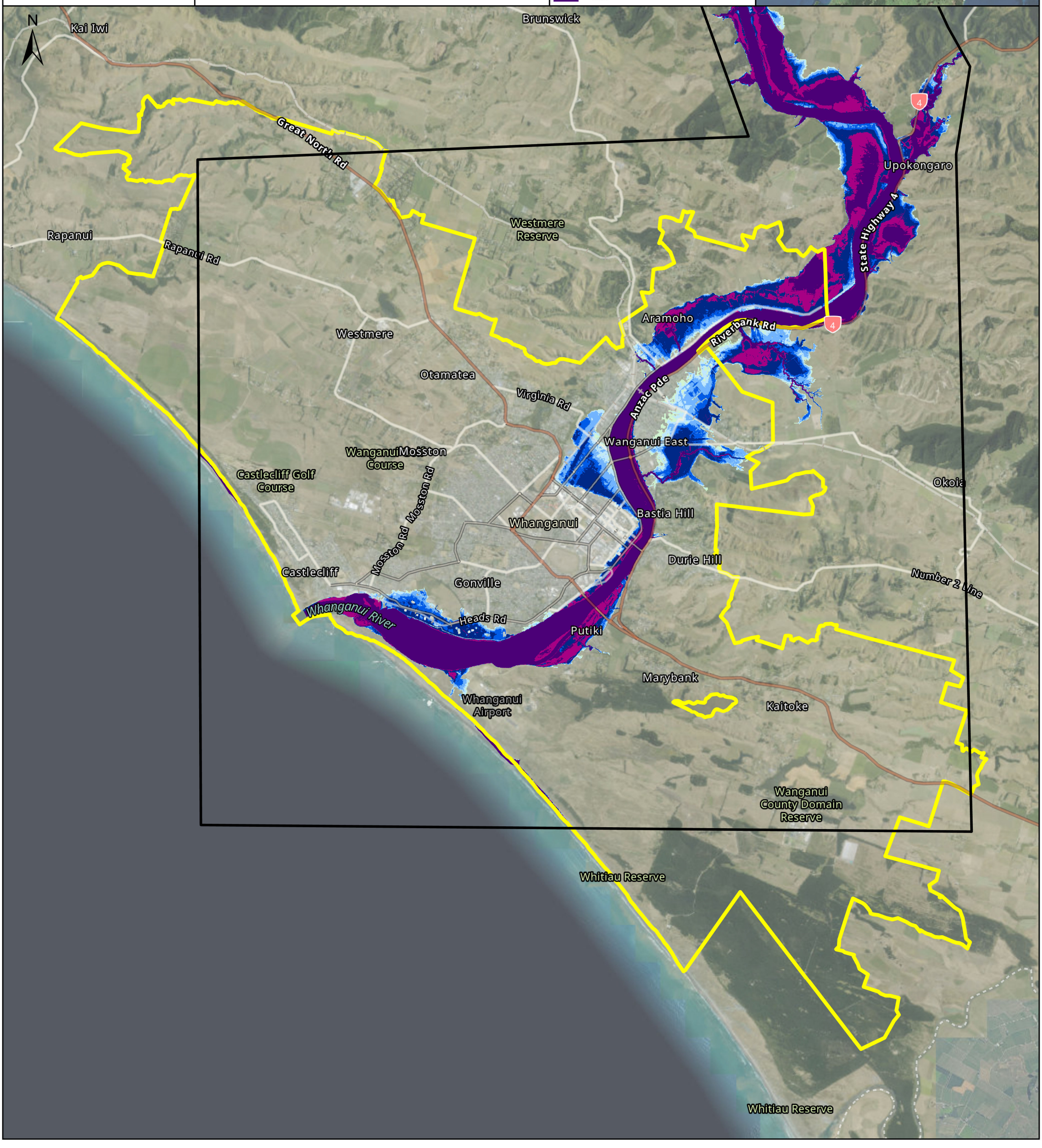
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

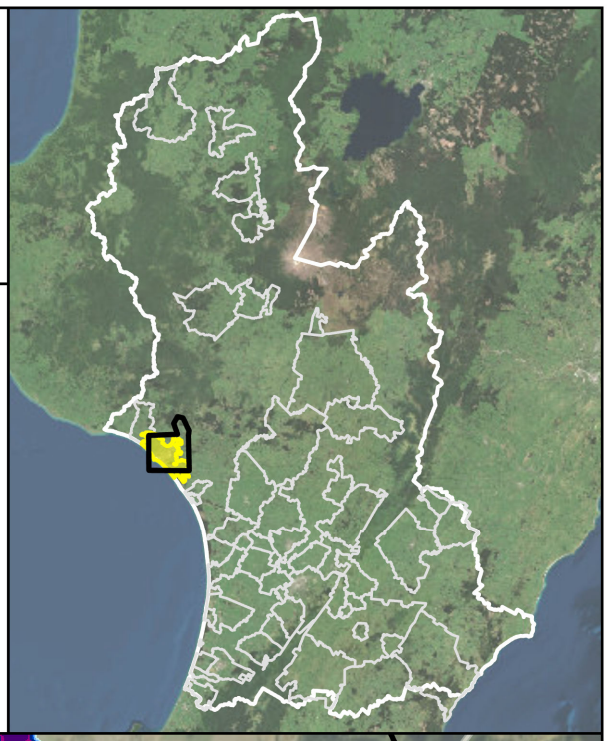
0 2 4 Km

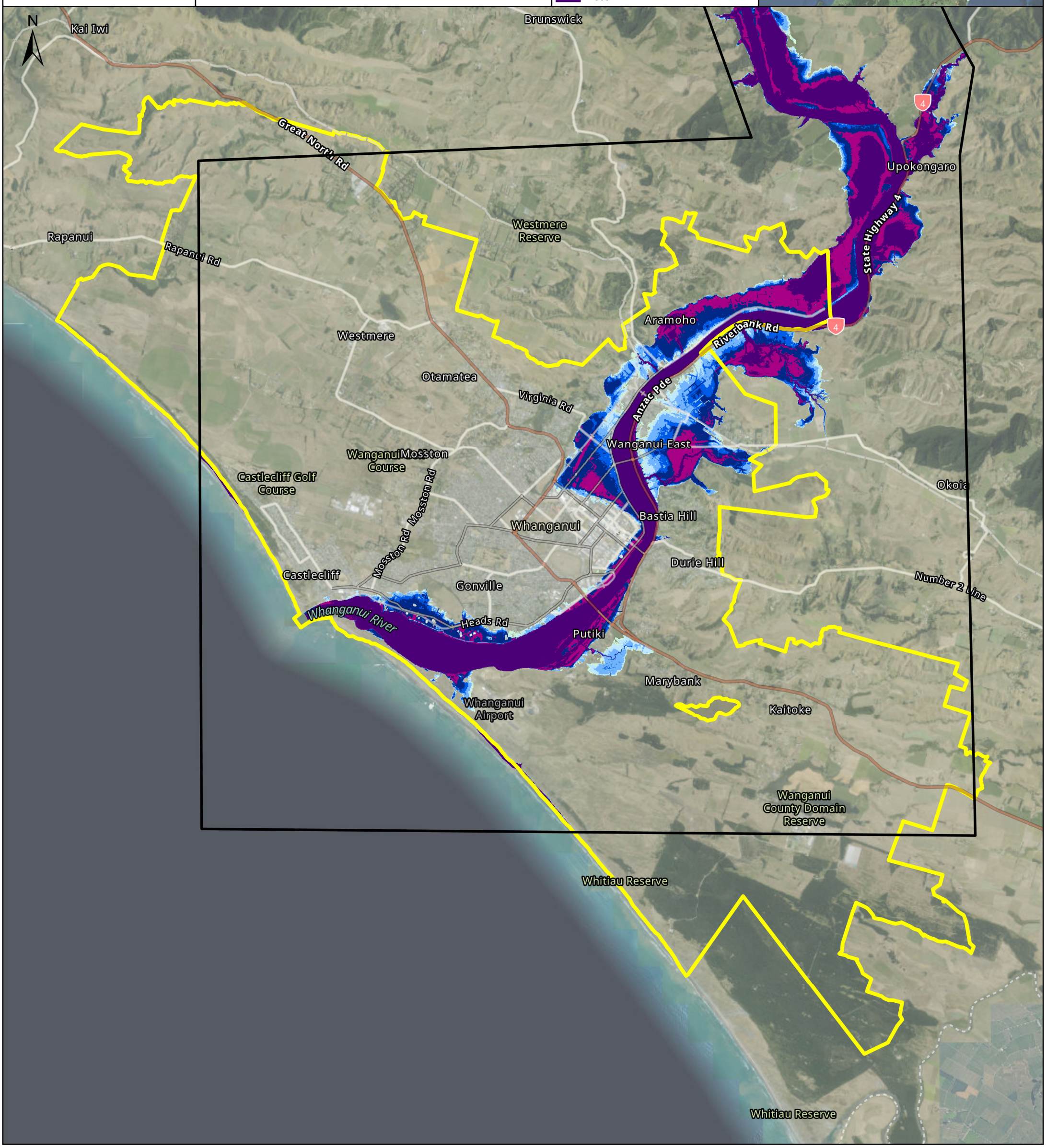
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

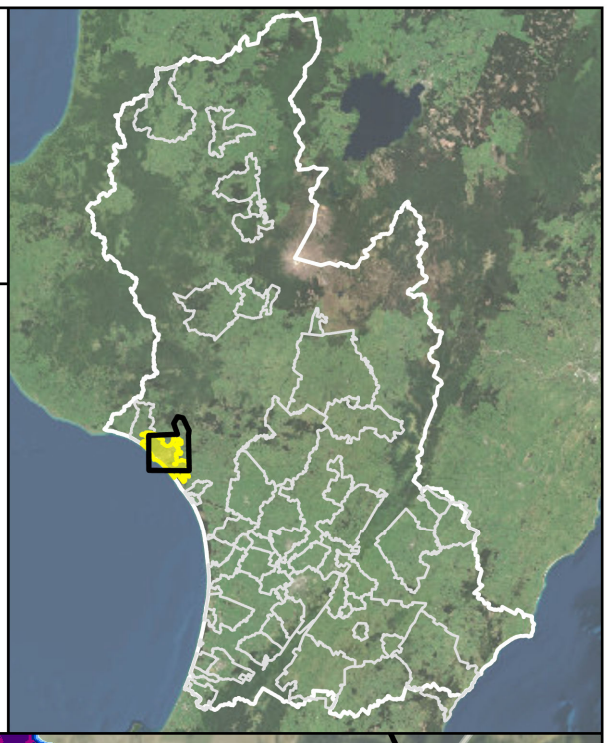
0 2 4 Km

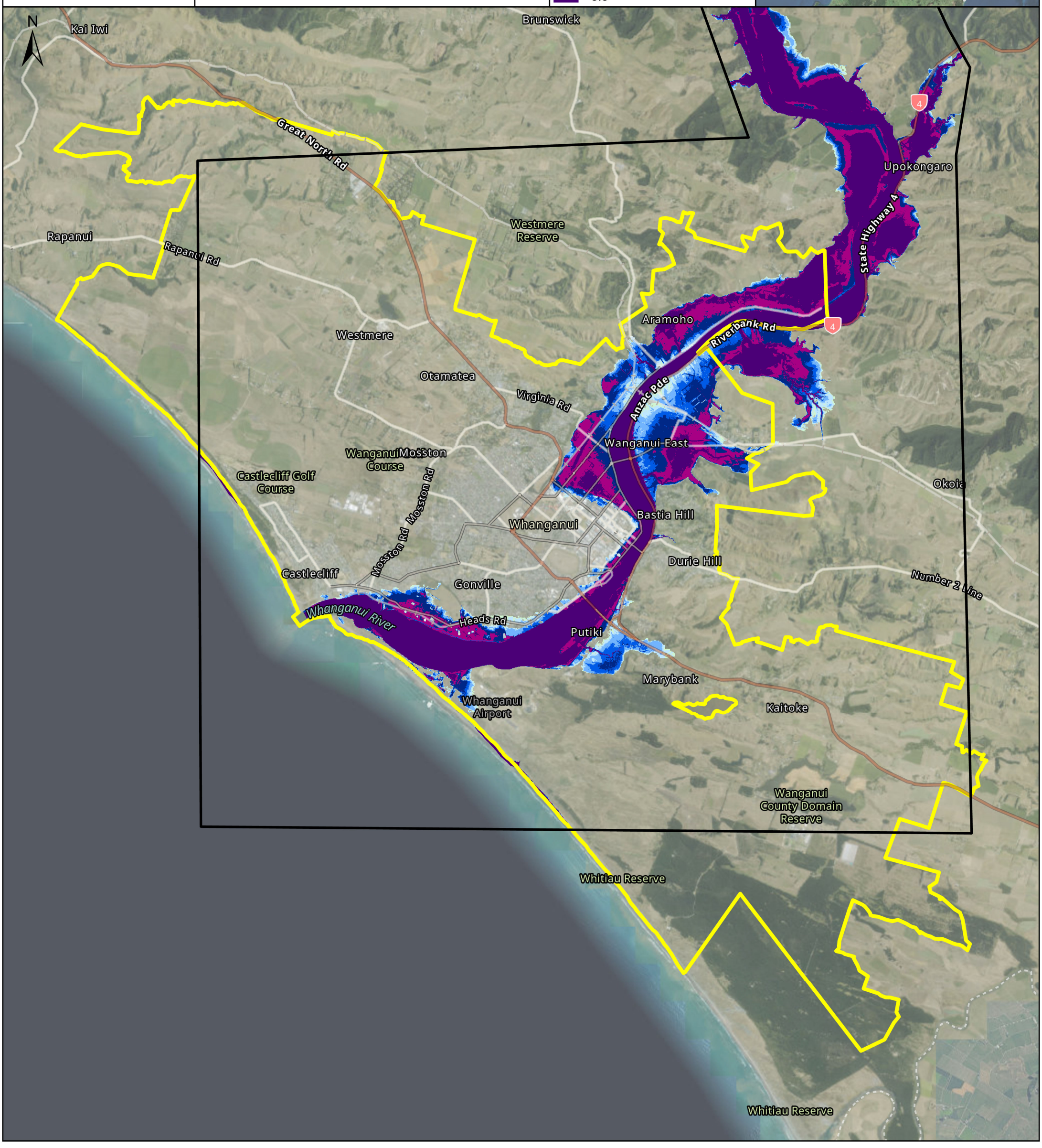
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community
Whanganui,
Whanganui District

Scale 1:69,000 at A3

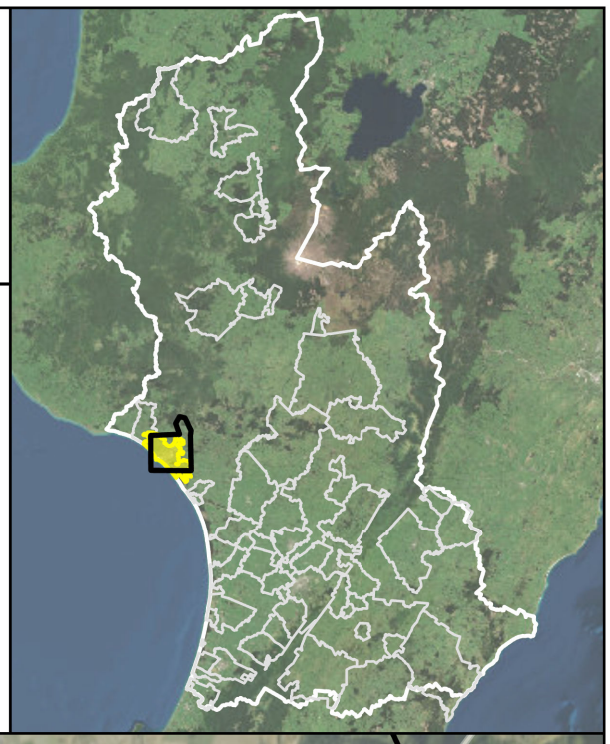
0 2 4 Km

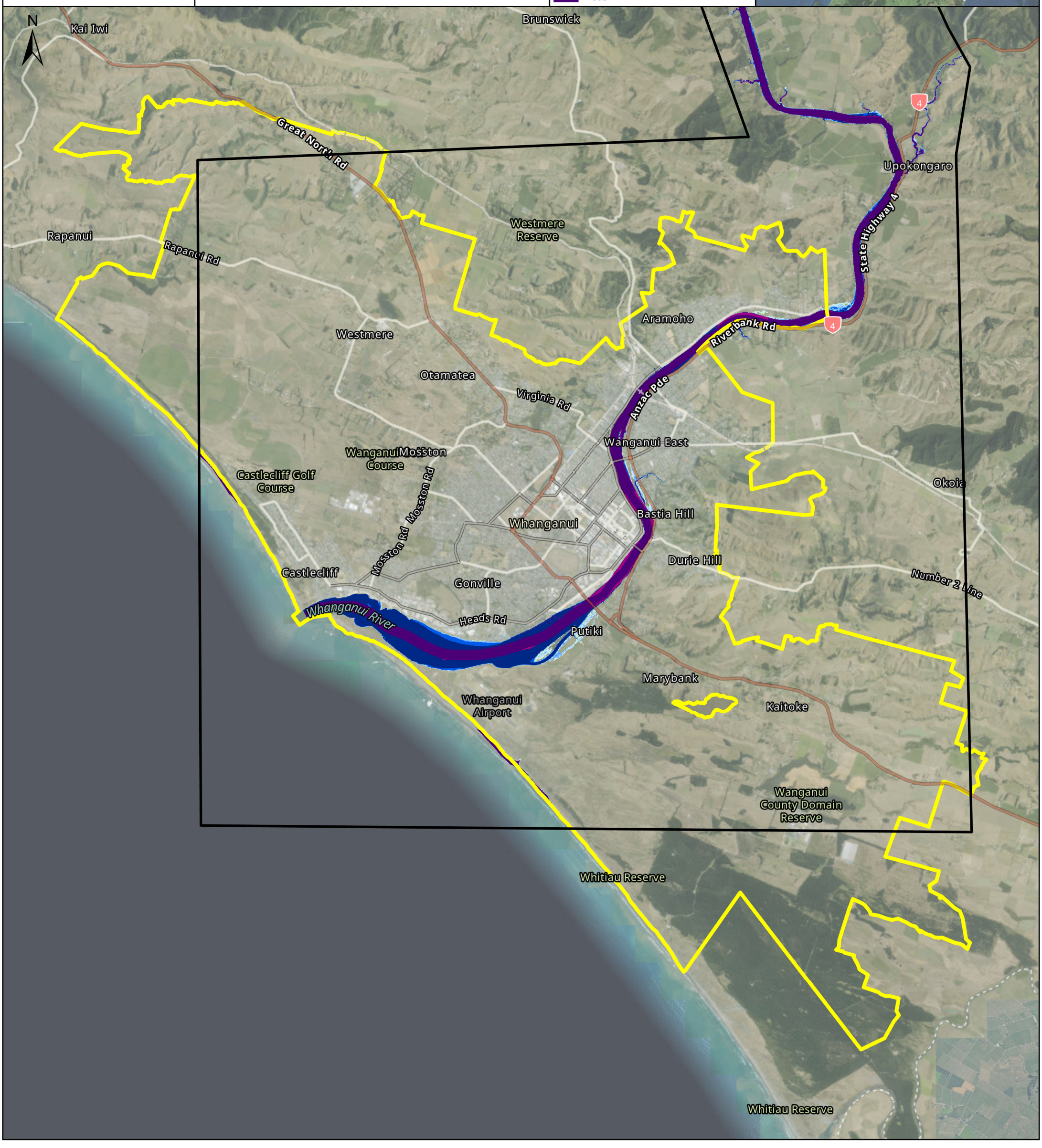
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

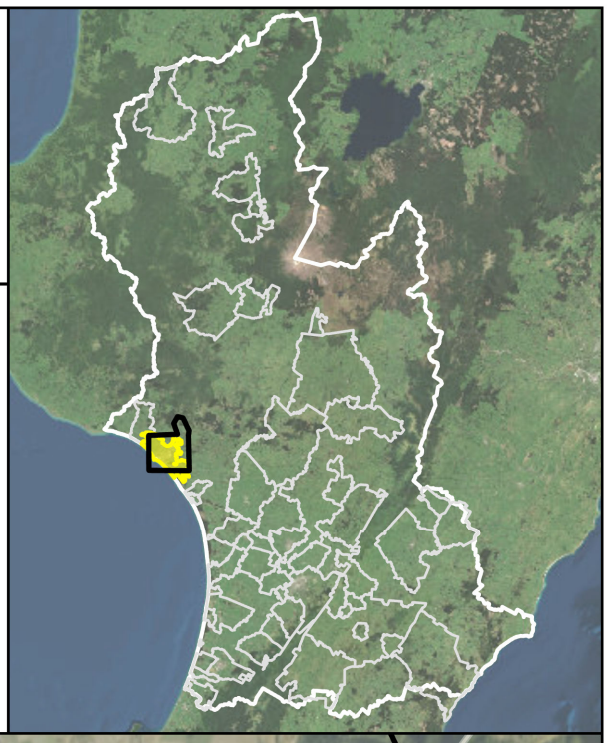
0 2 4 Km

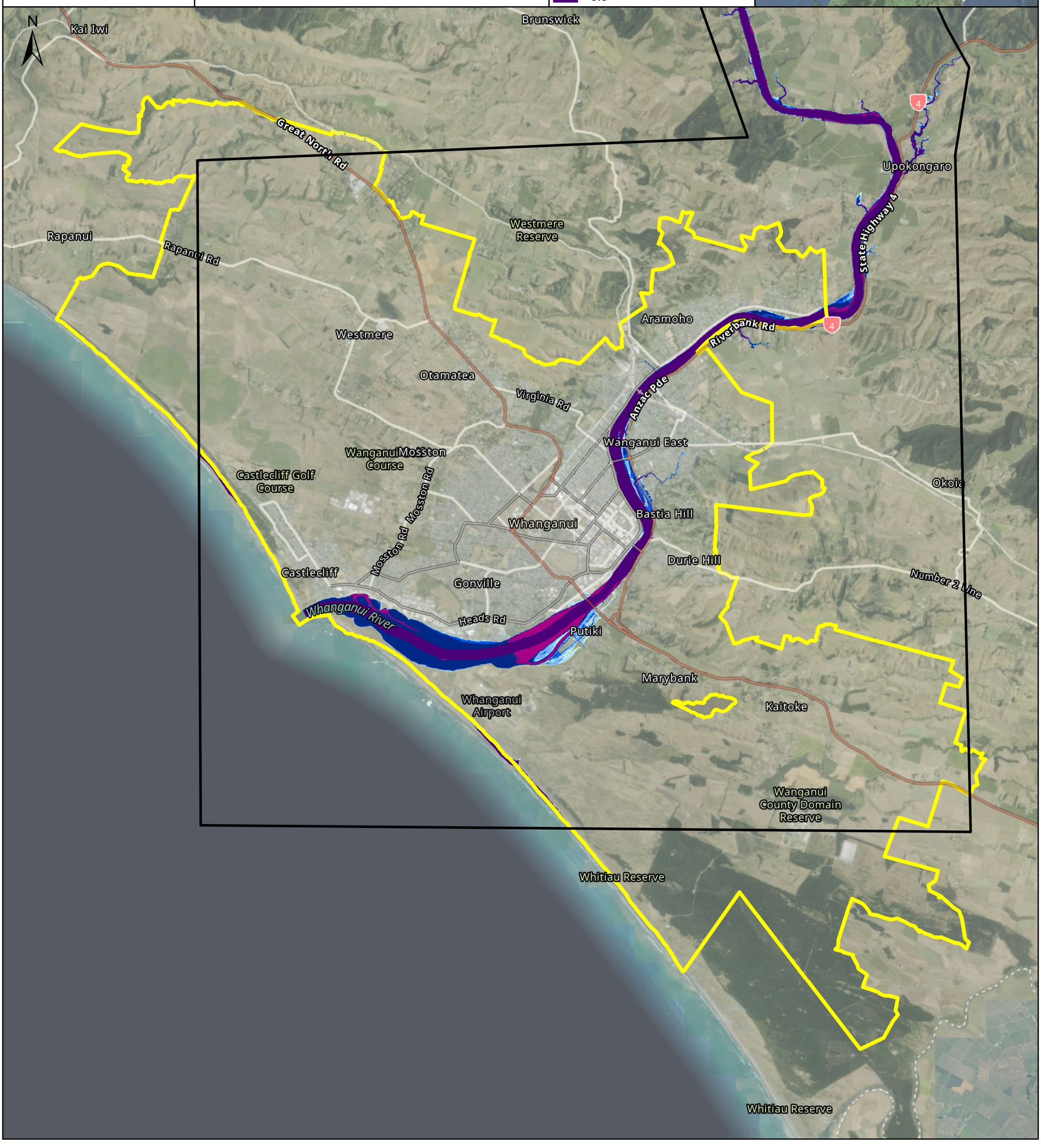
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

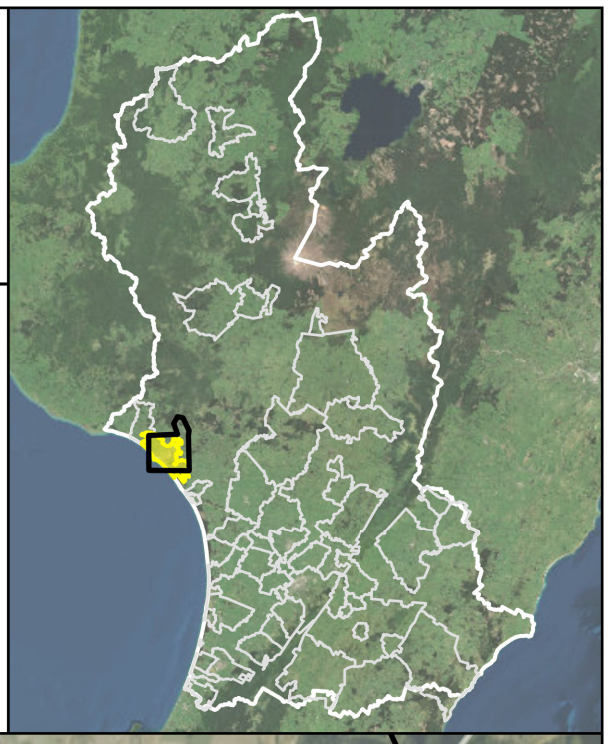
0 2 4 Km

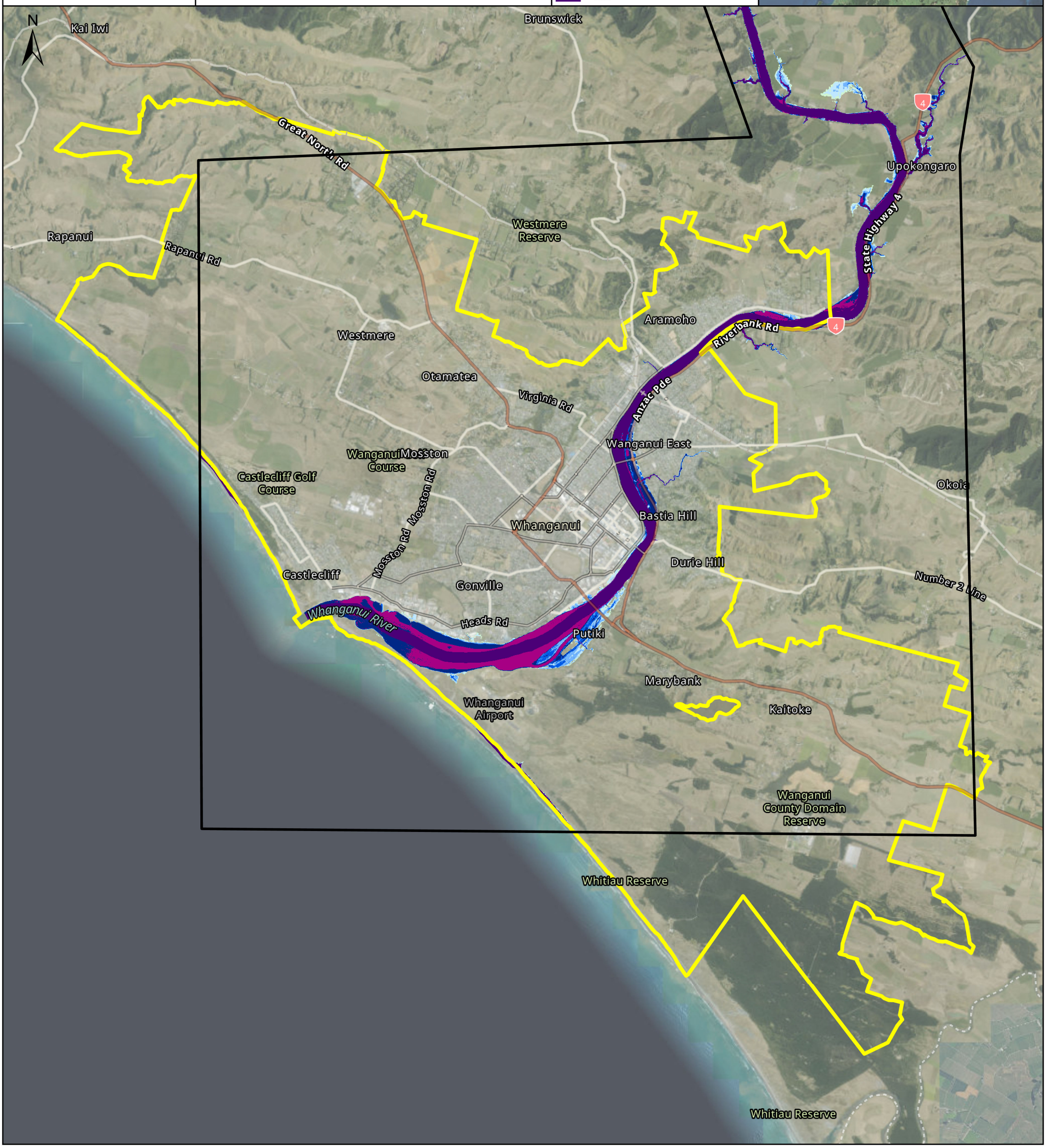
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community
Whanganui,
Whanganui District

Scale 1:69,000 at A3

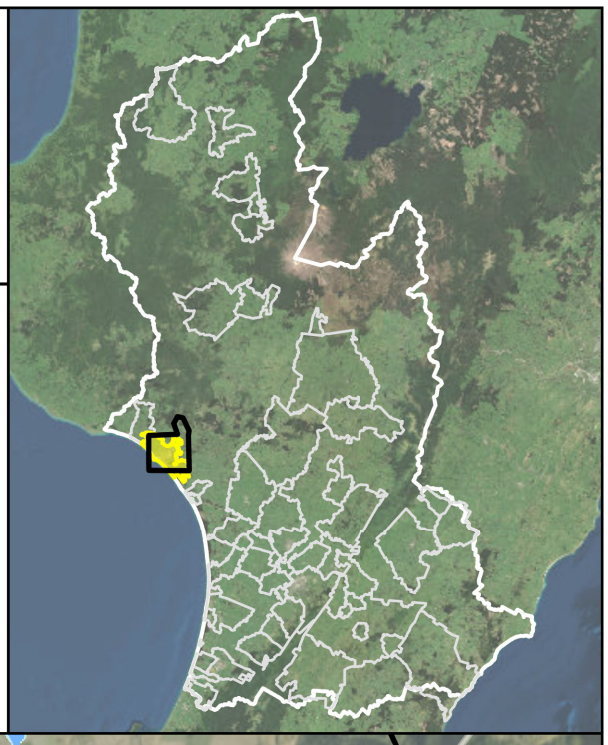
0 2 4 Km

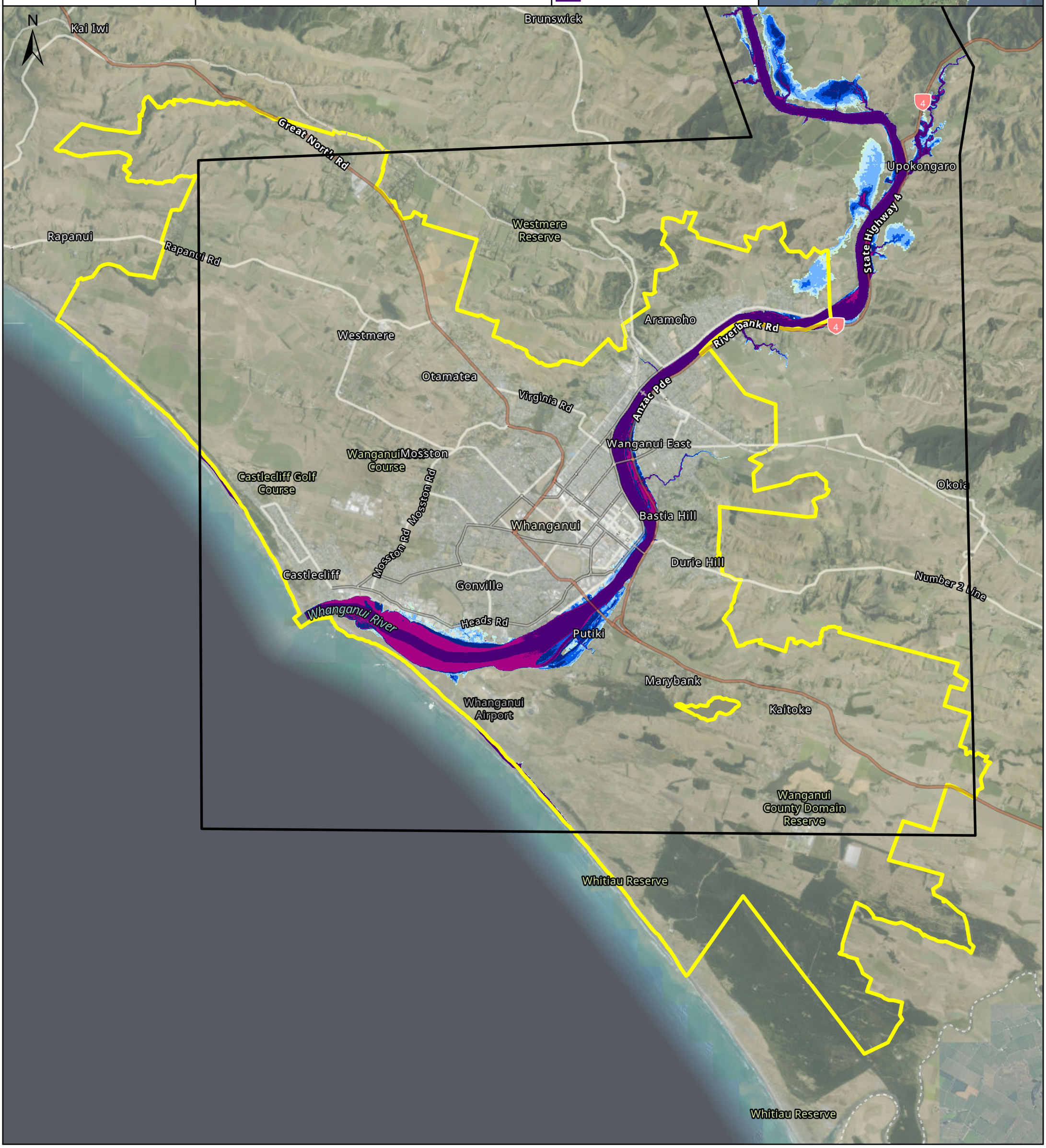
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 1 degree warming due to climate change, sea level rise excluded

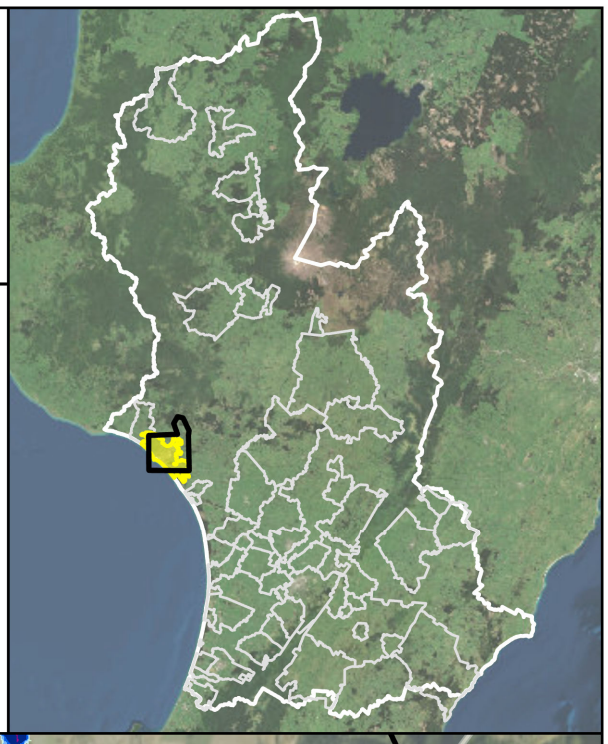
Community
Whanganui,
Whanganui District

Scale 1:69,000 at A3

0 2 4 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 2 degrees warming due to climate change, sea level rise excluded

Community

Whanganui,
Whanganui District

Scale 1:69,000 at A3

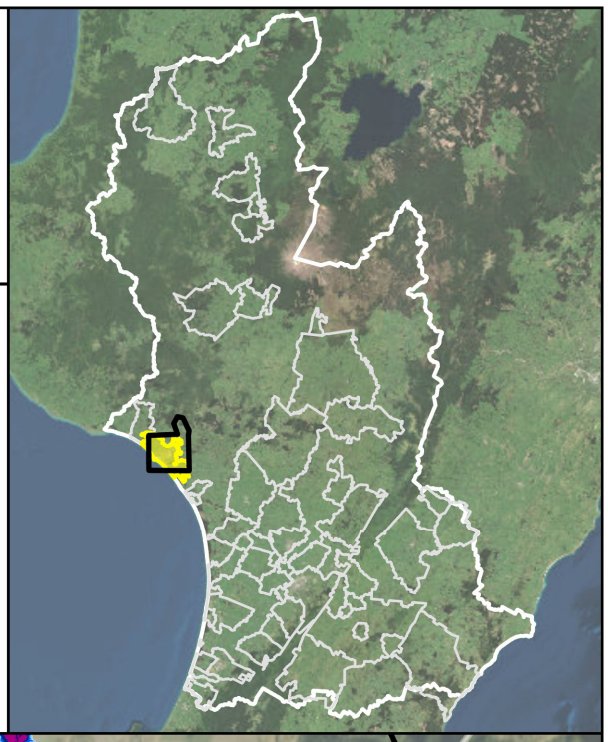
0 2 4 Km

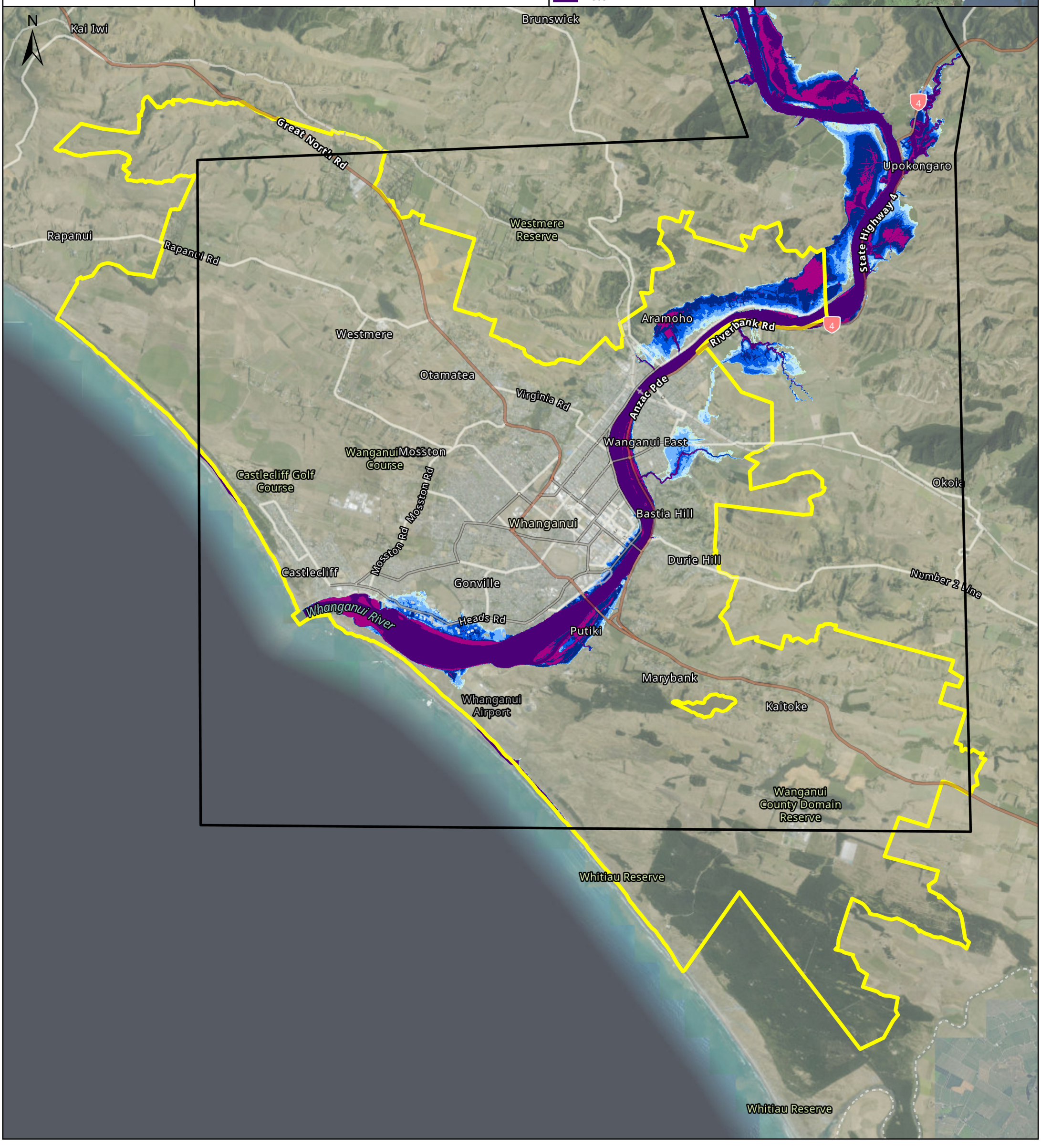
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 3 degrees warming due to climate change, sea level rise excluded

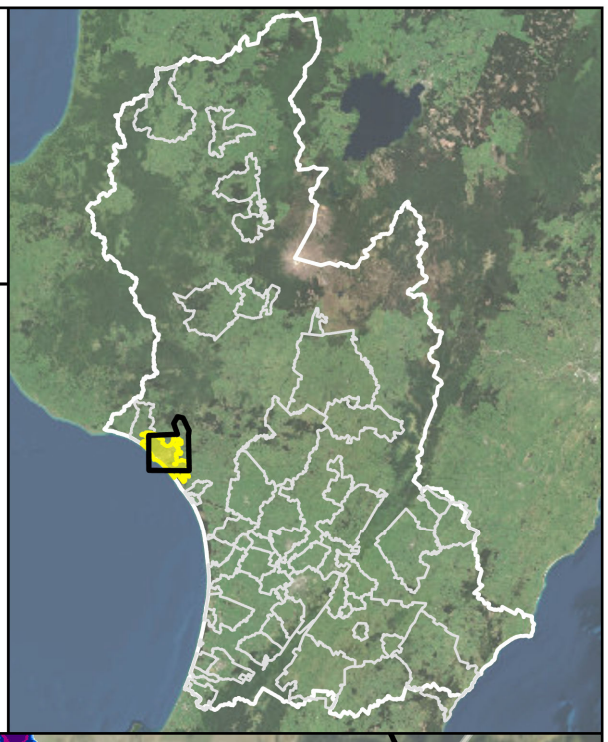
Community
Whanganui,
Whanganui District

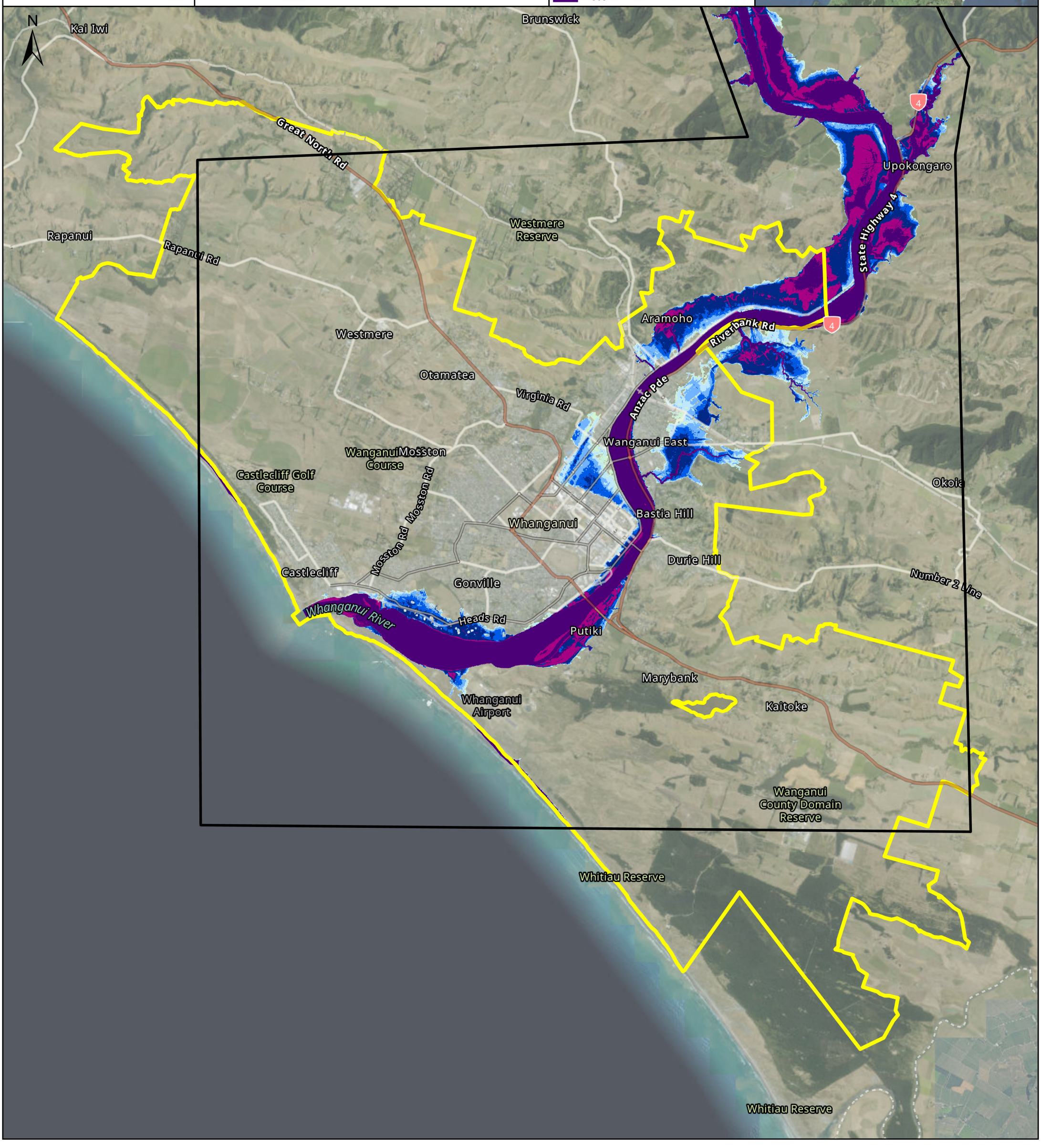
Scale 1:69,000 at A3

0 2 4 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

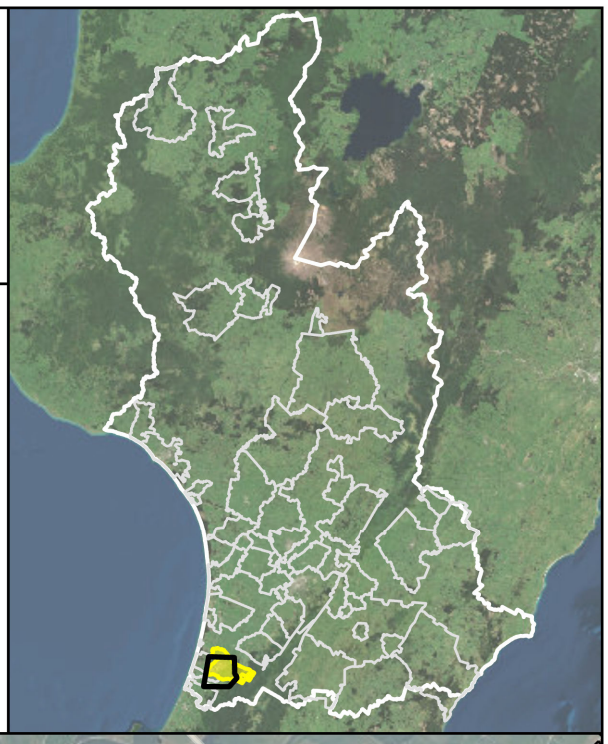
Community
Levin,
Horowhenua District

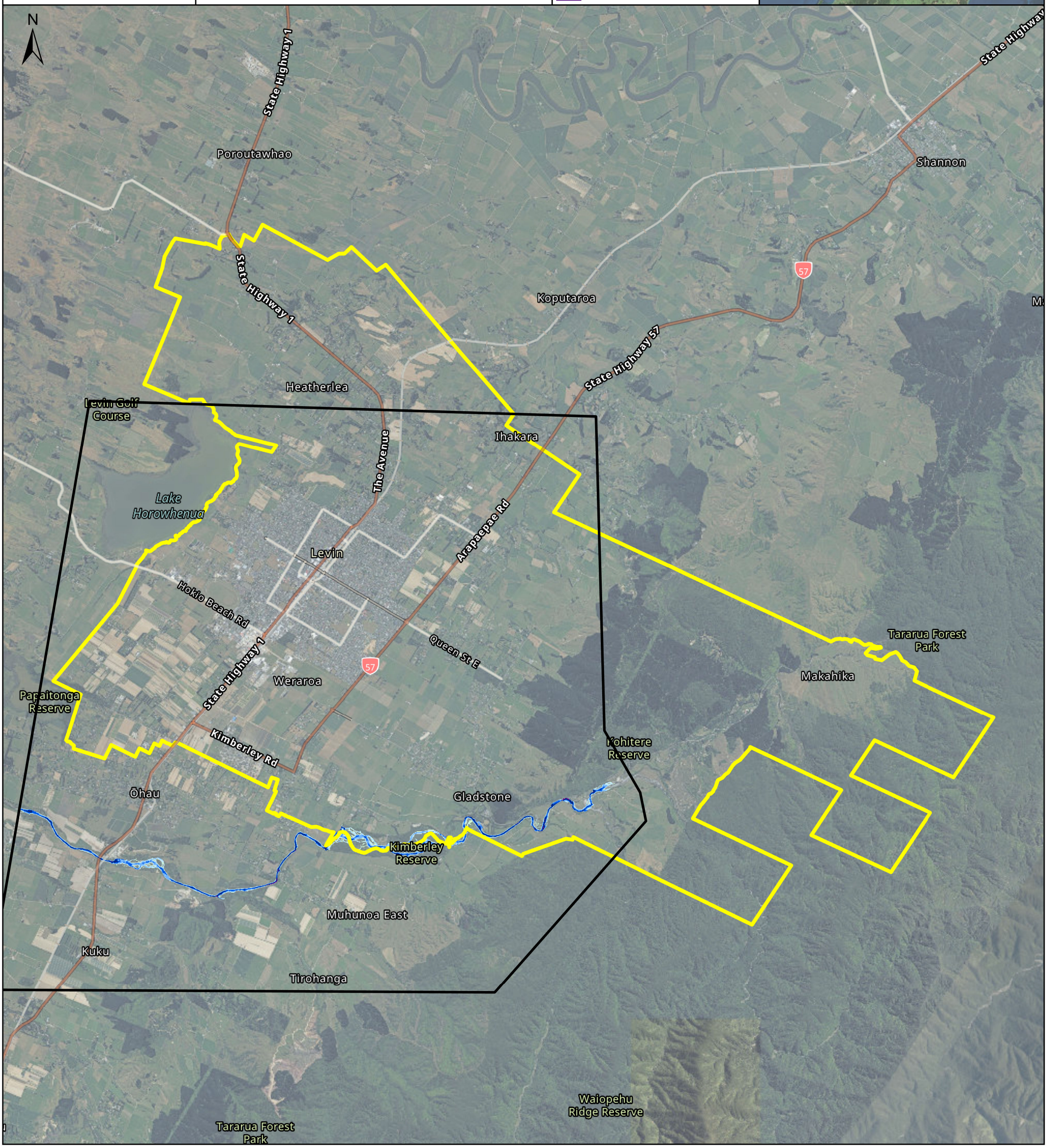
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

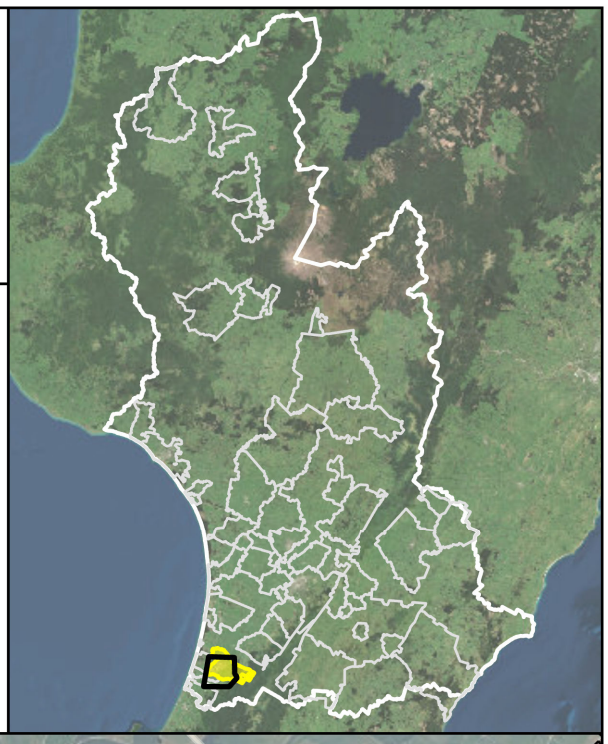
0 1.75 3.5 Km

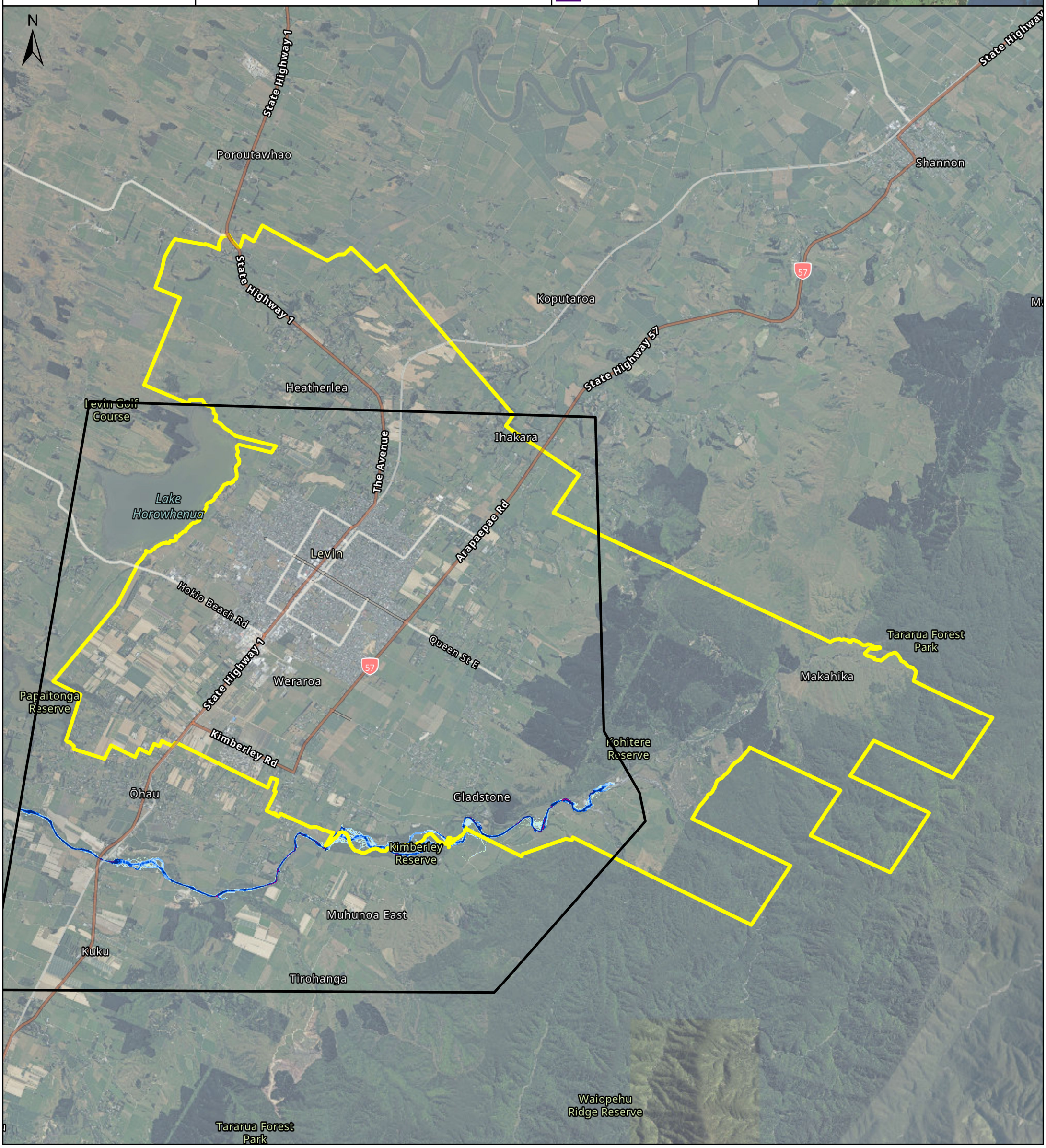
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

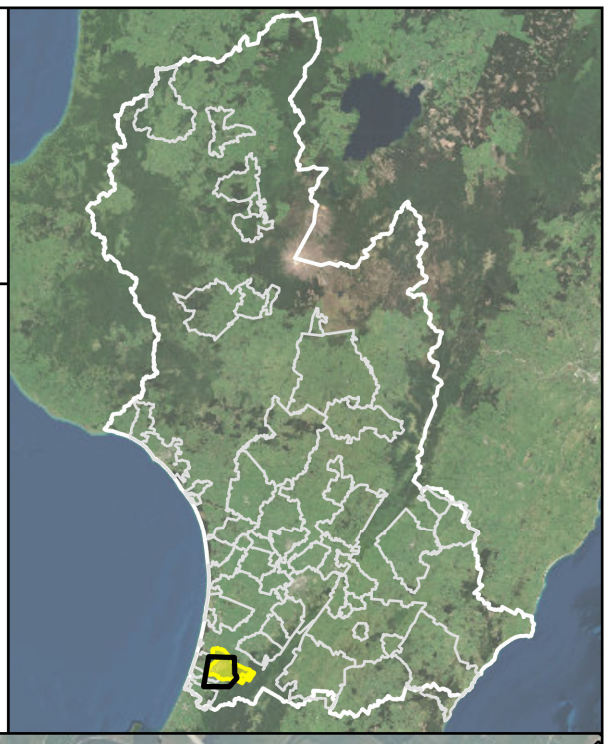
0 1.75 3.5 Km

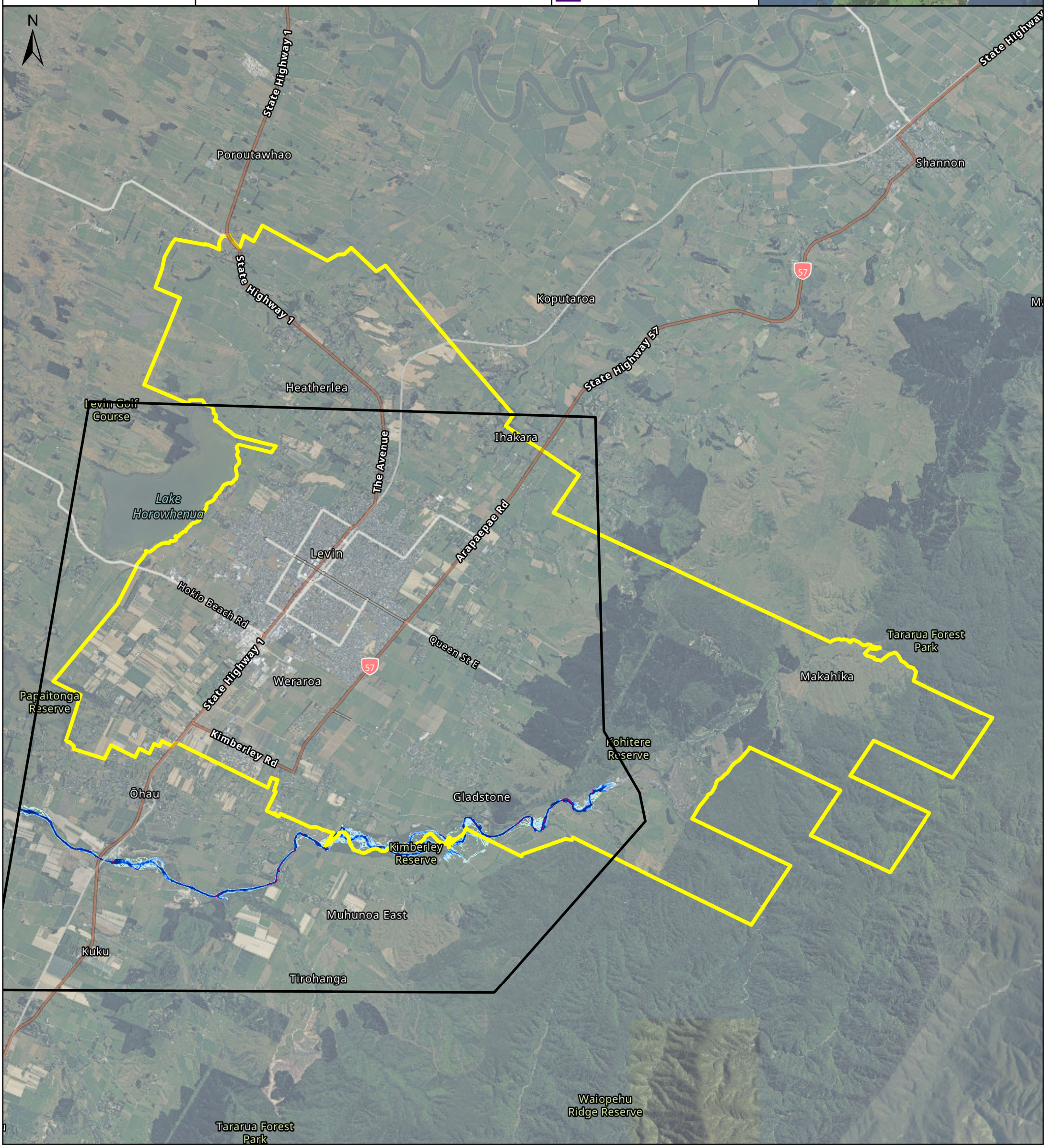
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

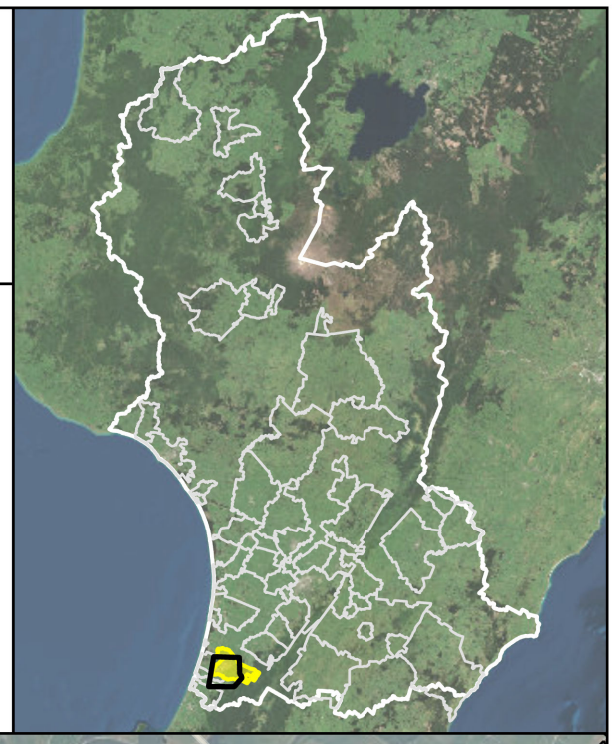
0 1.75 3.5 Km

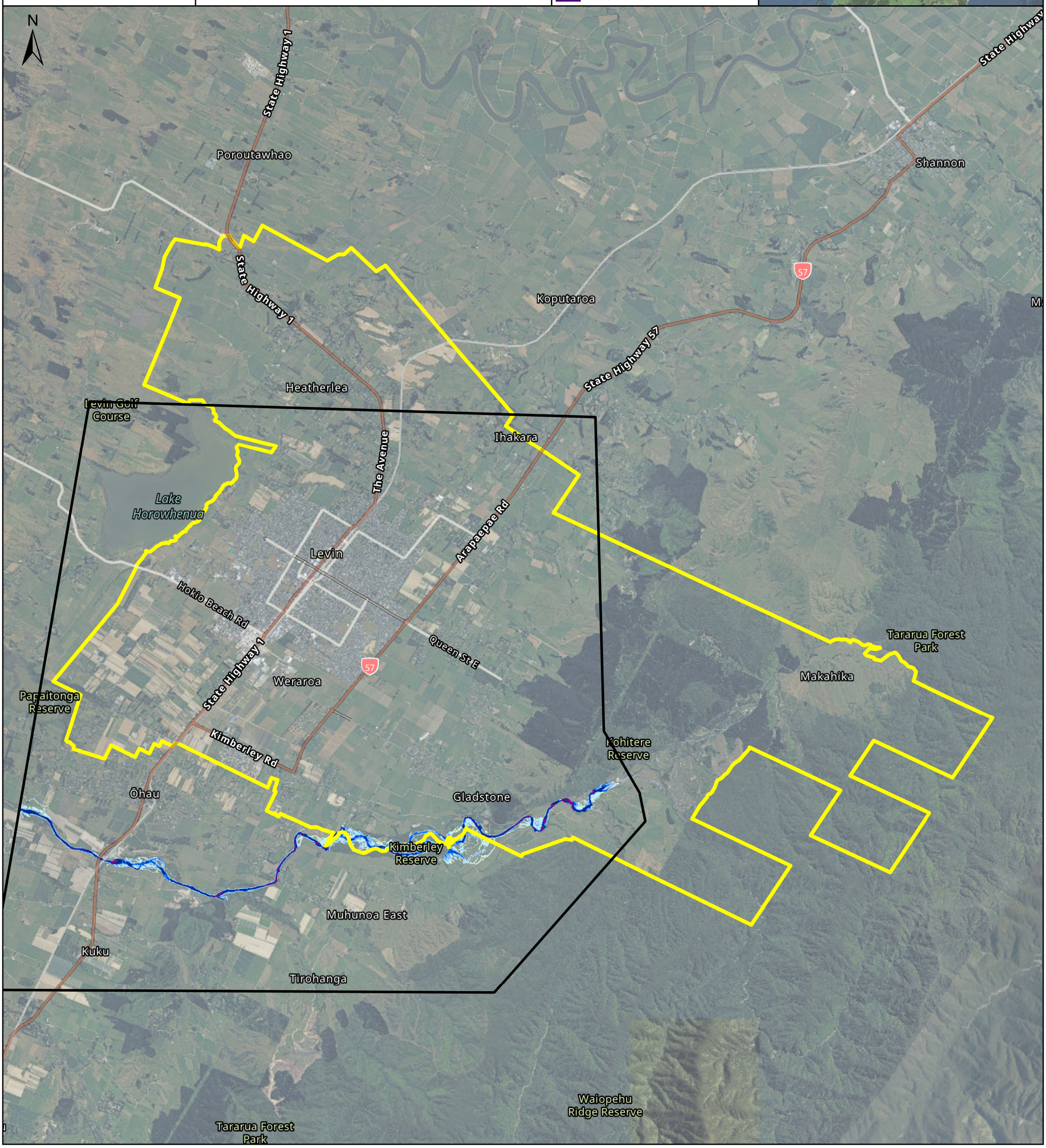
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community
Levin,
Horowhenua District

Scale 1:67,000 at A3

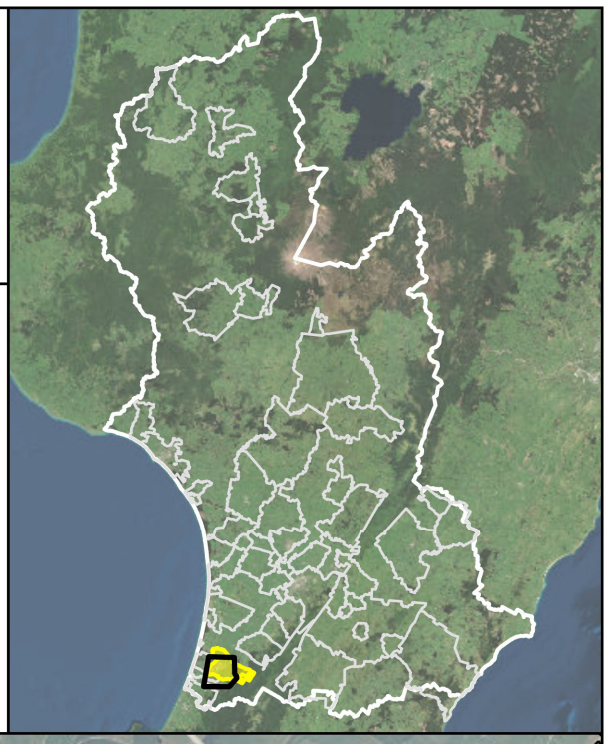
0 1.75 3.5 Km

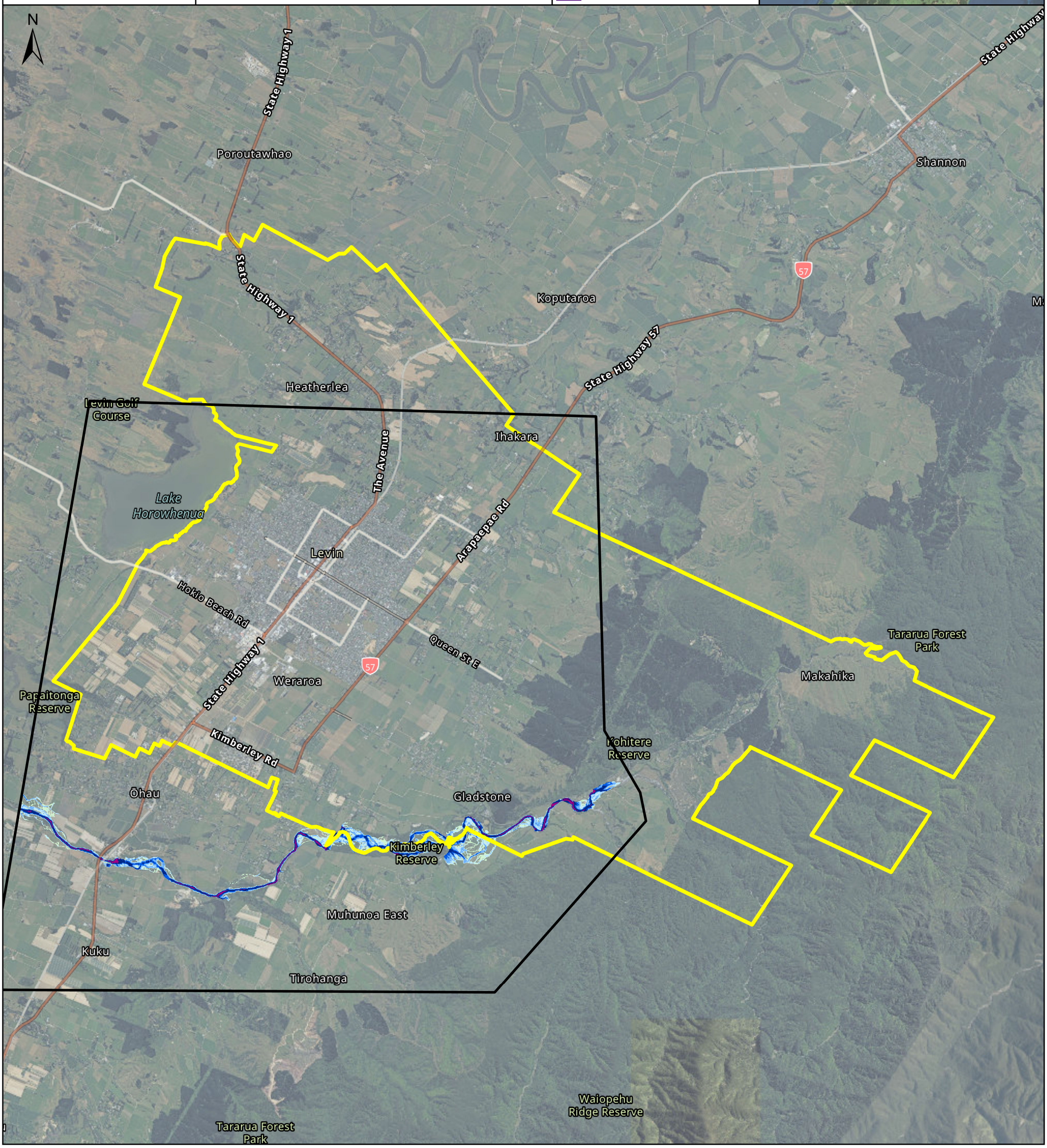
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community
Levin,
Horowhenua District

Scale 1:67,000 at A3

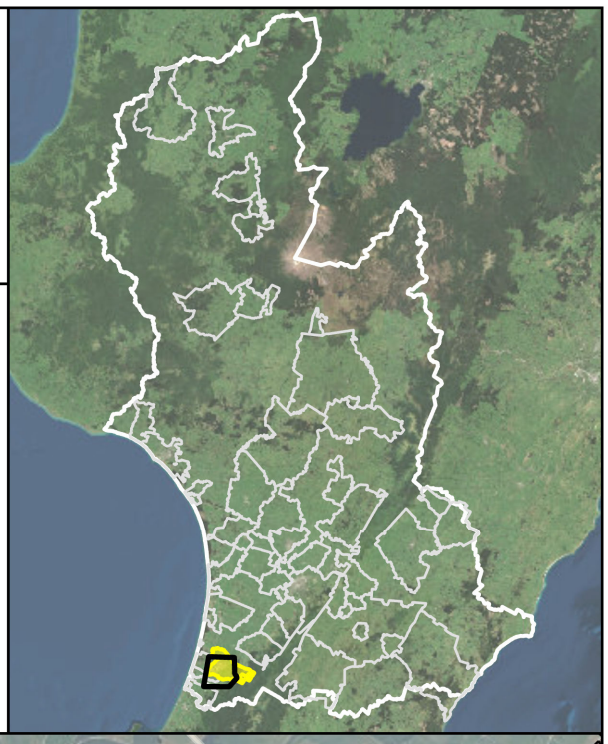
0 1.75 3.5 Km

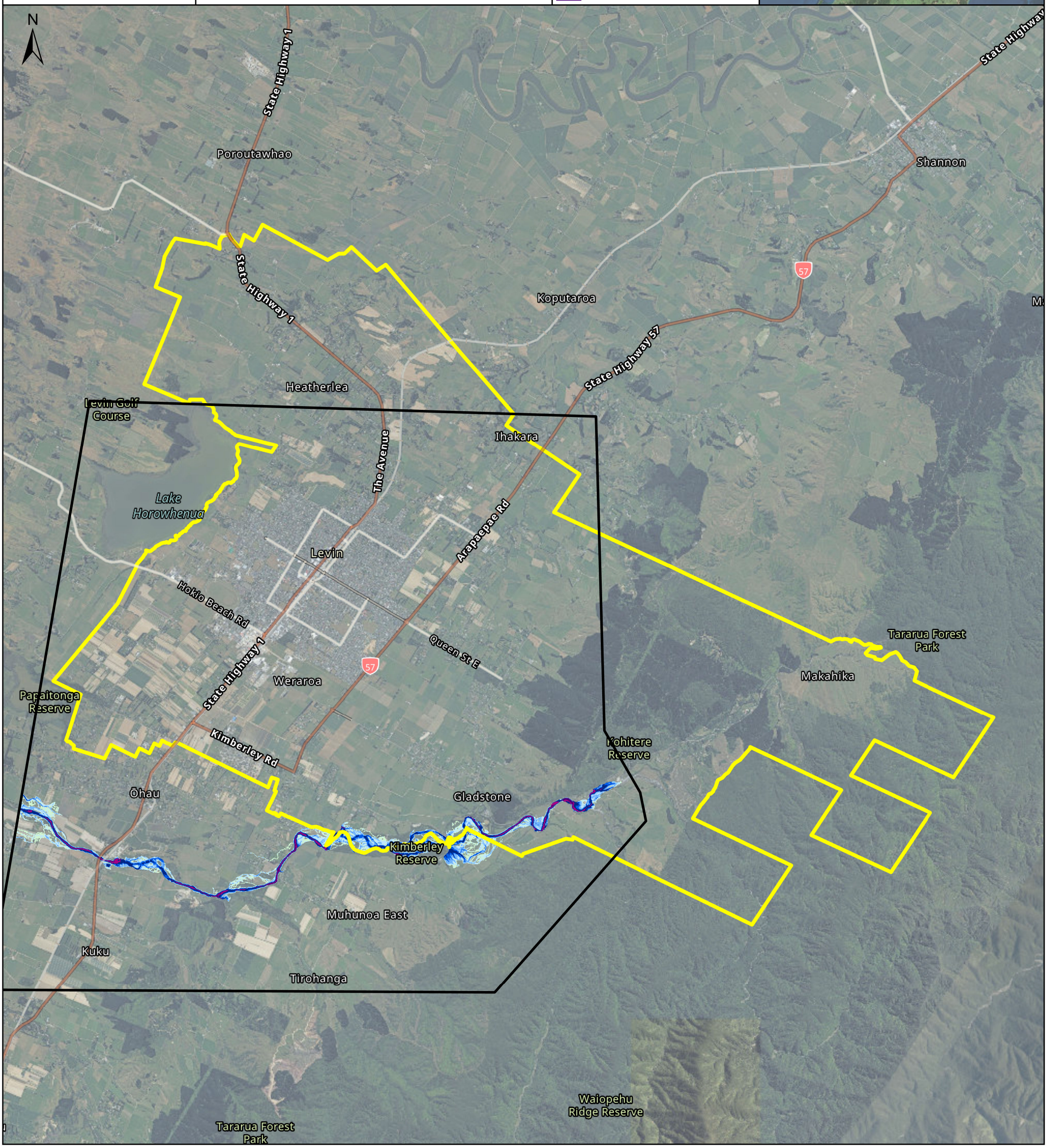
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

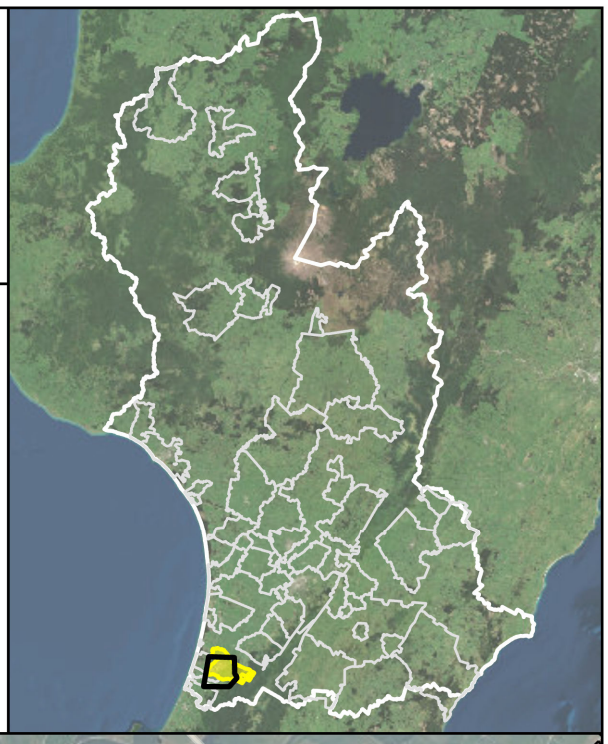
Community
Levin,
Horowhenua District

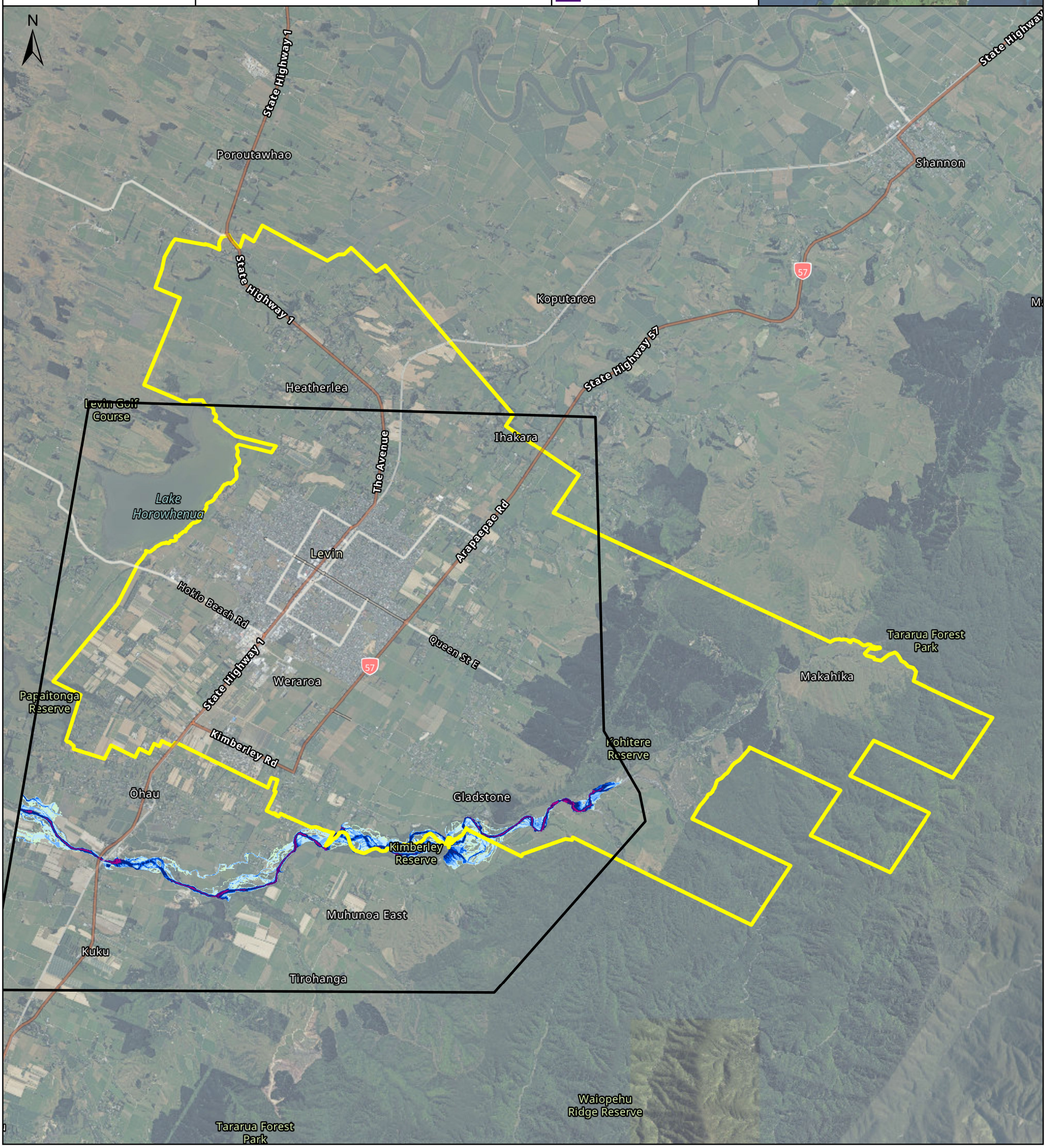
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community
Levin,
Horowhenua District

Scale 1:67,000 at A3

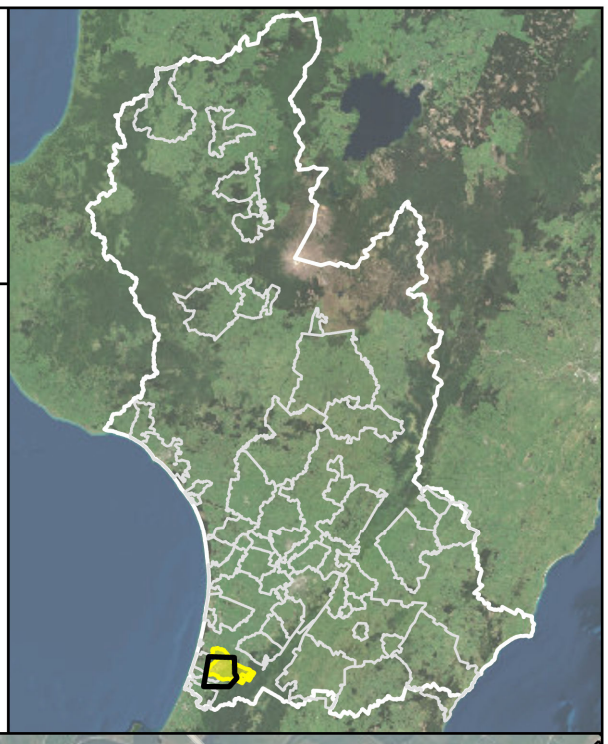
0 1.75 3.5 Km

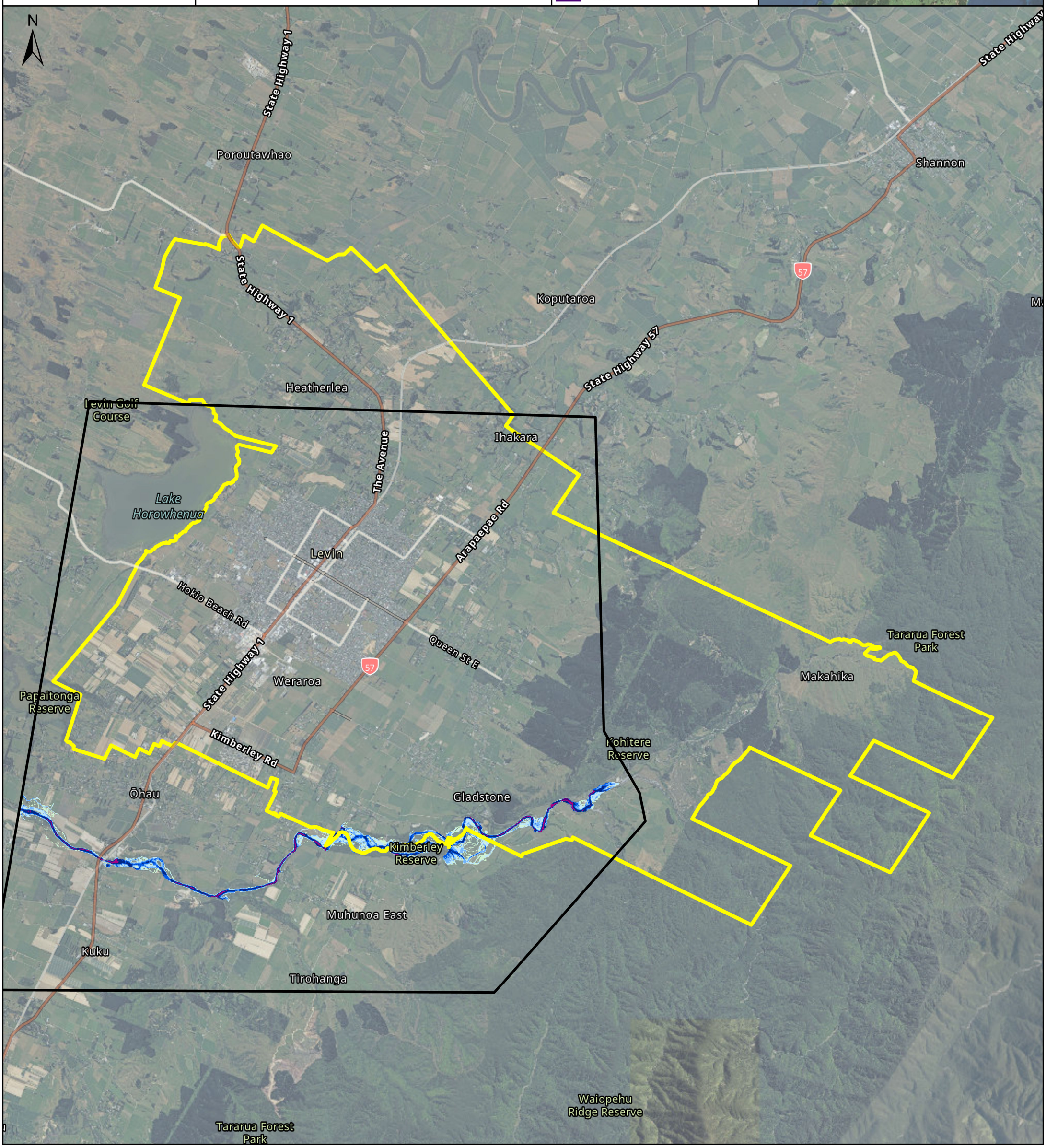
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

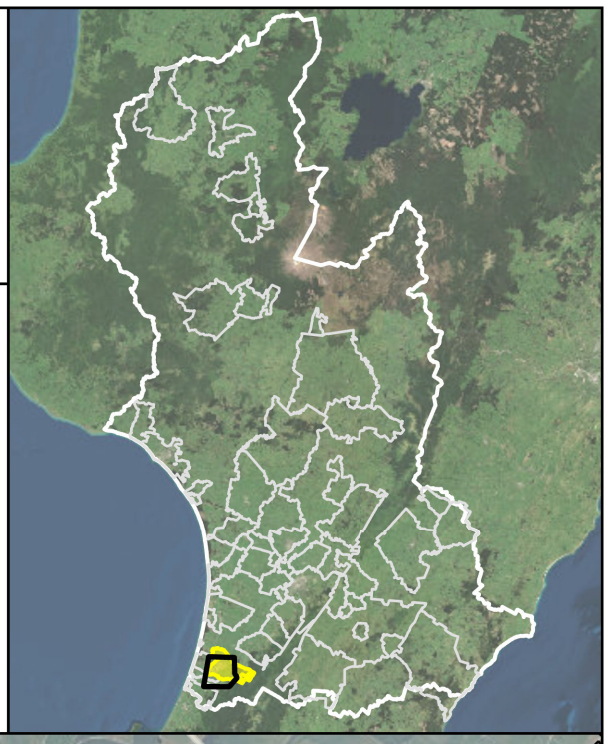
Community
Levin,
Horowhenua District

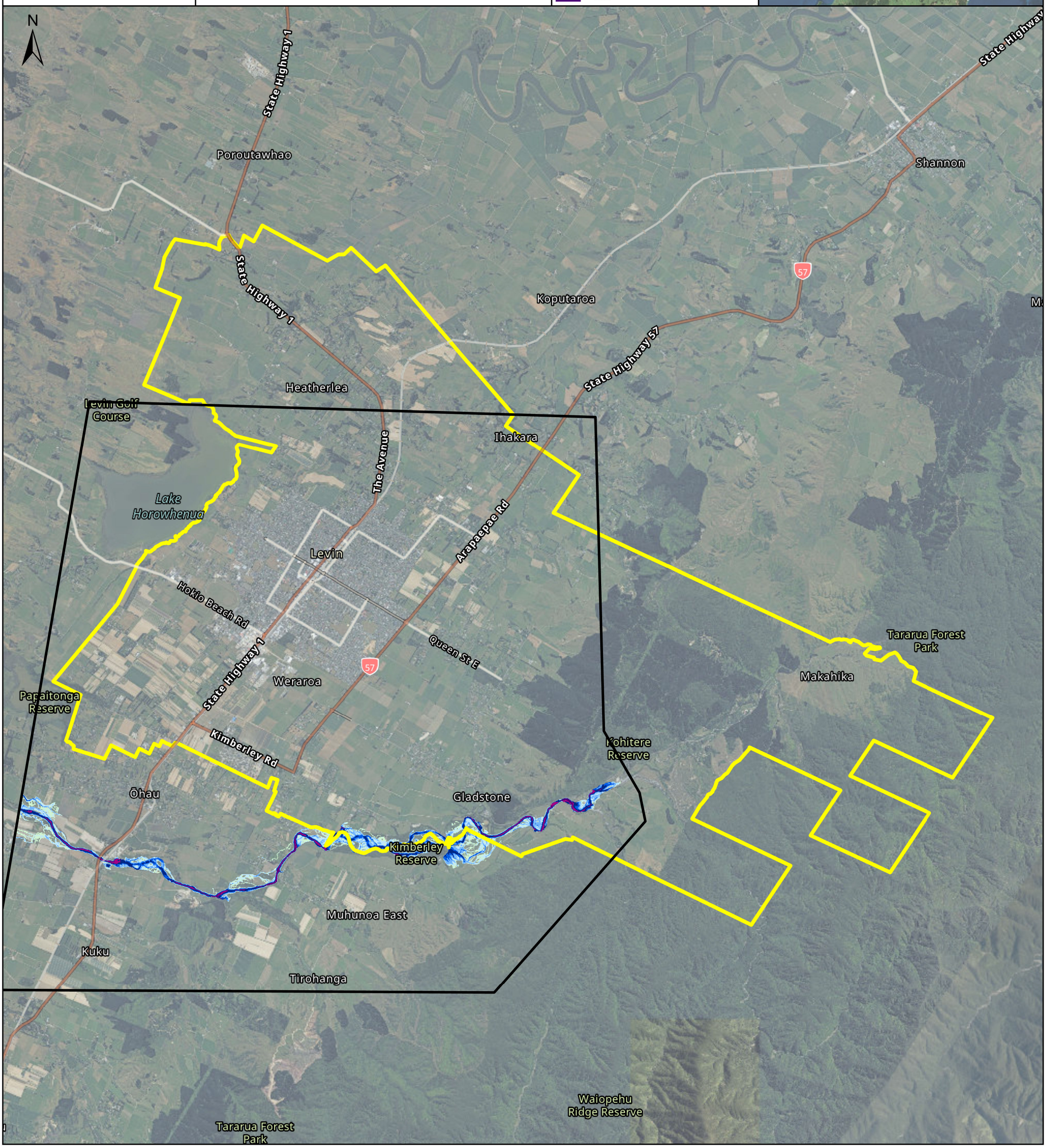
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

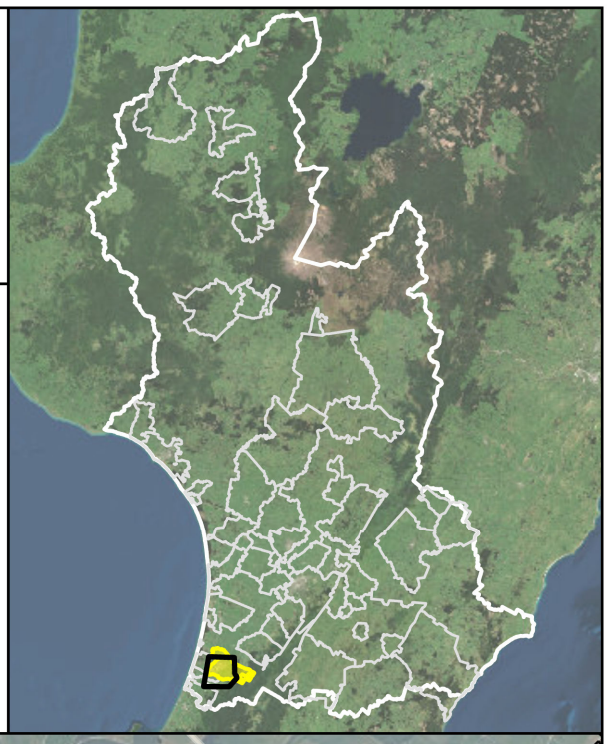
0 1.75 3.5 Km

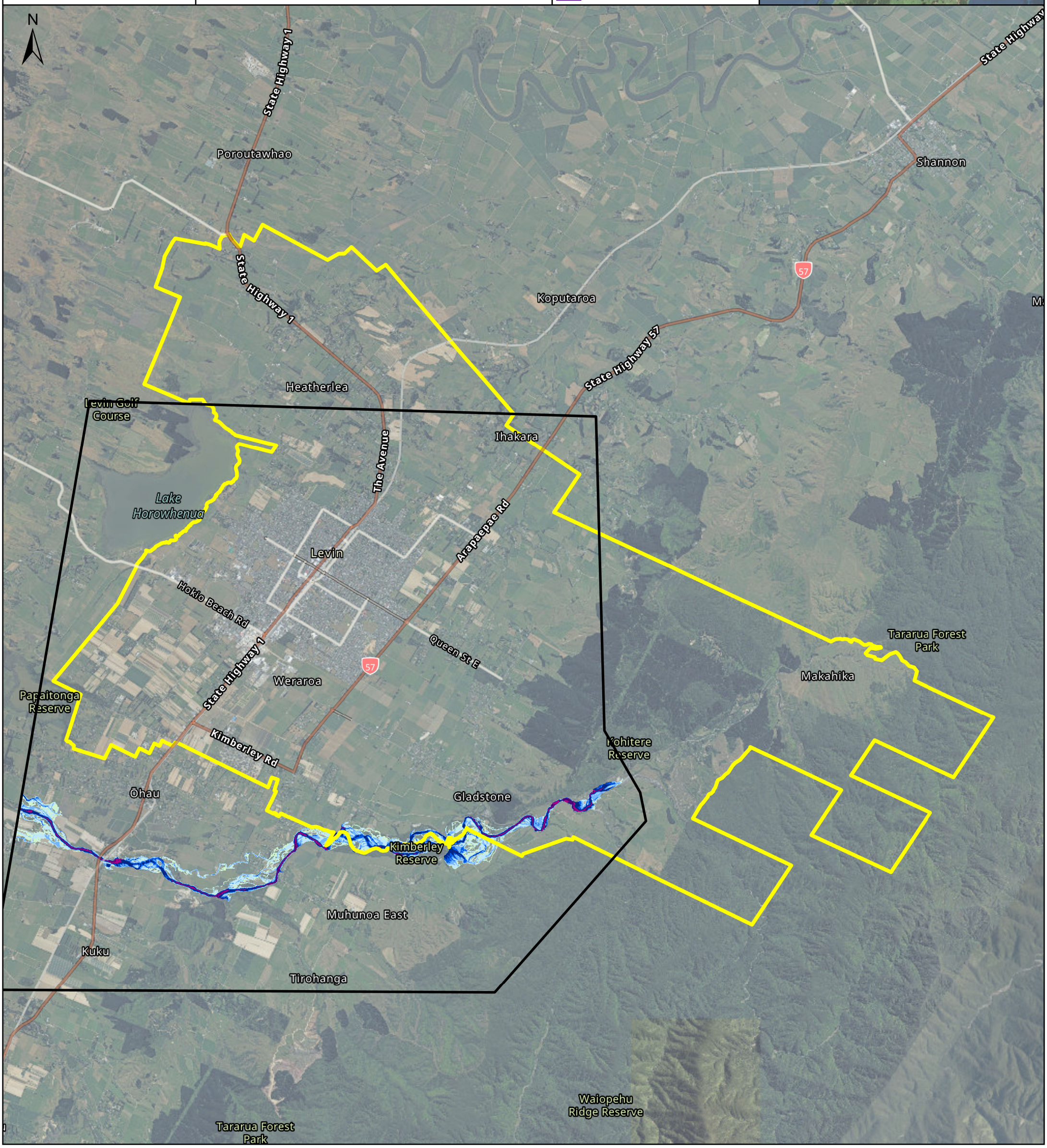
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

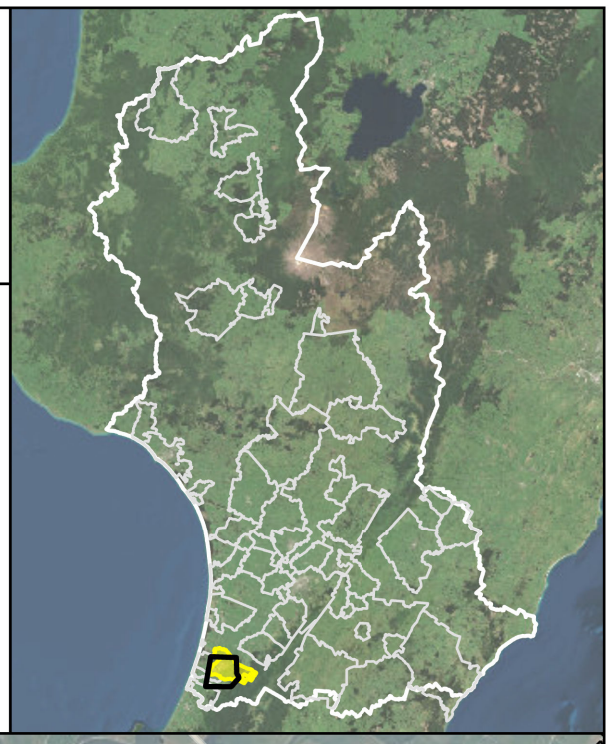
0 1.75 3.5 Km

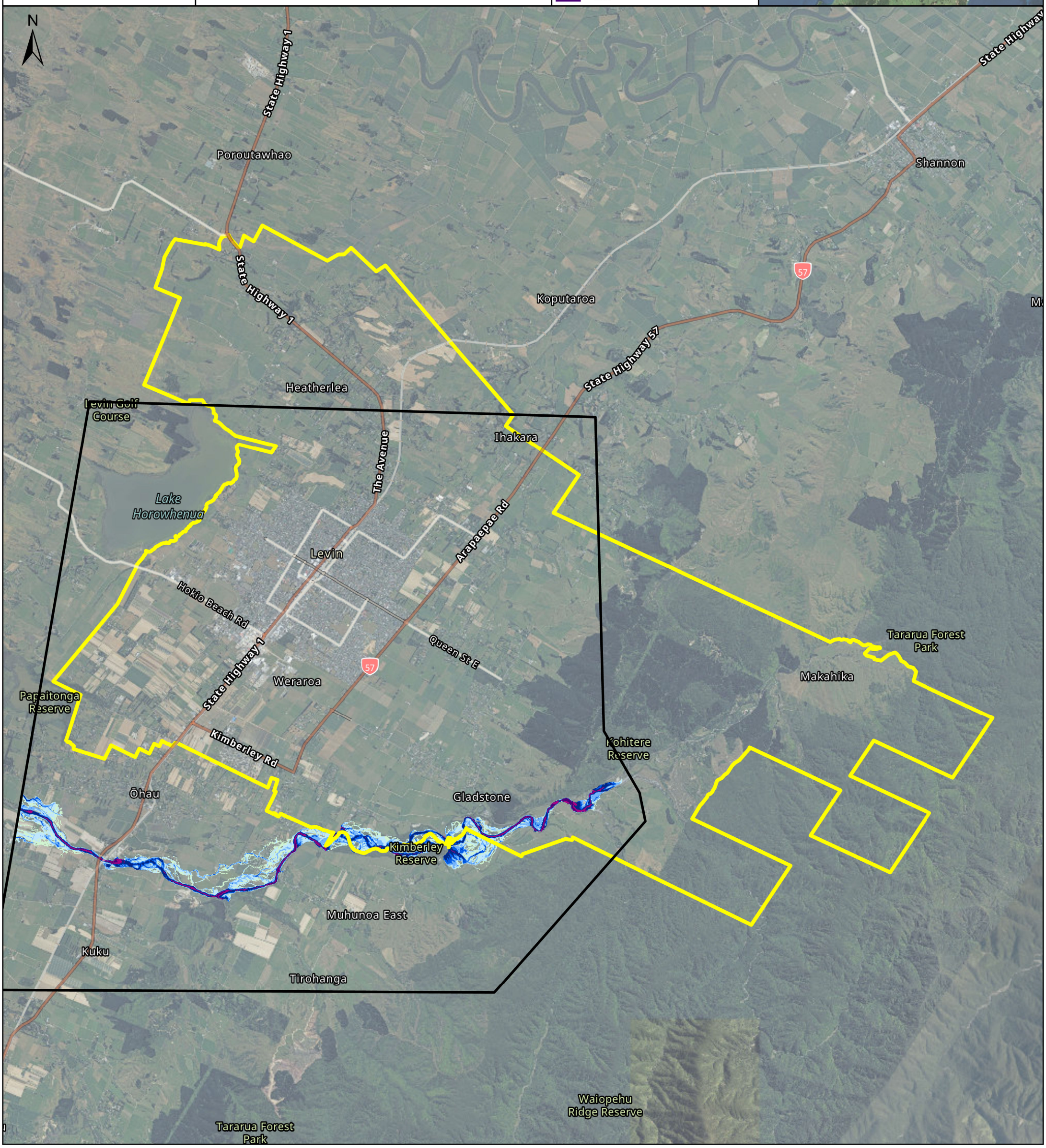
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

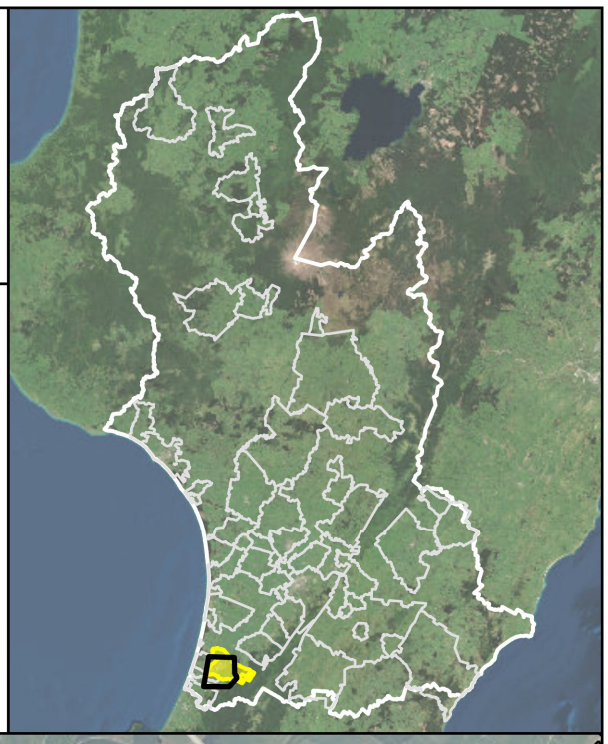
Community
Levin,
Horowhenua District

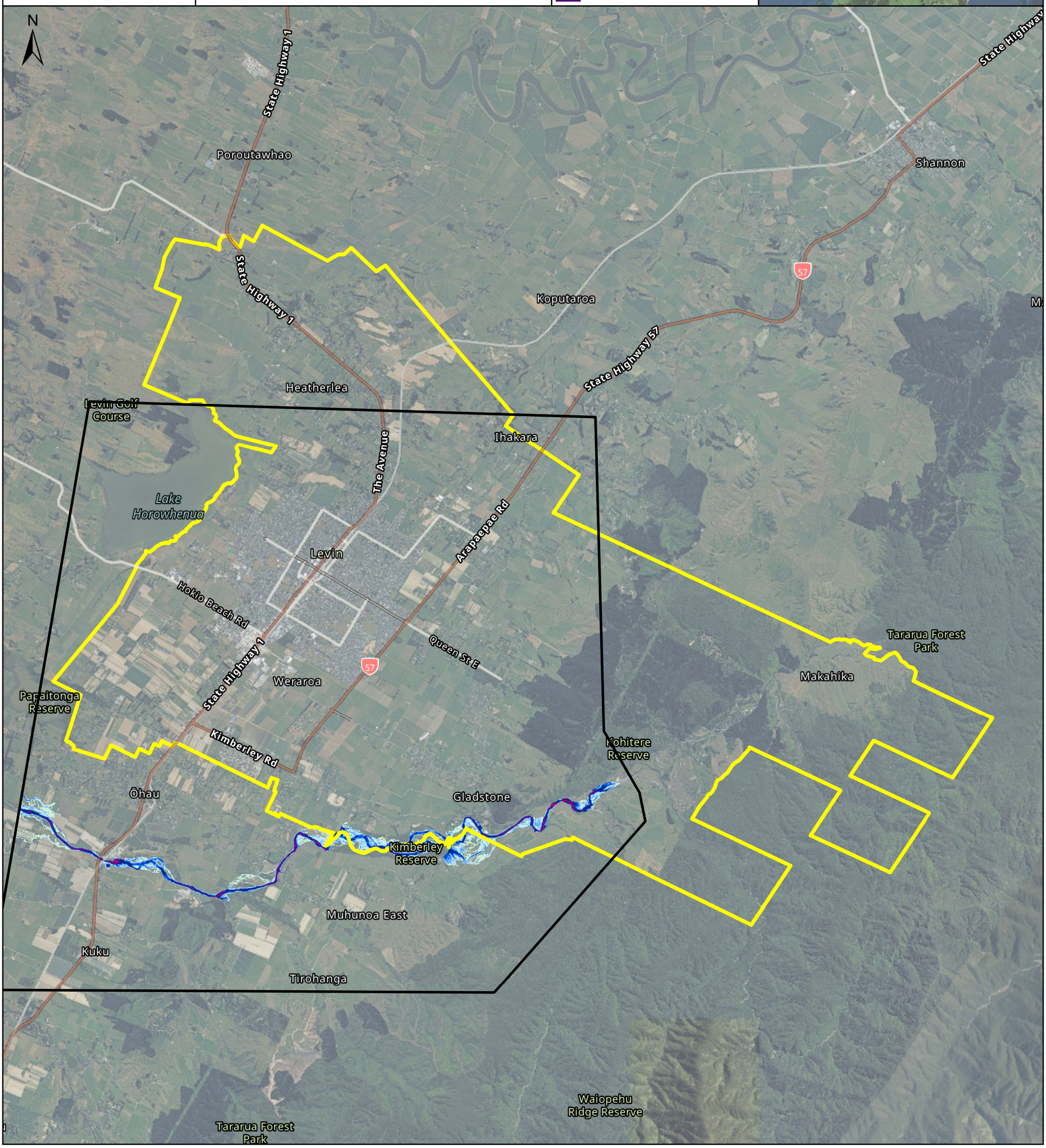
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

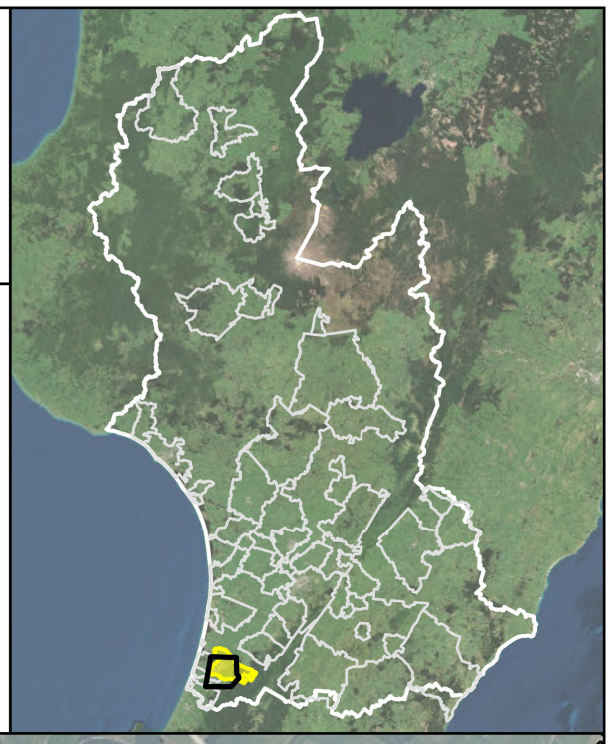
0 1.75 3.5 Km

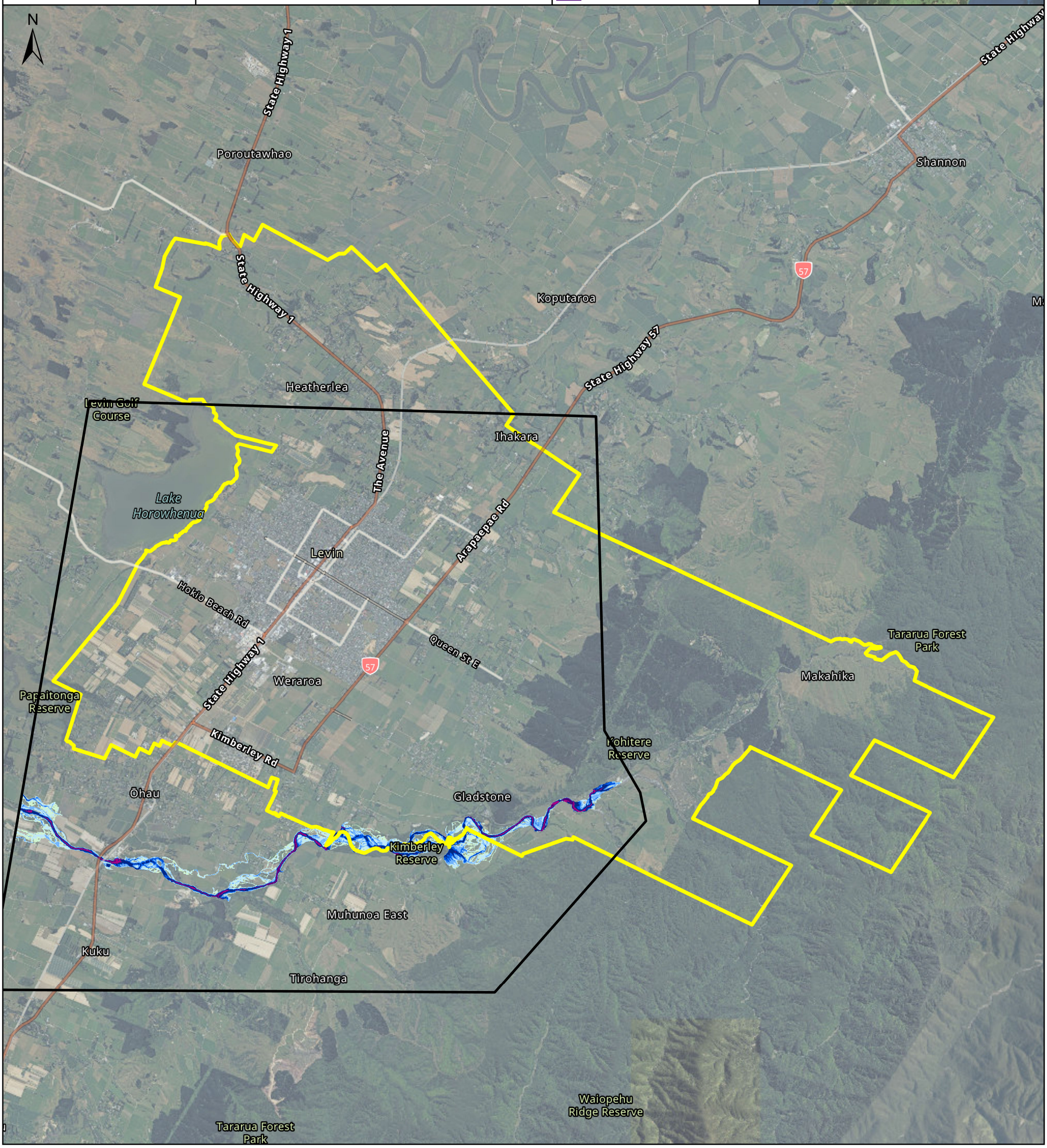
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community
Levin,
Horowhenua District

Scale 1:67,000 at A3

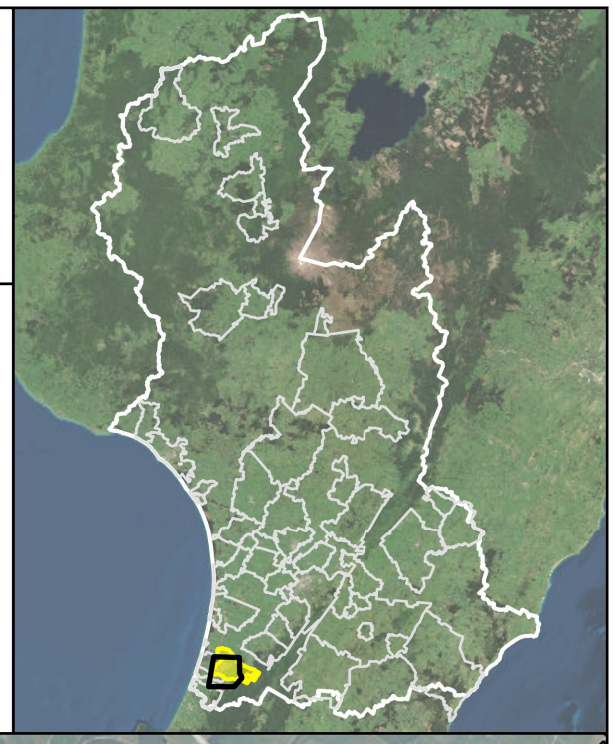
0 1.75 3.5 Km

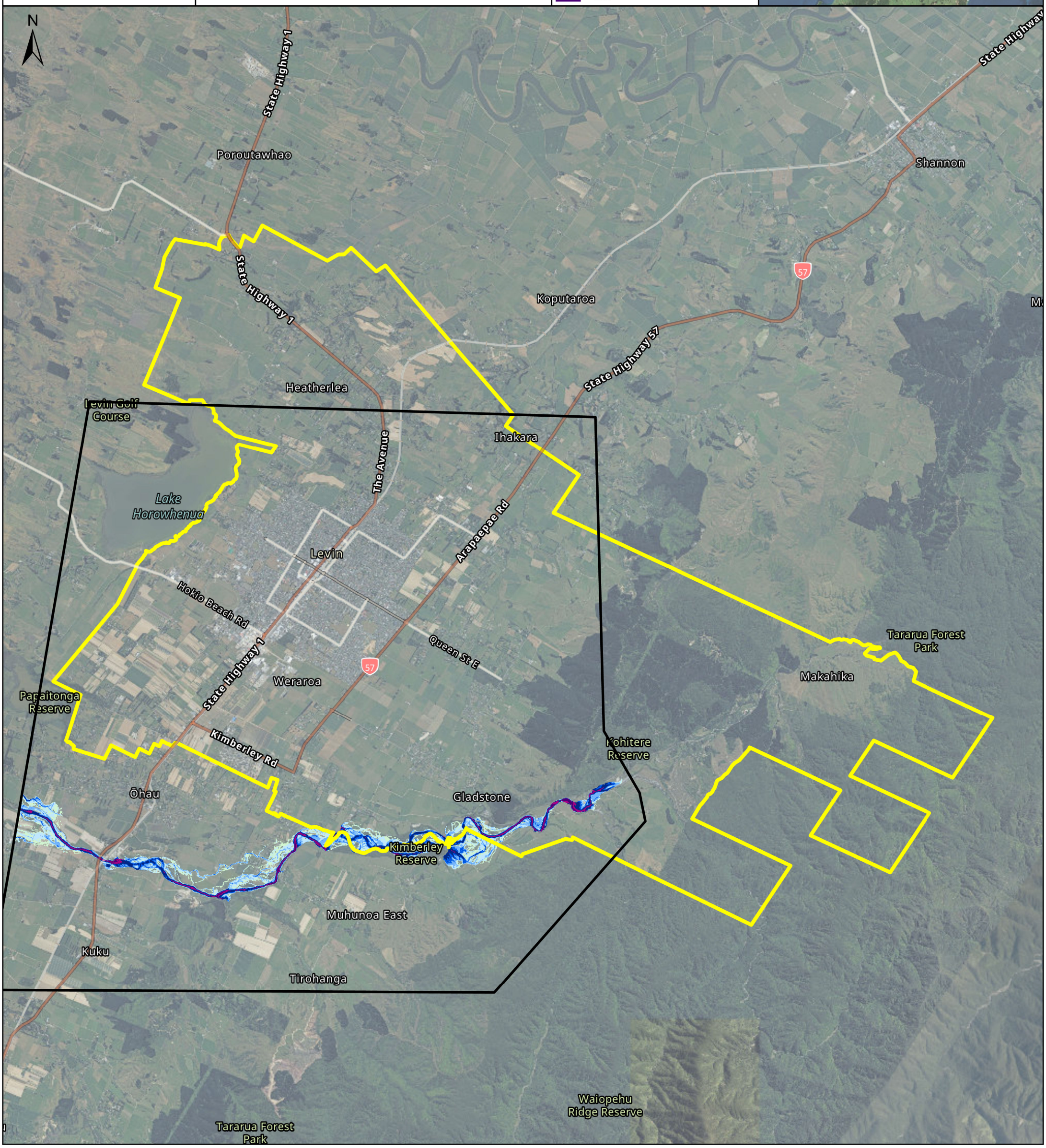
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

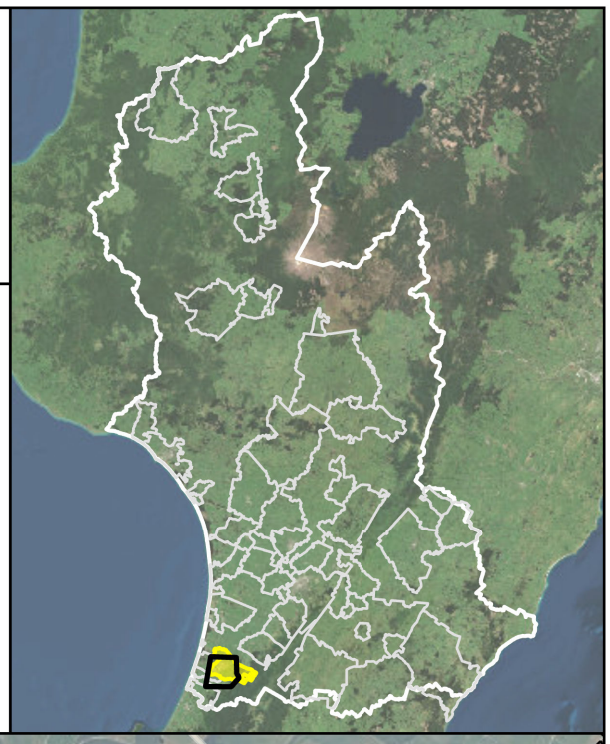
0 1.75 3.5 Km

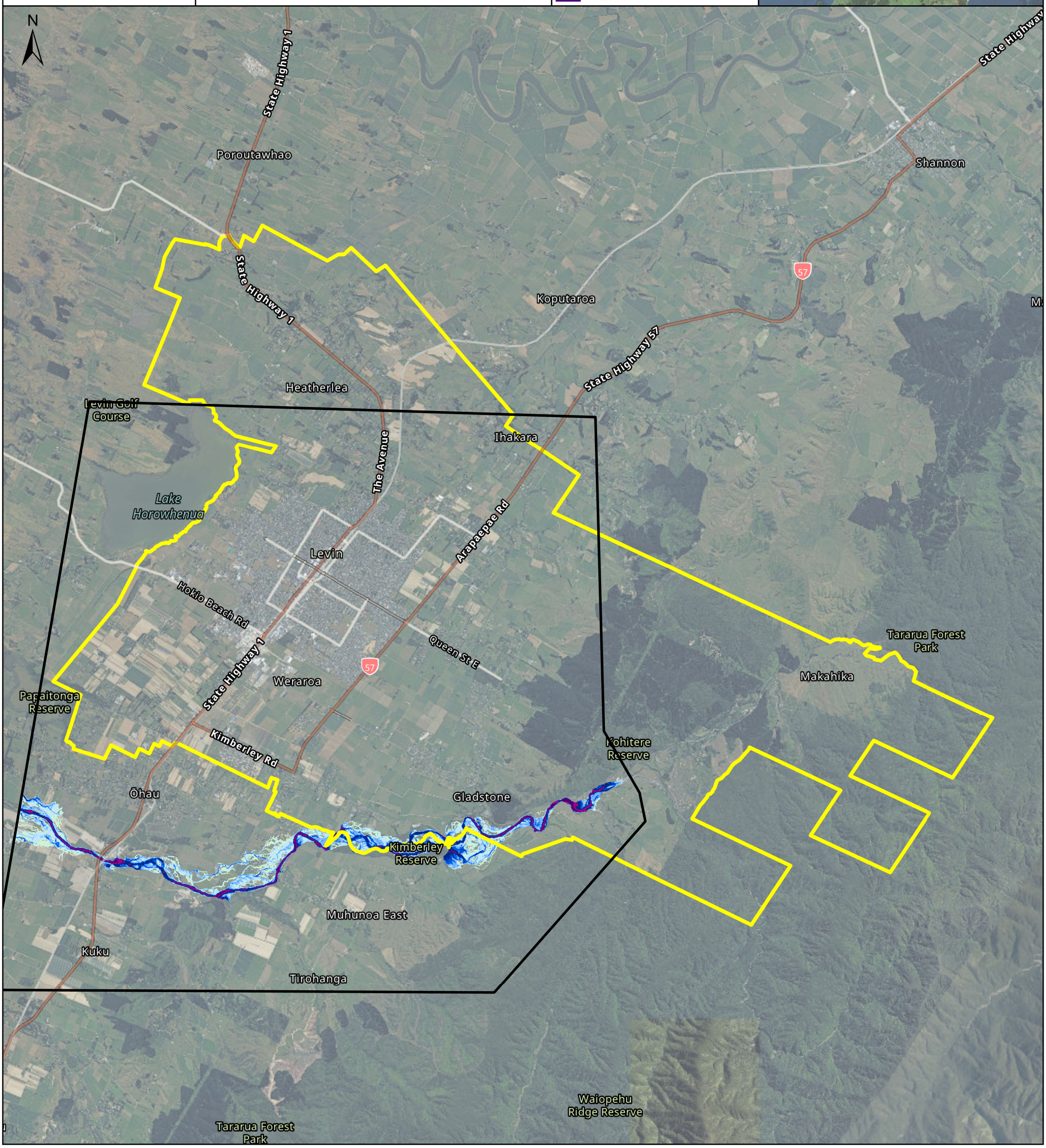
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

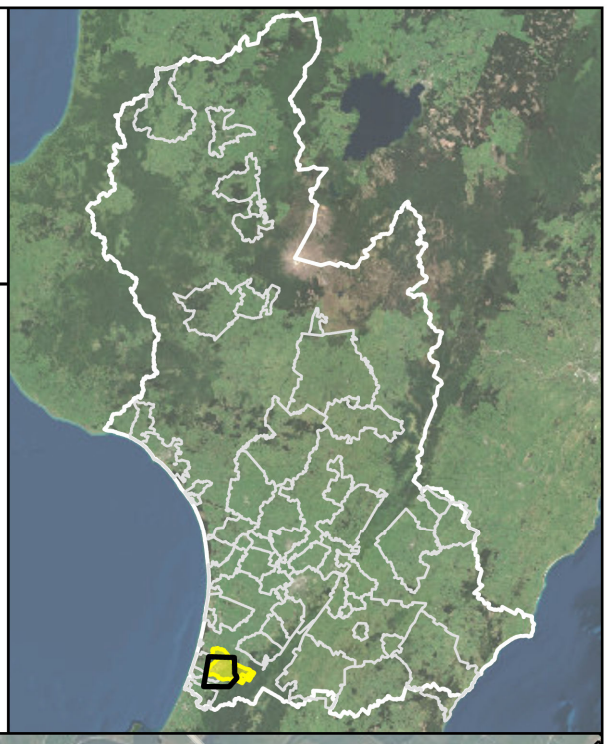
Community
Levin,
Horowhenua District

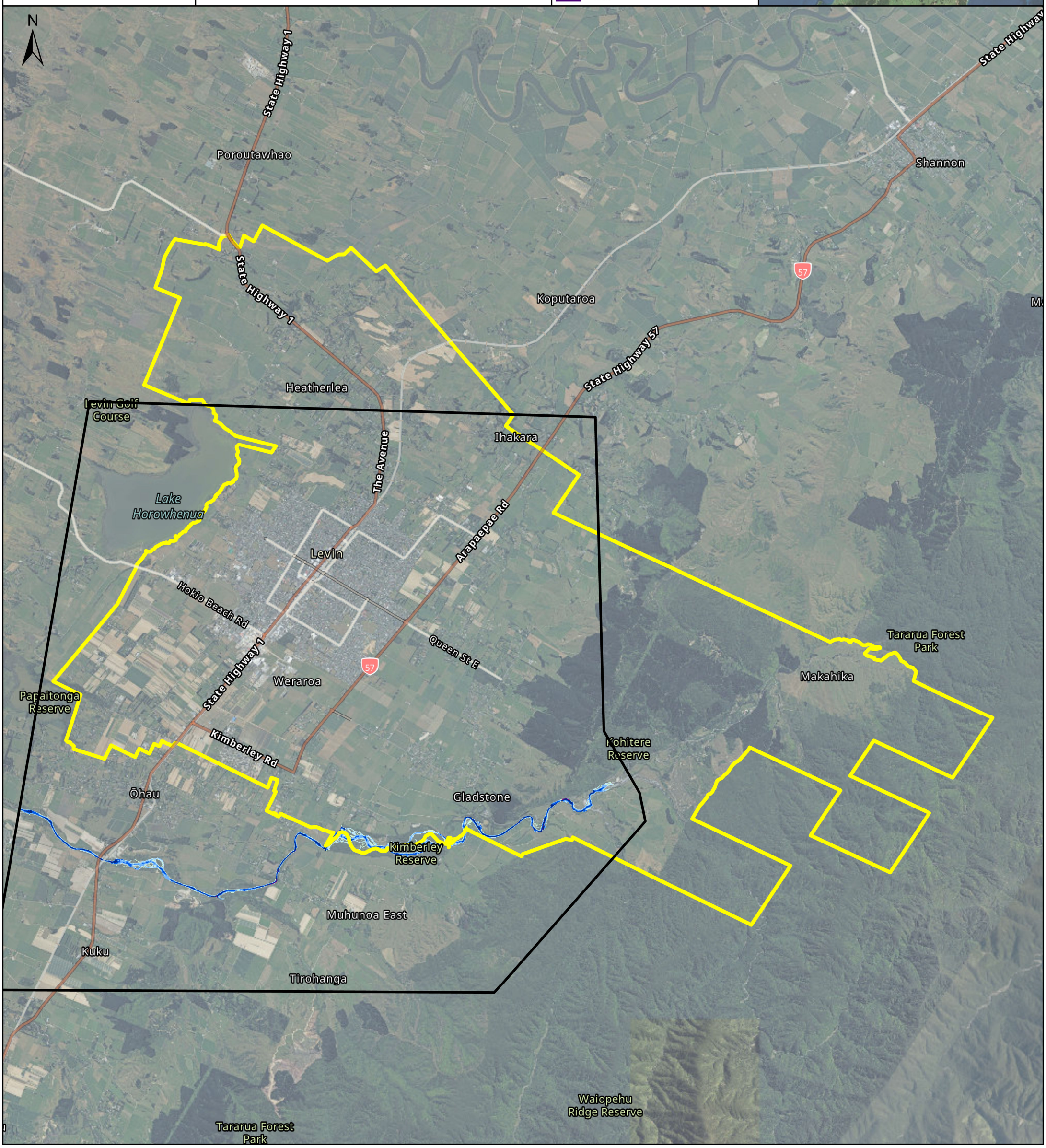
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

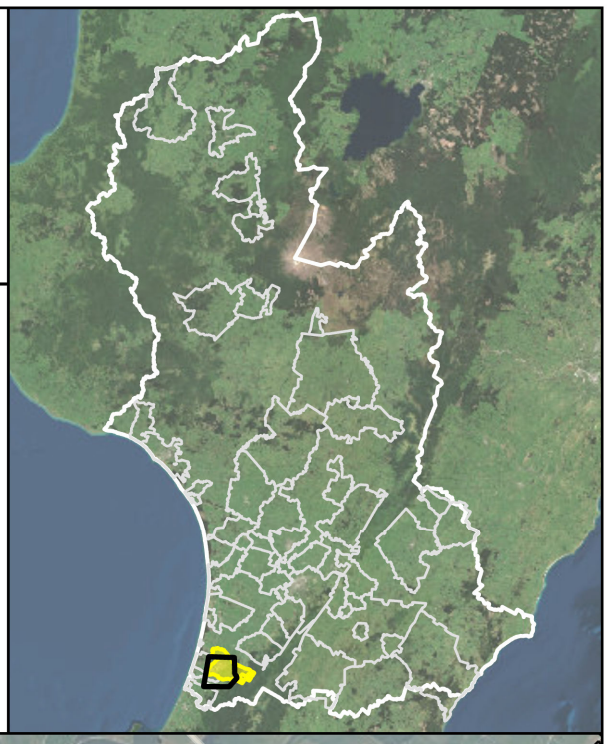
0 1.75 3.5 Km

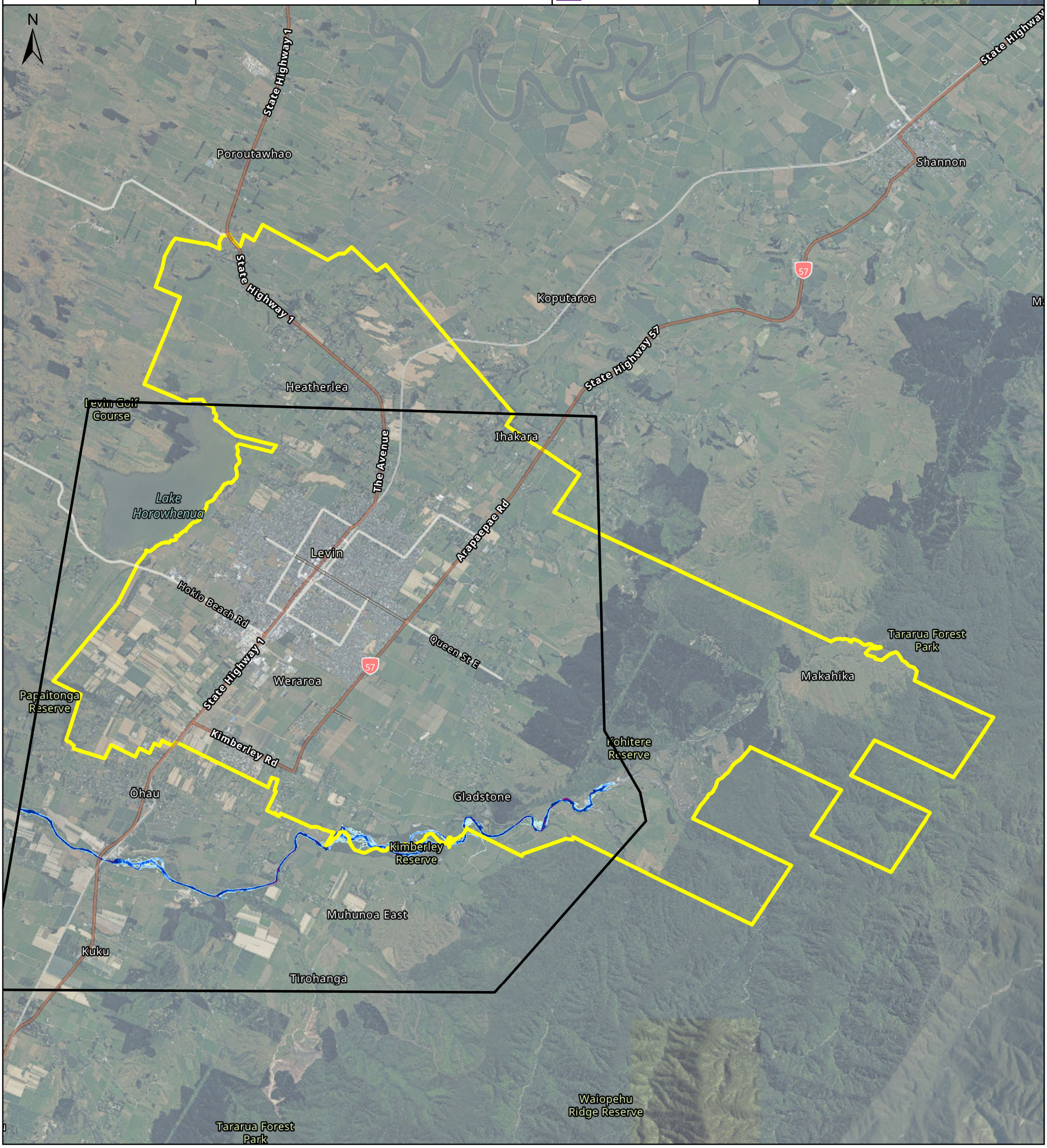
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

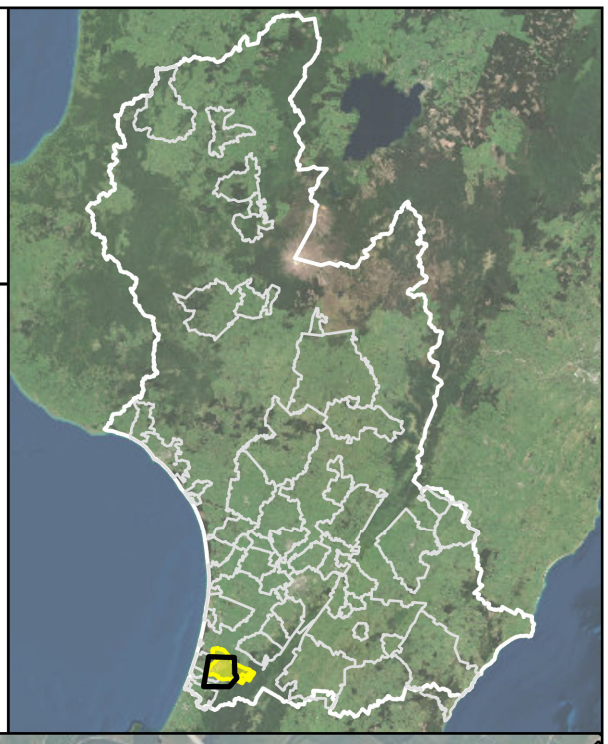
0 1.75 3.5 Km

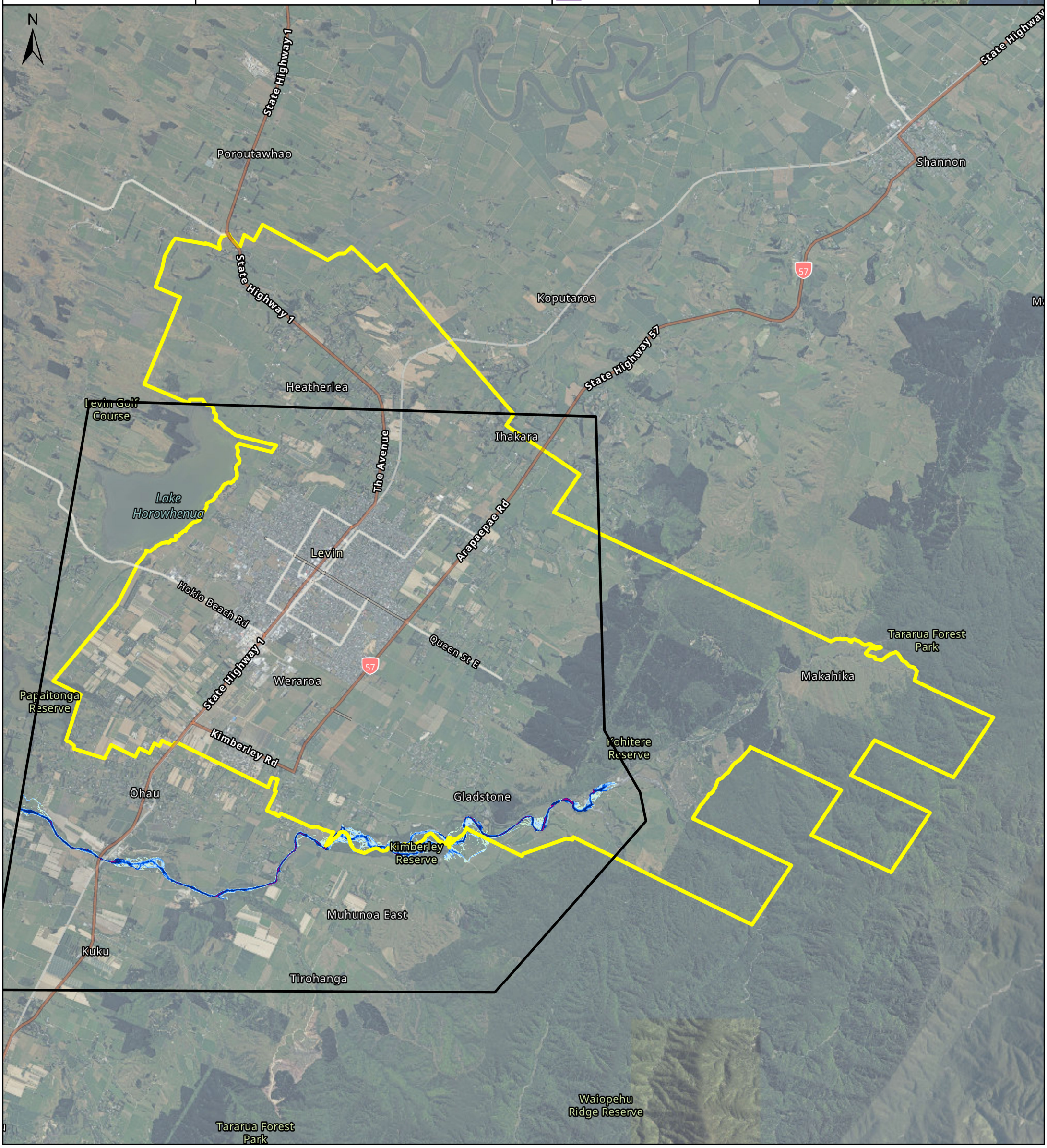
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

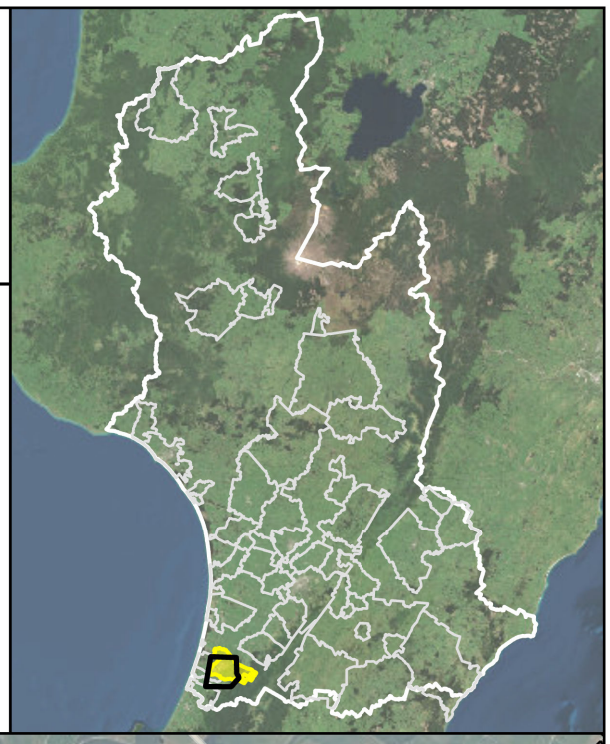
Community
Levin,
Horowhenua District

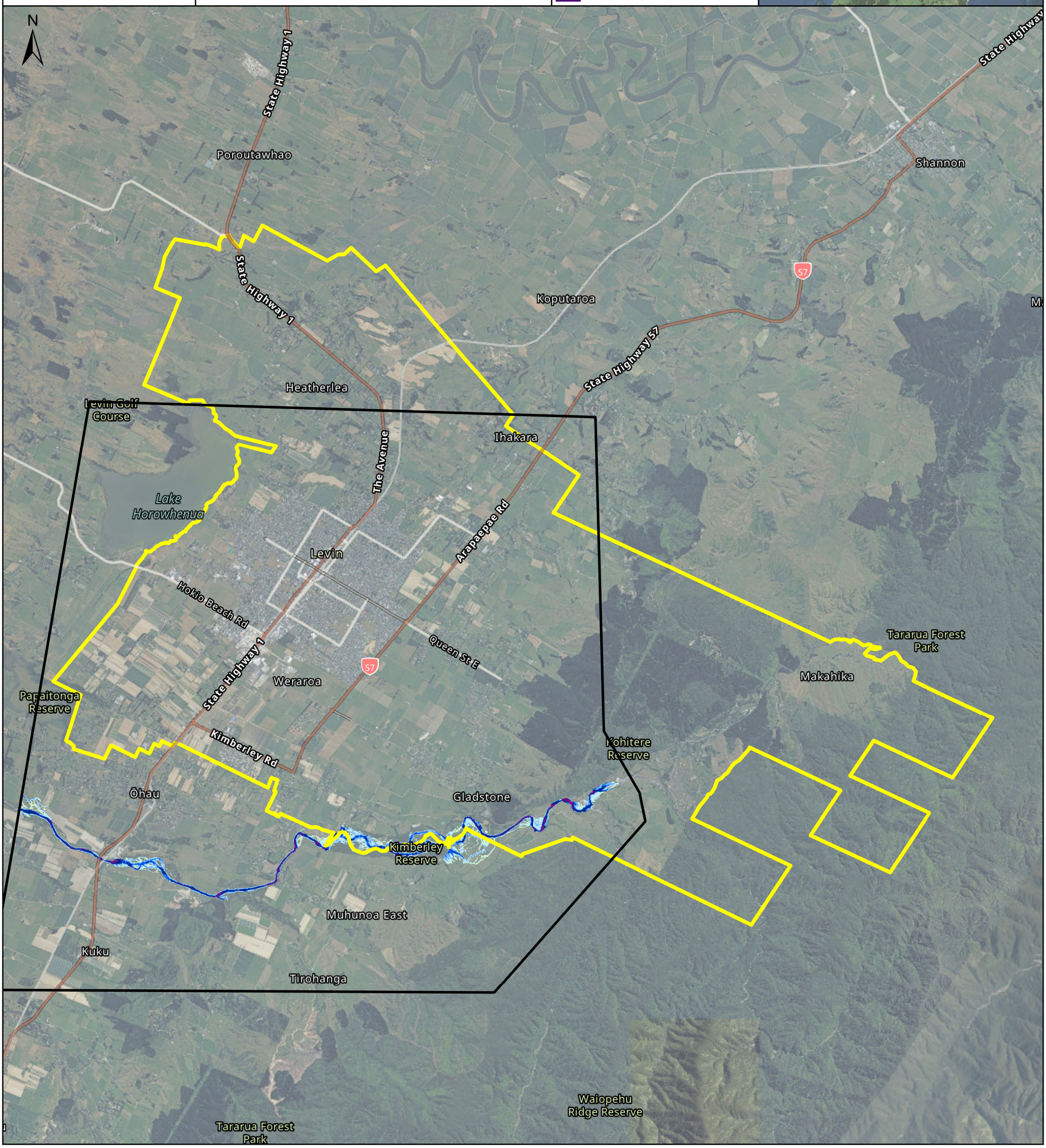
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 1 degree warming due to climate change, sea level rise excluded

Community

Levin,
Horowhenua District

Scale 1:67,000 at A3

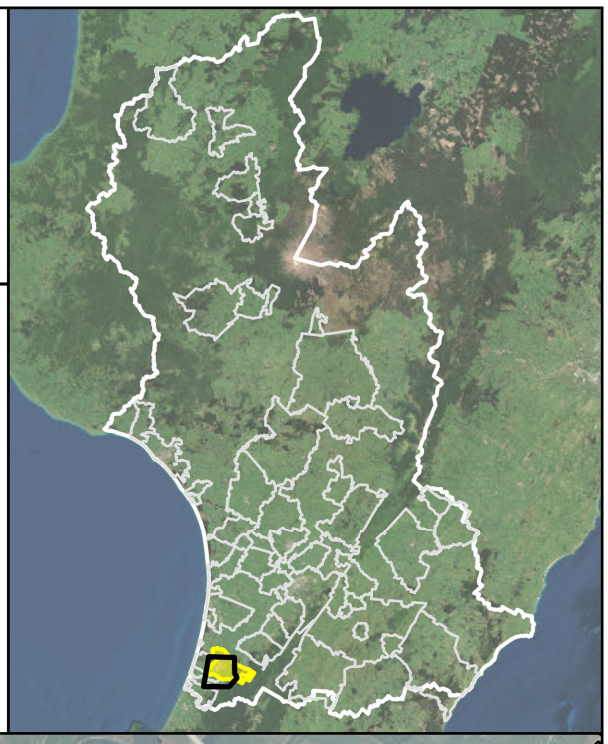
0 1.75 3.5 Km

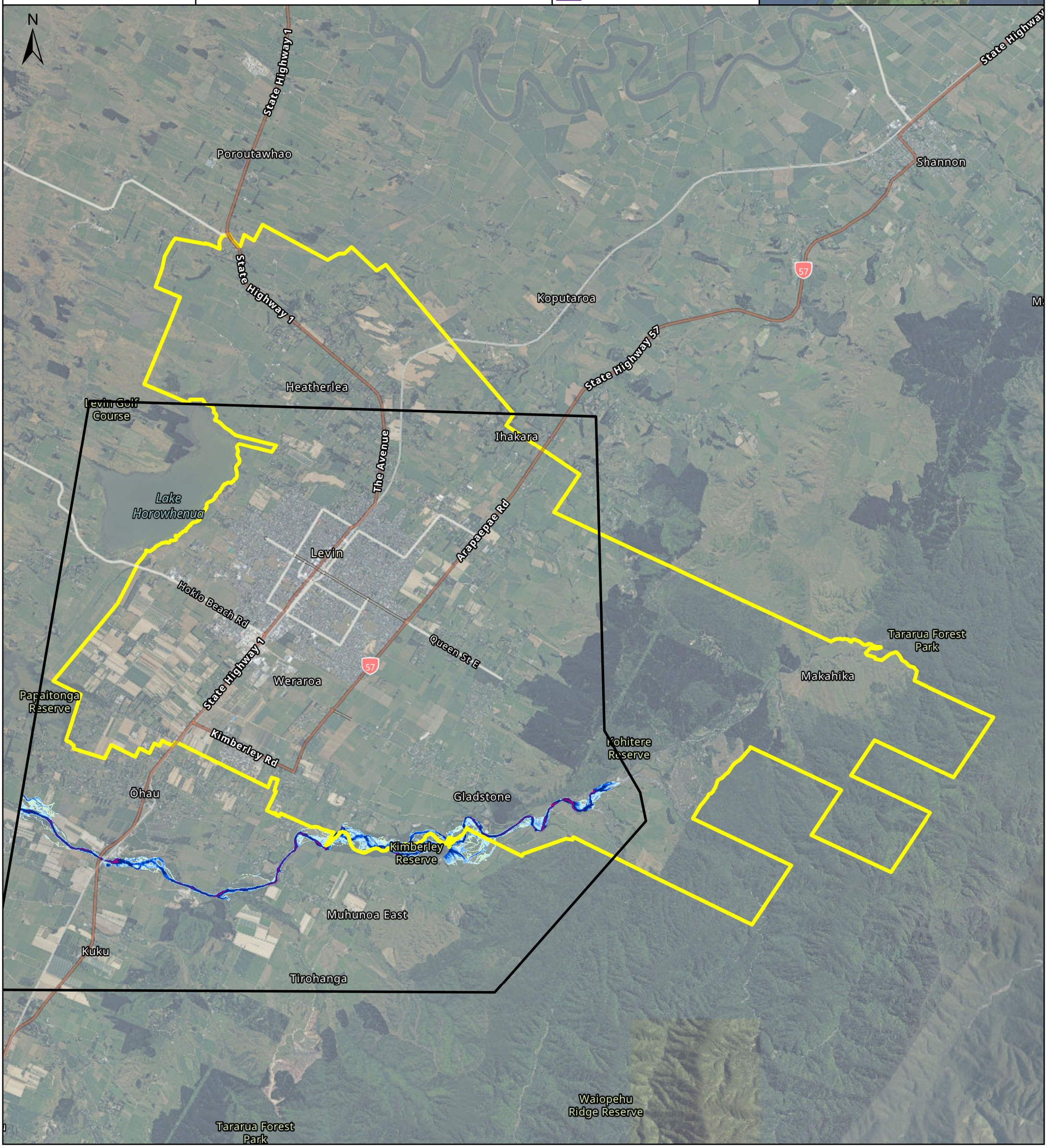
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 2 degrees warming due to climate change, sea level rise excluded

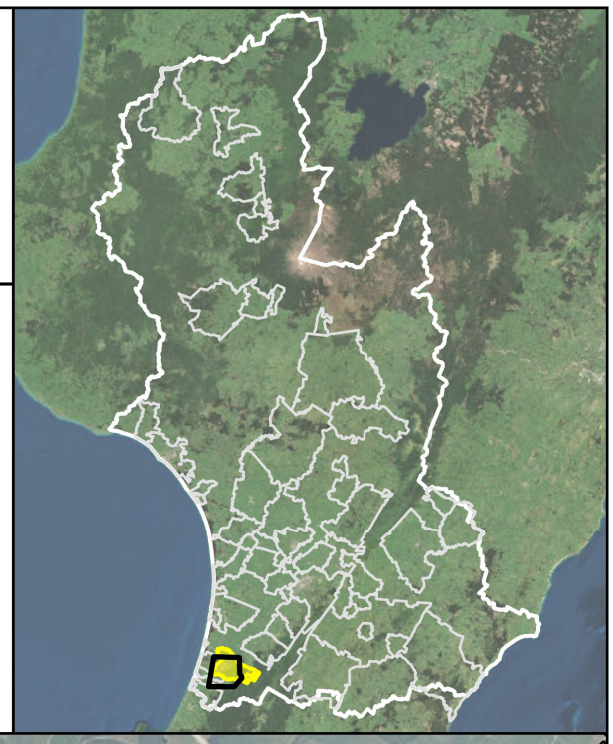
Community
Levin,
Horowhenua District

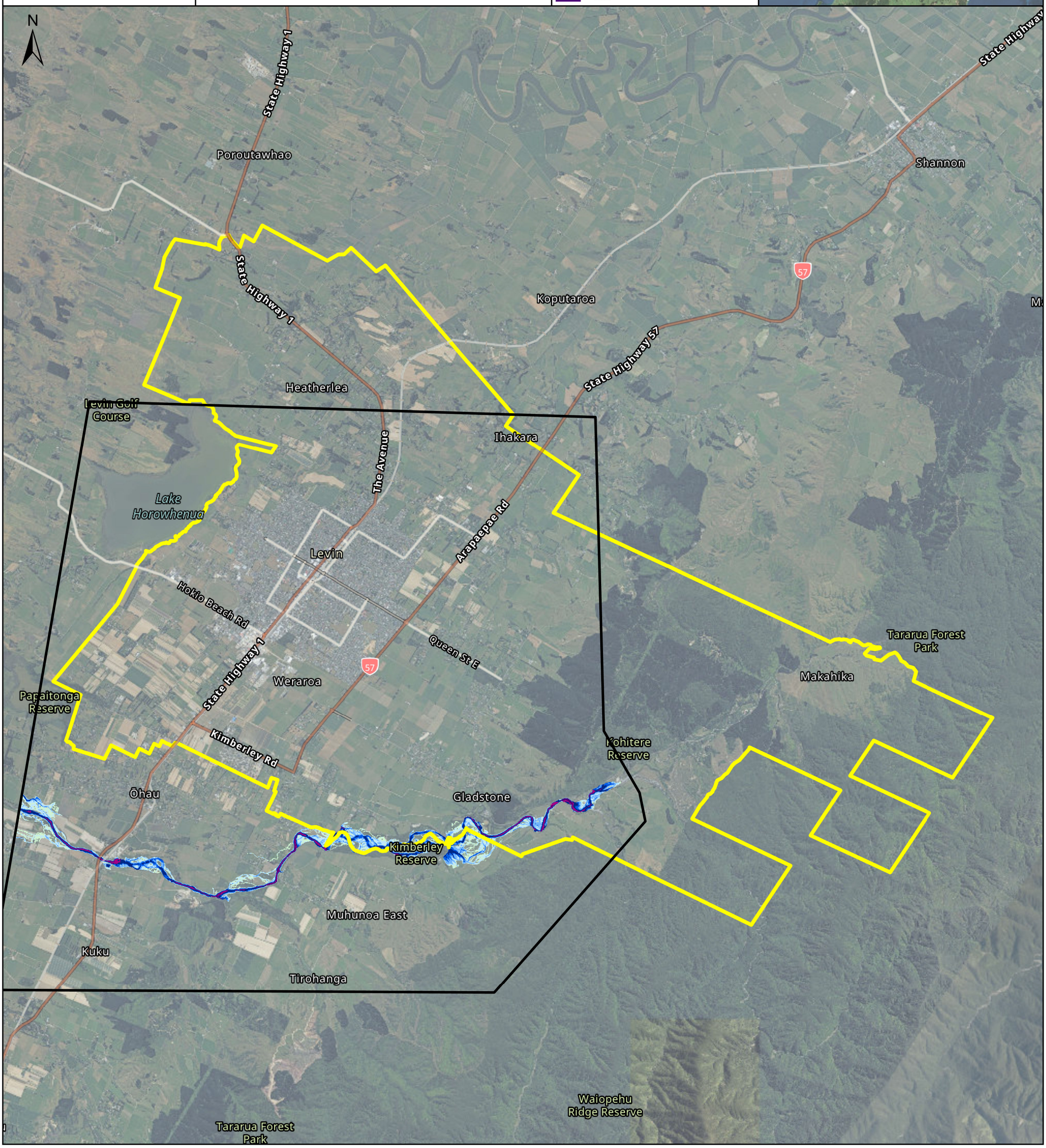
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 3 degrees warming due to climate change, sea level rise excluded

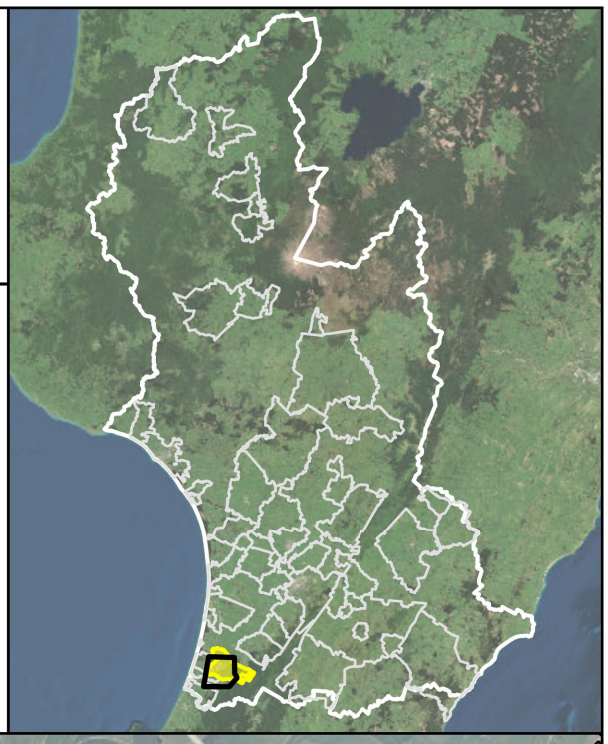
Community
Levin,
Horowhenua District

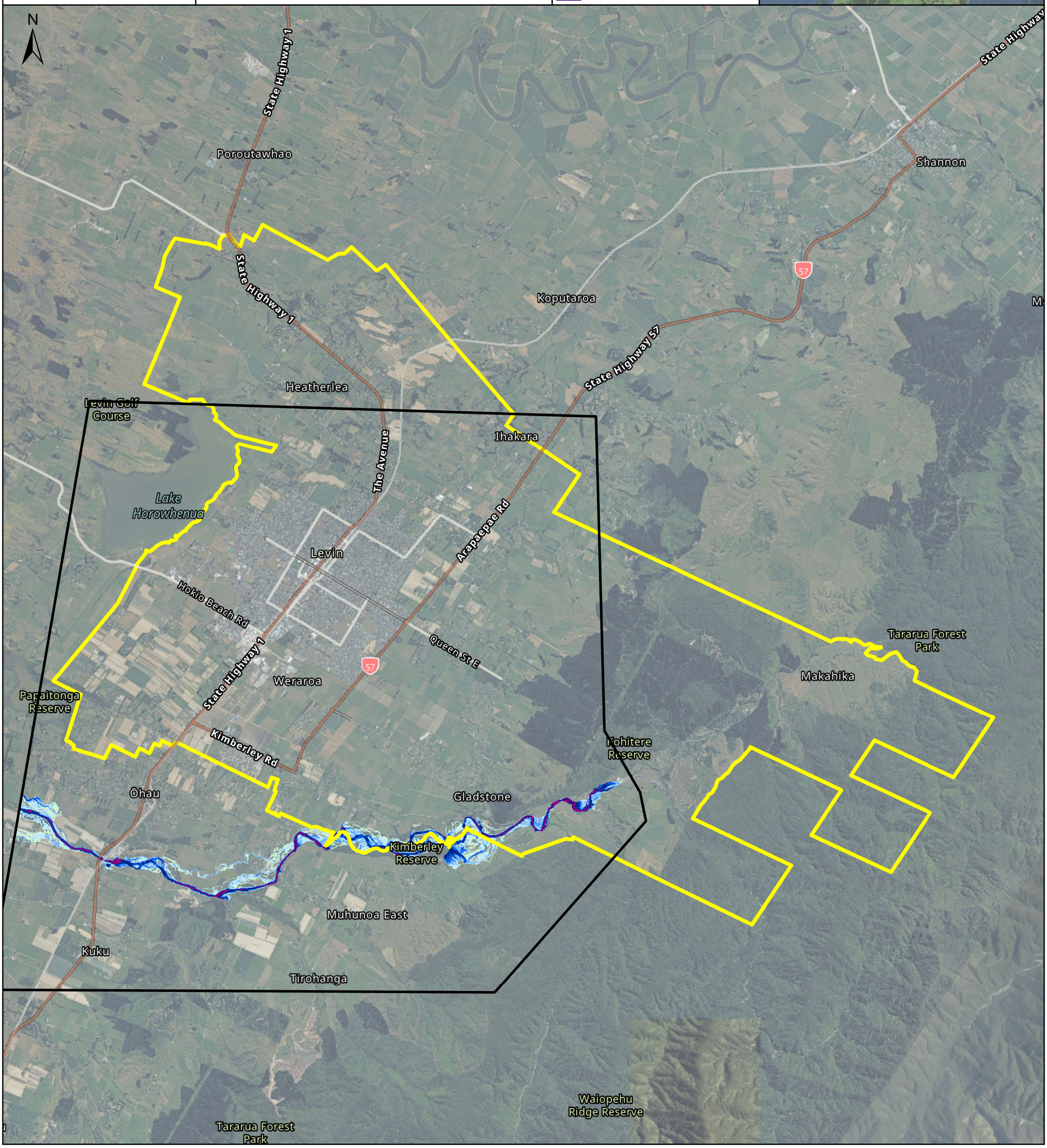
Scale 1:67,000 at A3

0 1.75 3.5 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

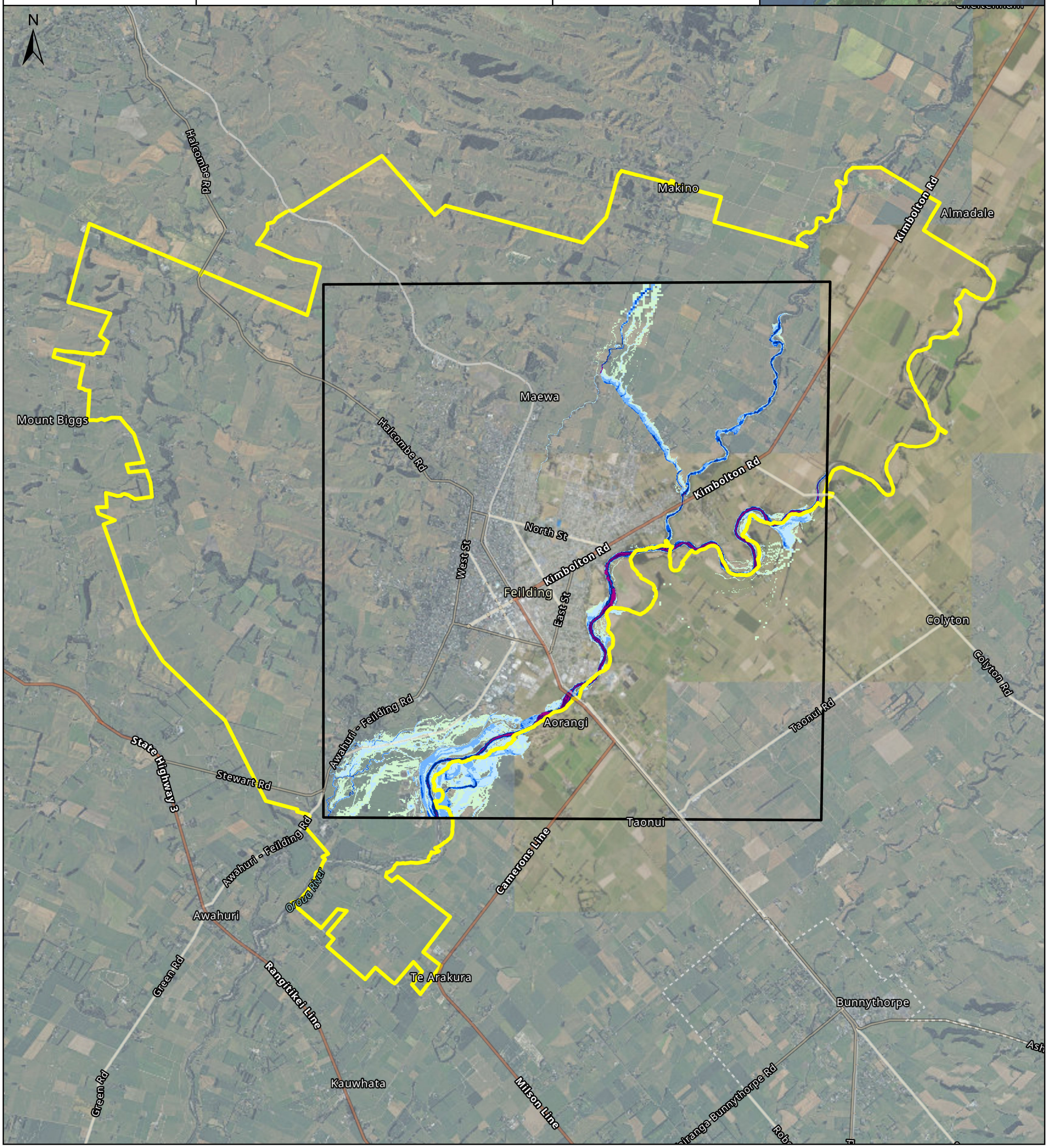
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

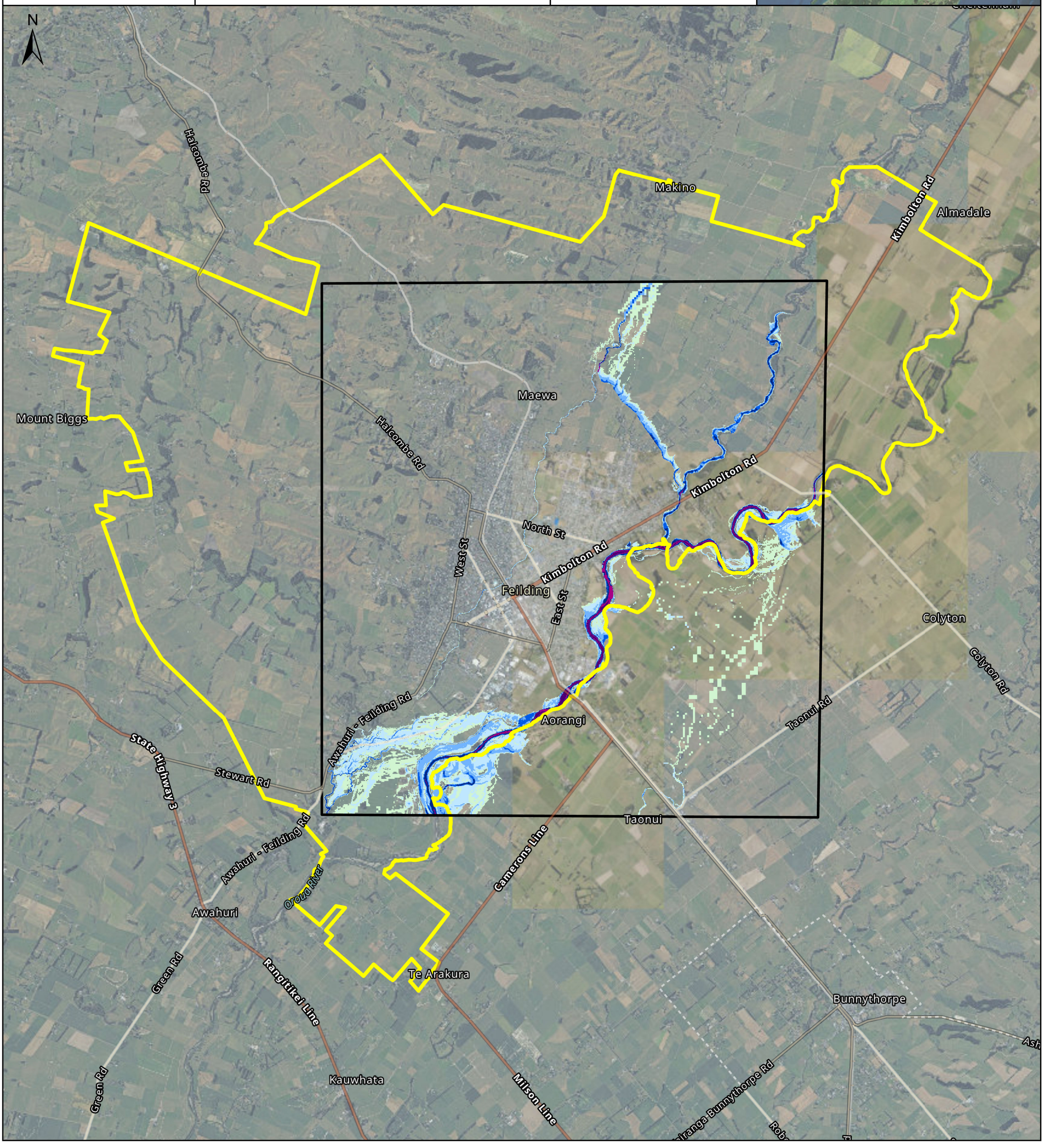
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

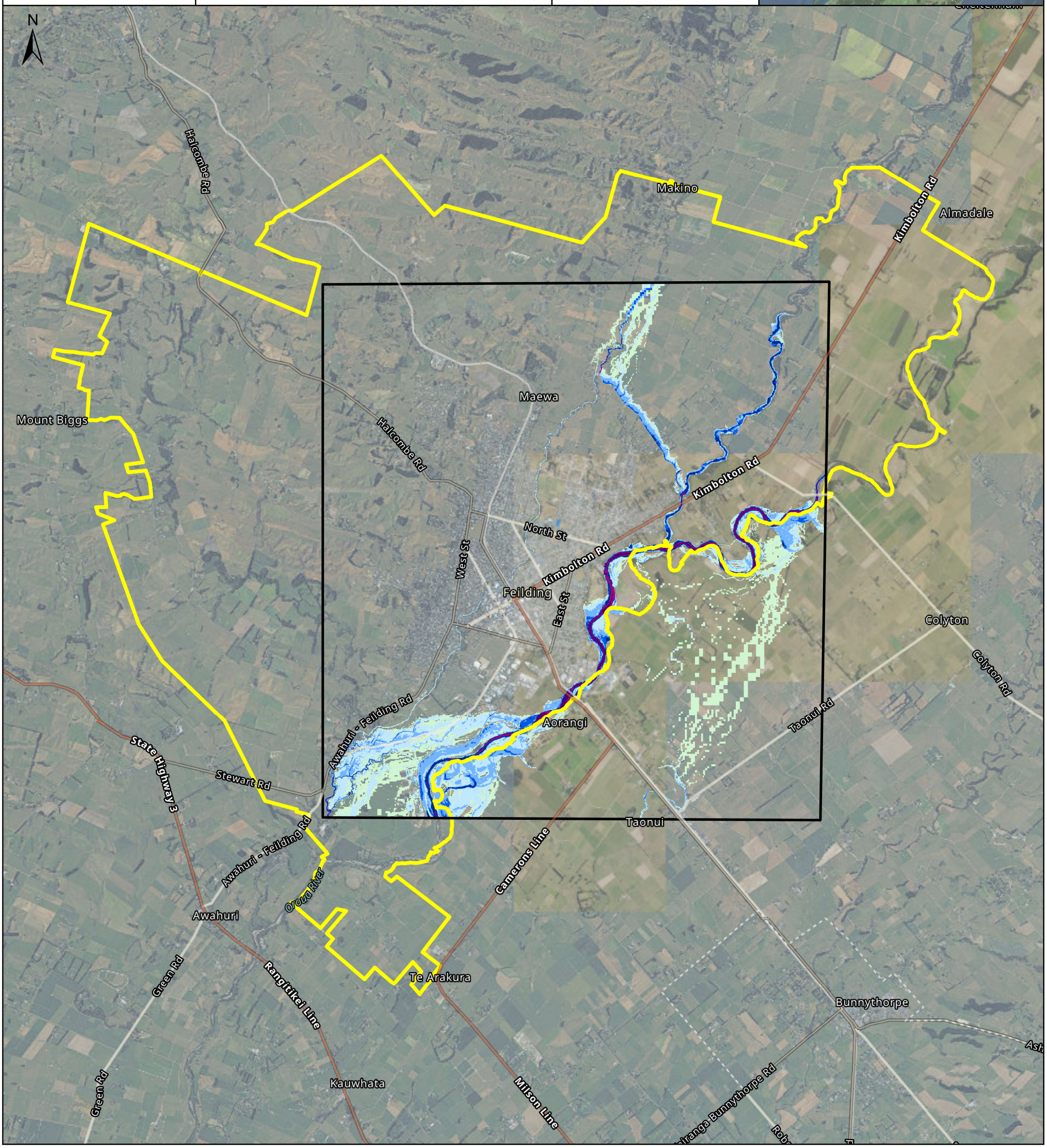
Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

0 1.5 3 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Feilding,
Manawatu District

Scale 1:57,000 at A3

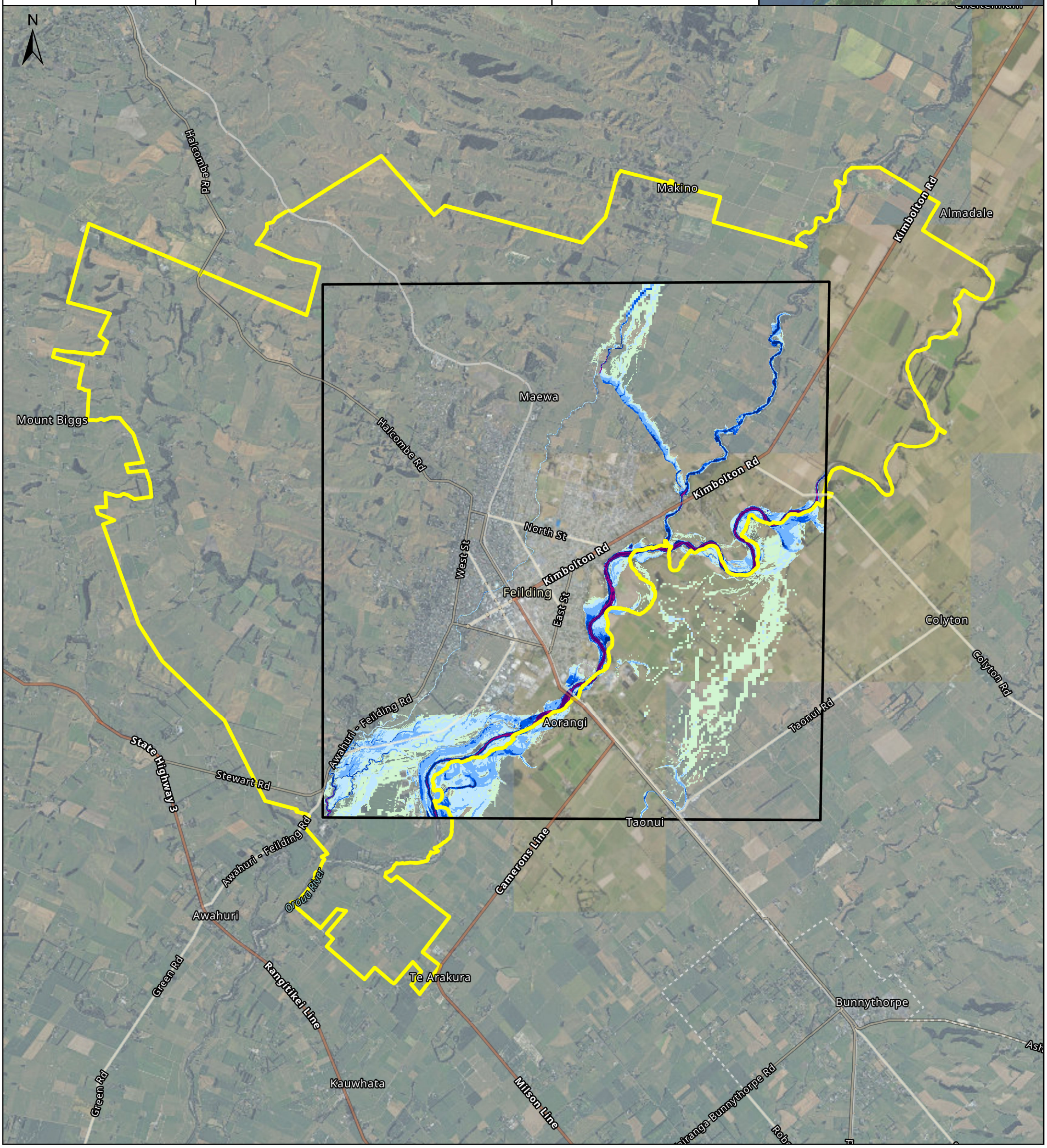
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

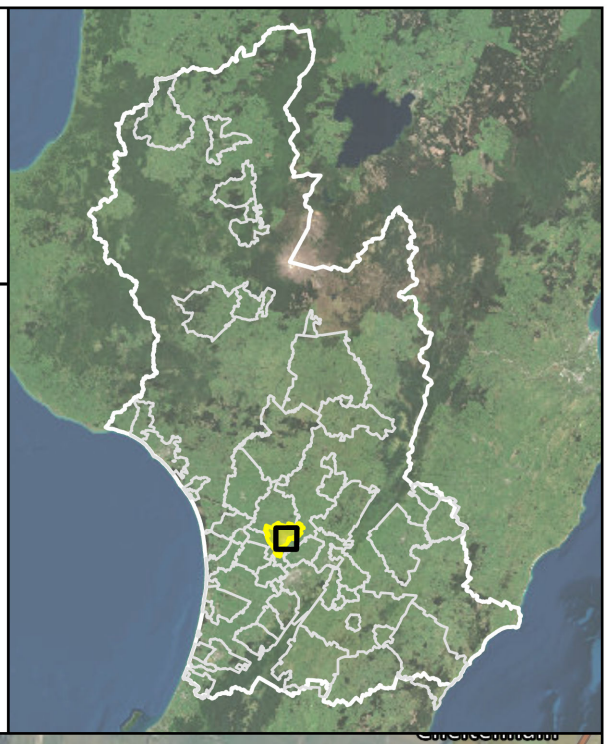
0 1.5 3 Km

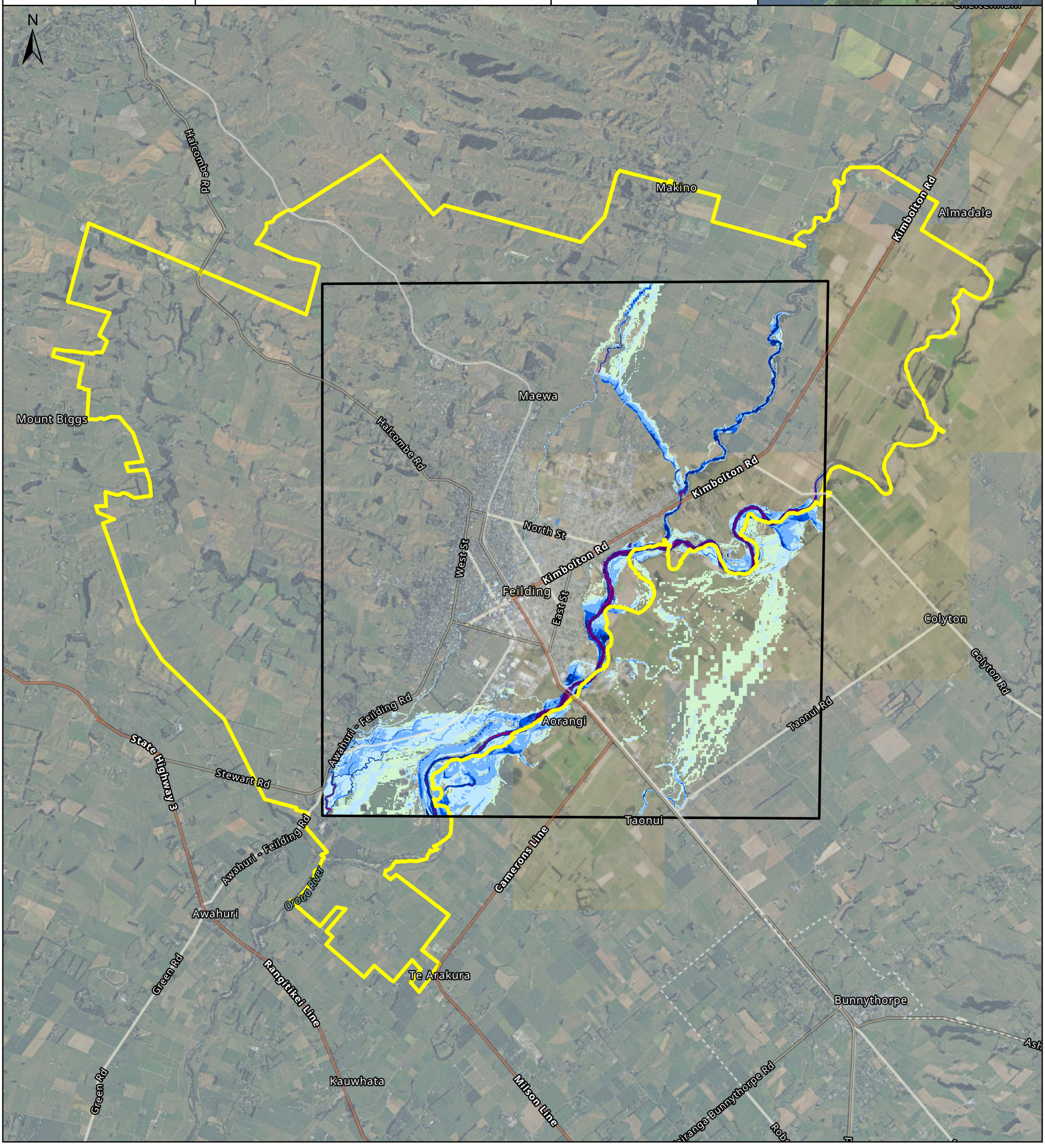
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

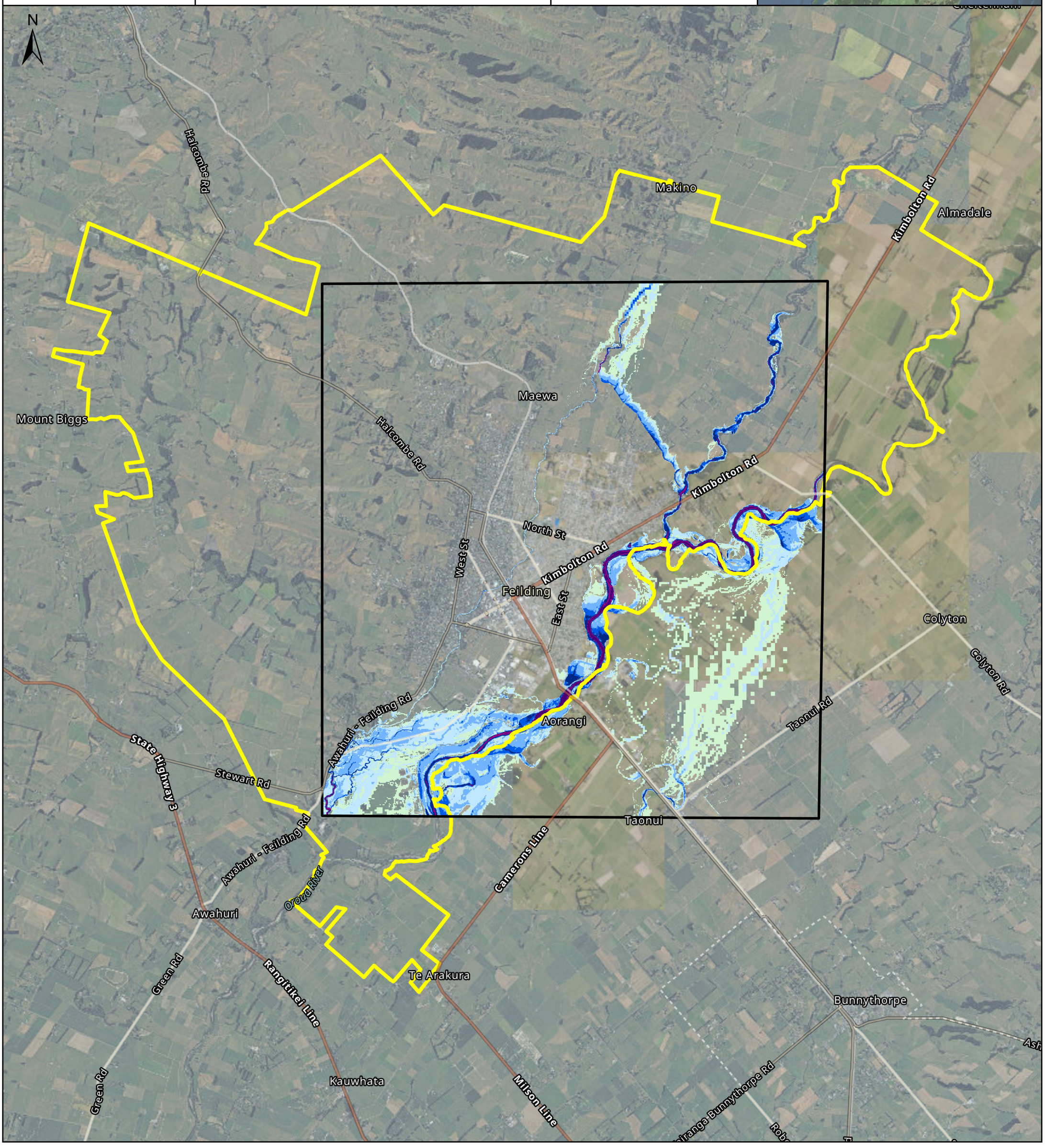
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

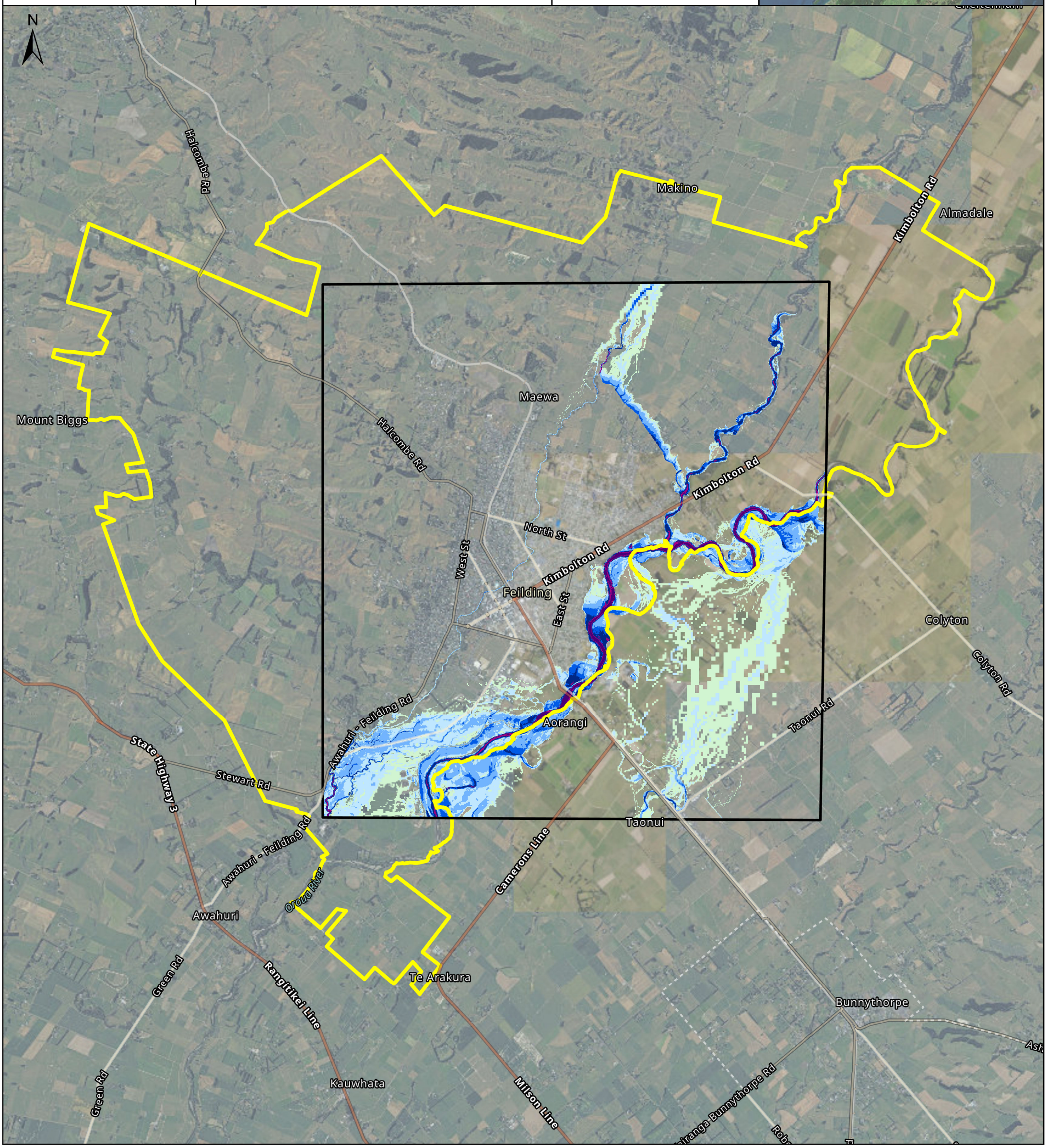
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Feilding,
Manawatu District

Scale 1:57,000 at A3

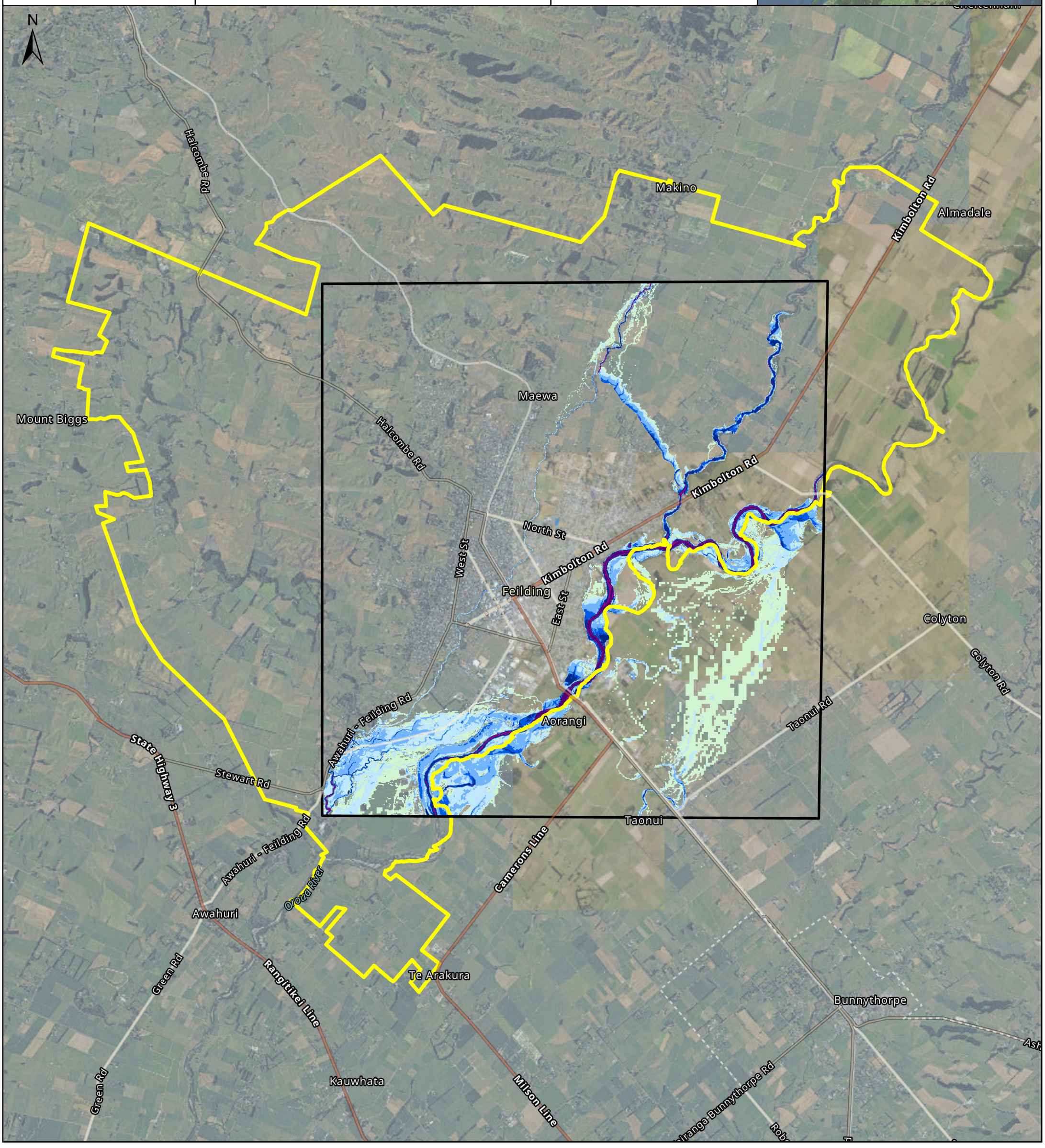
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

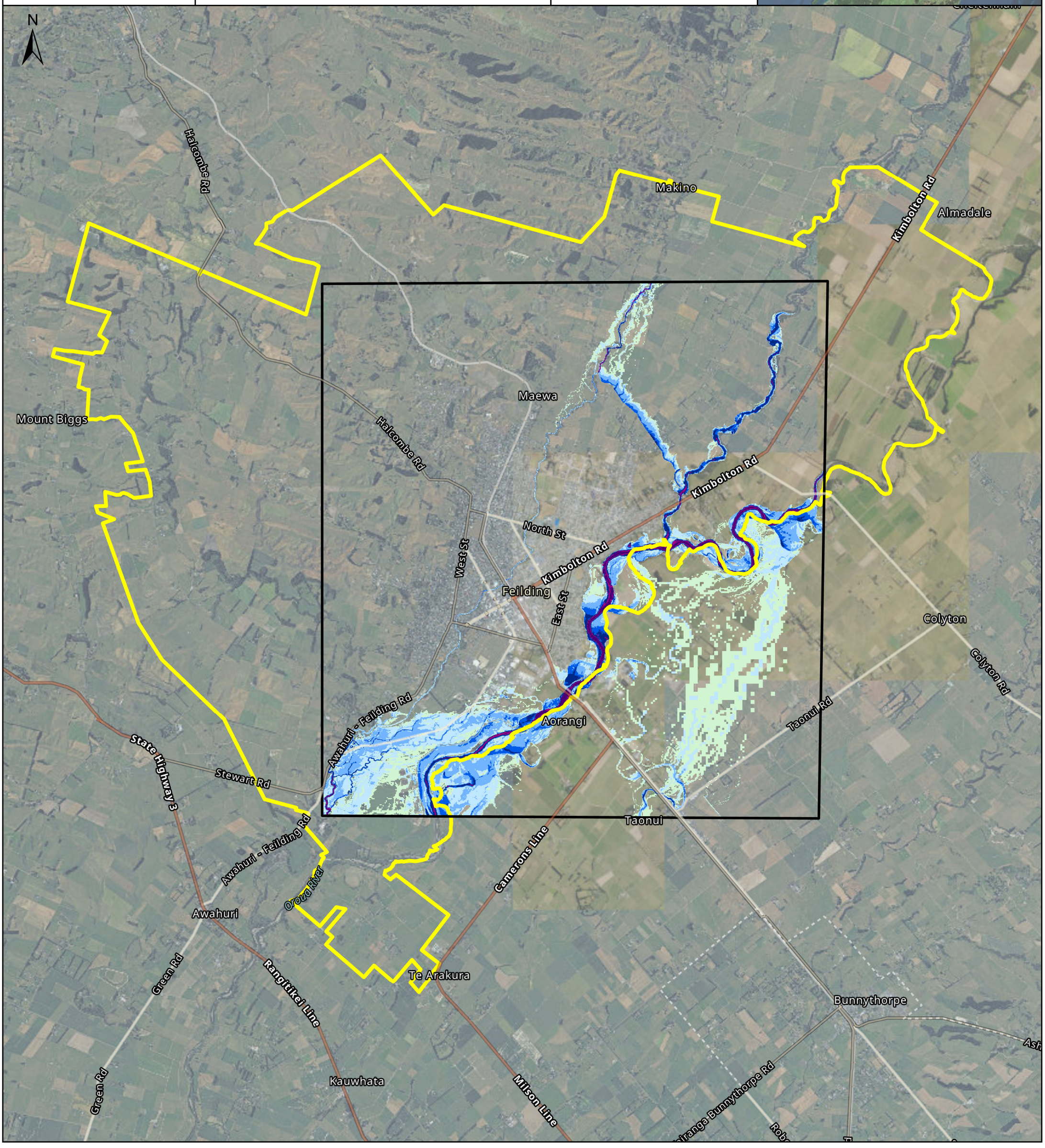
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

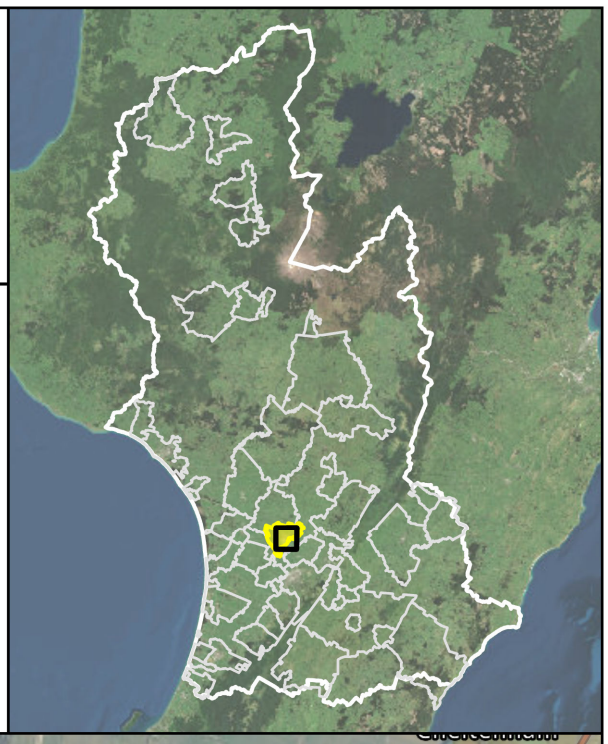
0 1.5 3 Km

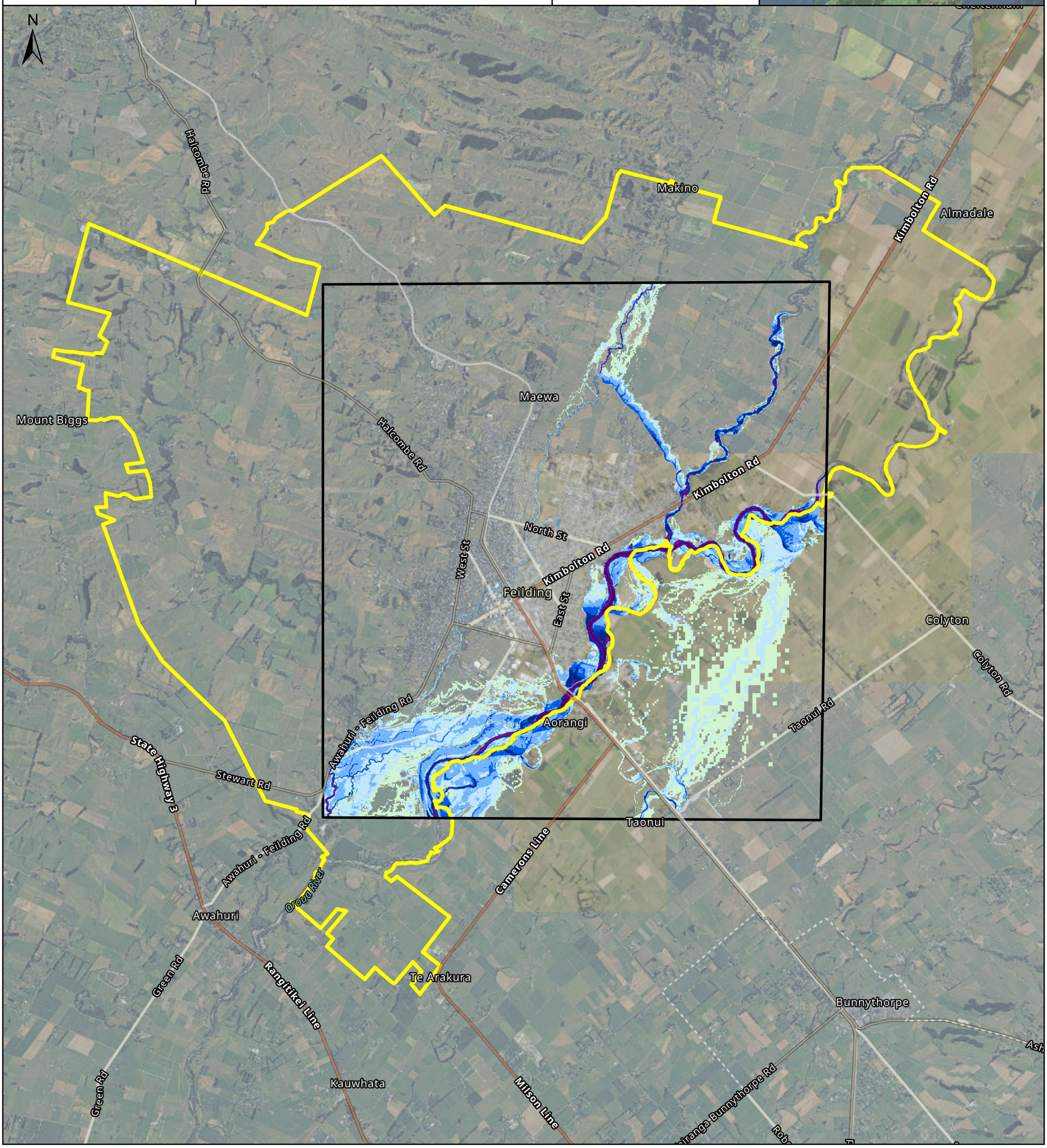
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.2% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community

Feilding,
Manawatu District

Scale 1:57,000 at A3

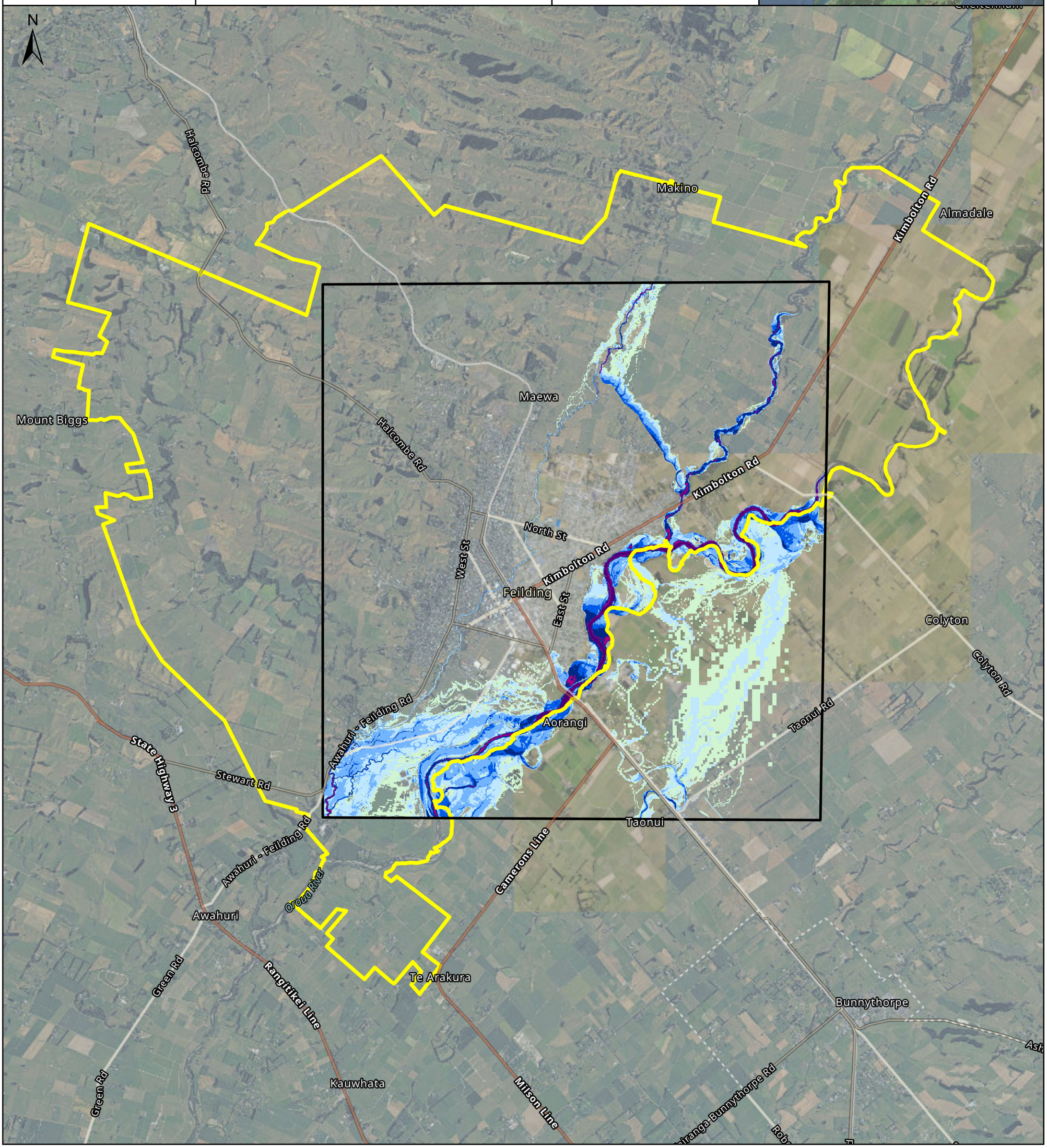
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 0 degrees warming due to climate change, sea level rise excluded

Community

Feilding,
Manawatu District

Scale 1:57,000 at A3

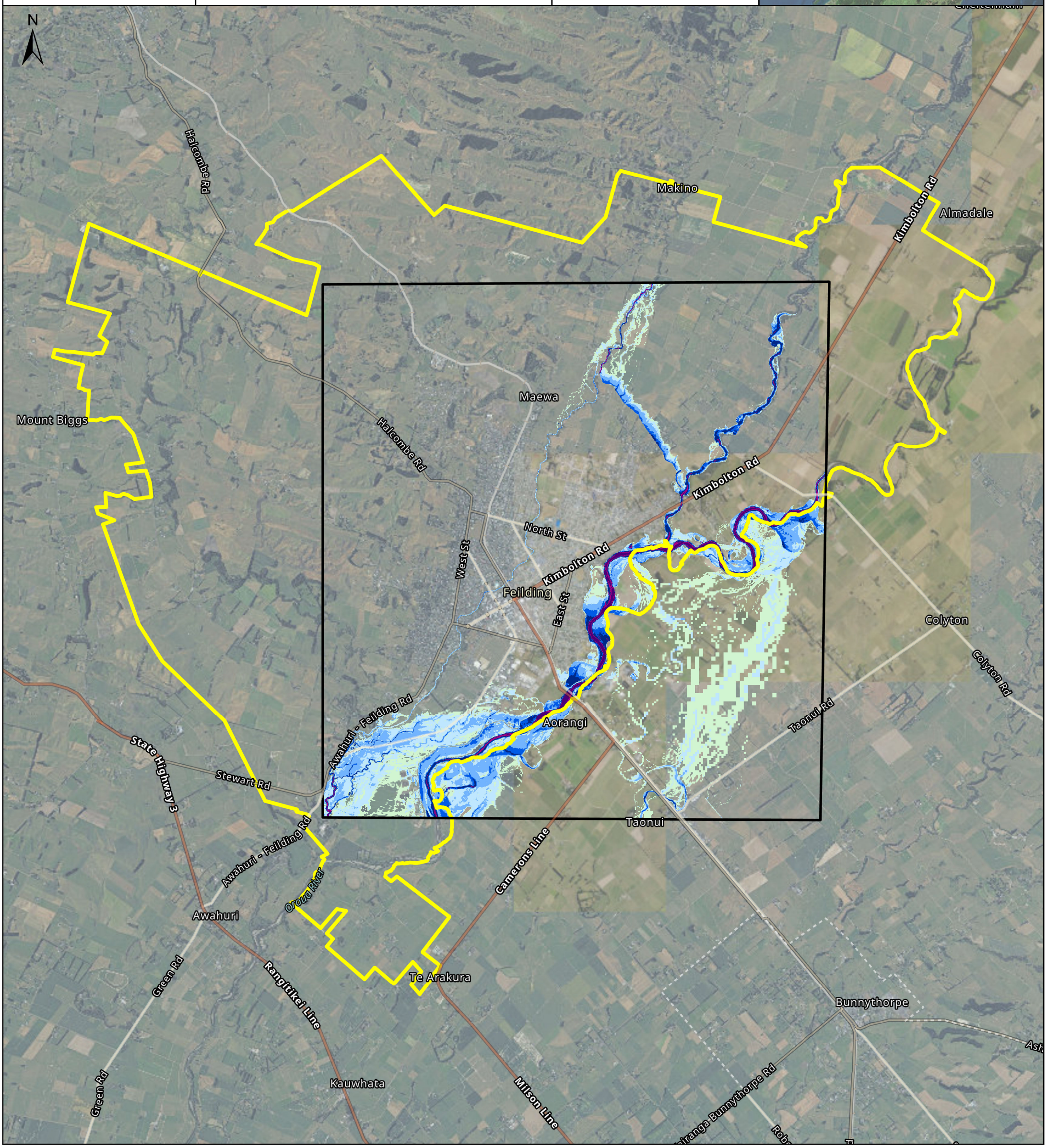
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 1 degree warming due to climate change, sea level rise excluded

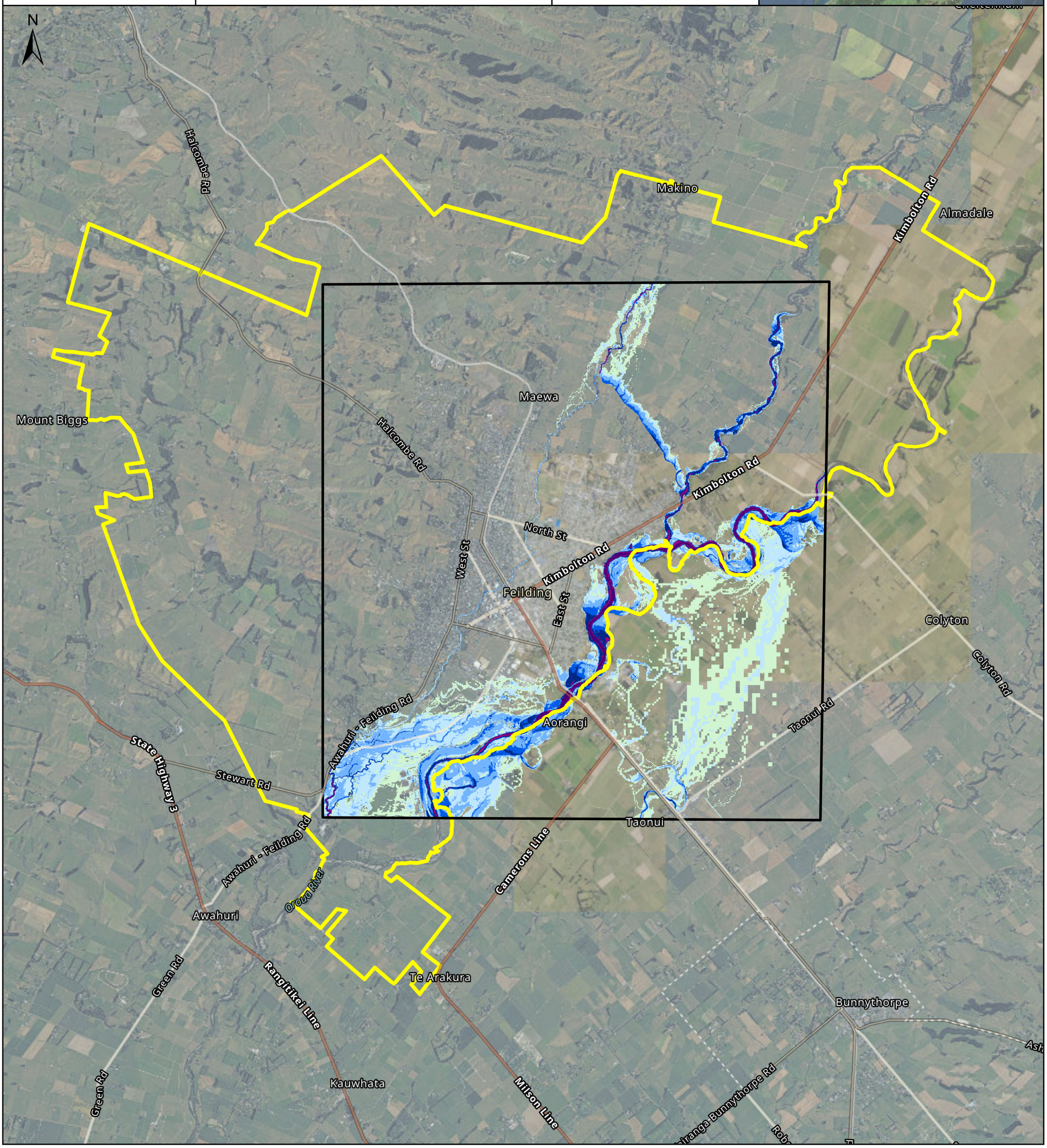
Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

0 1.5 3 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 2 degrees warming due to climate change, sea level rise excluded

Community

Feilding,
Manawatu District

Scale 1:57,000 at A3

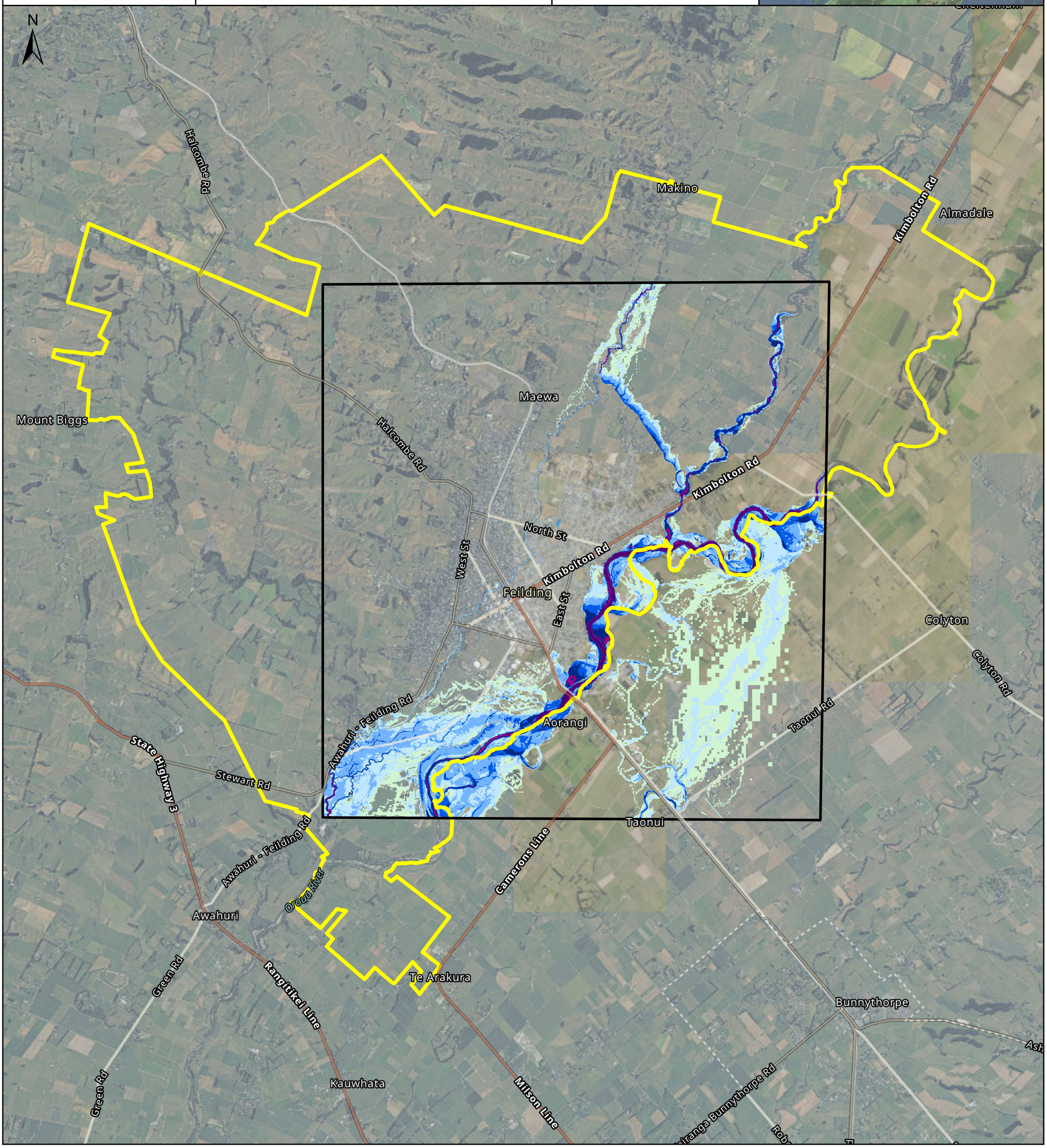
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.1% annual exceedance probability, flood defences up, 3 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

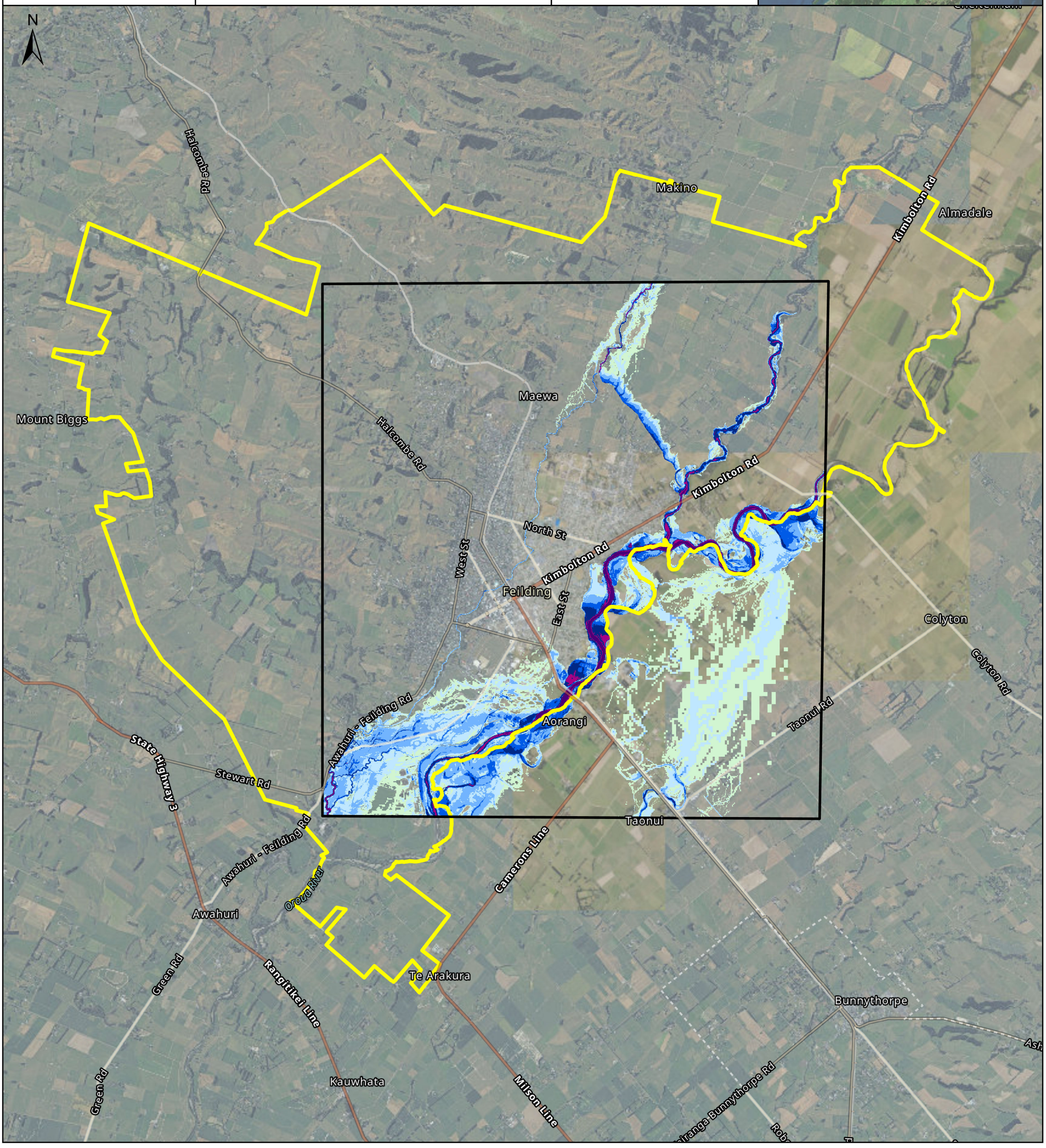
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

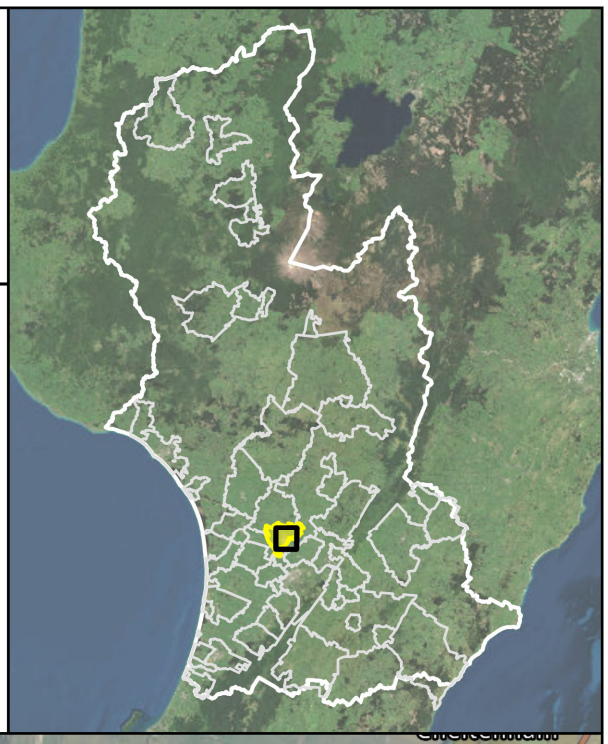
0 1.5 3 Km

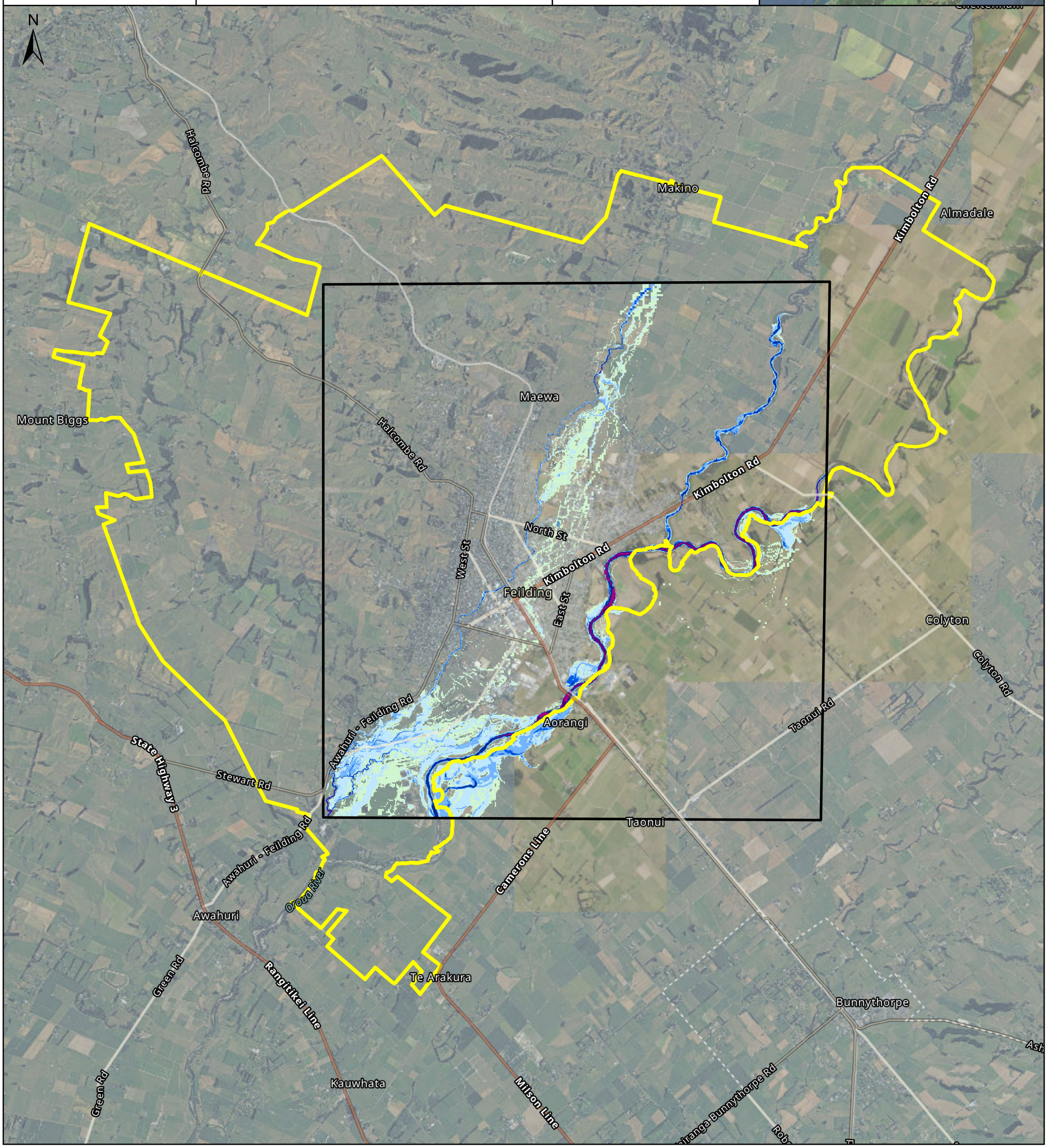
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 2% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

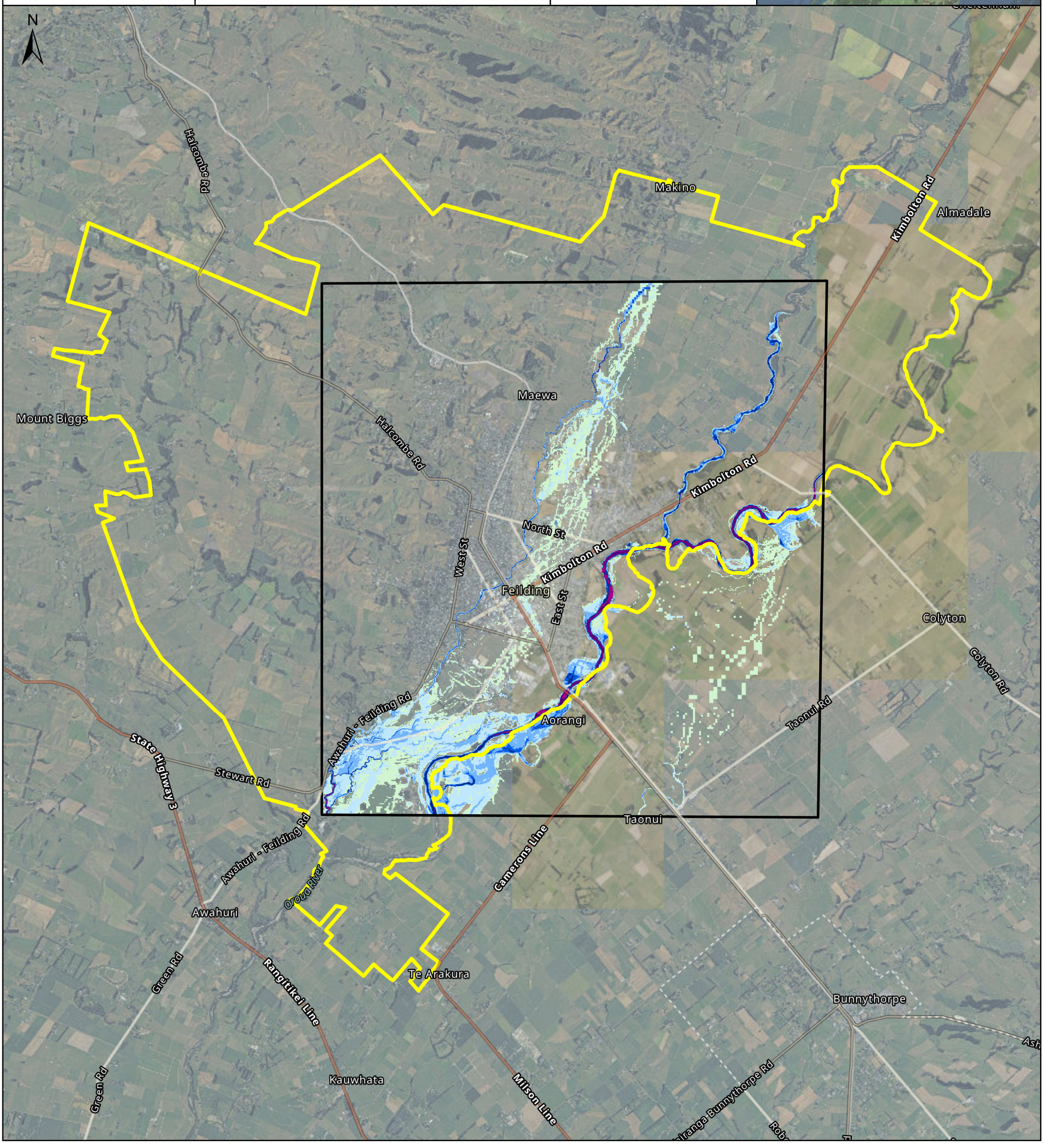
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 1% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

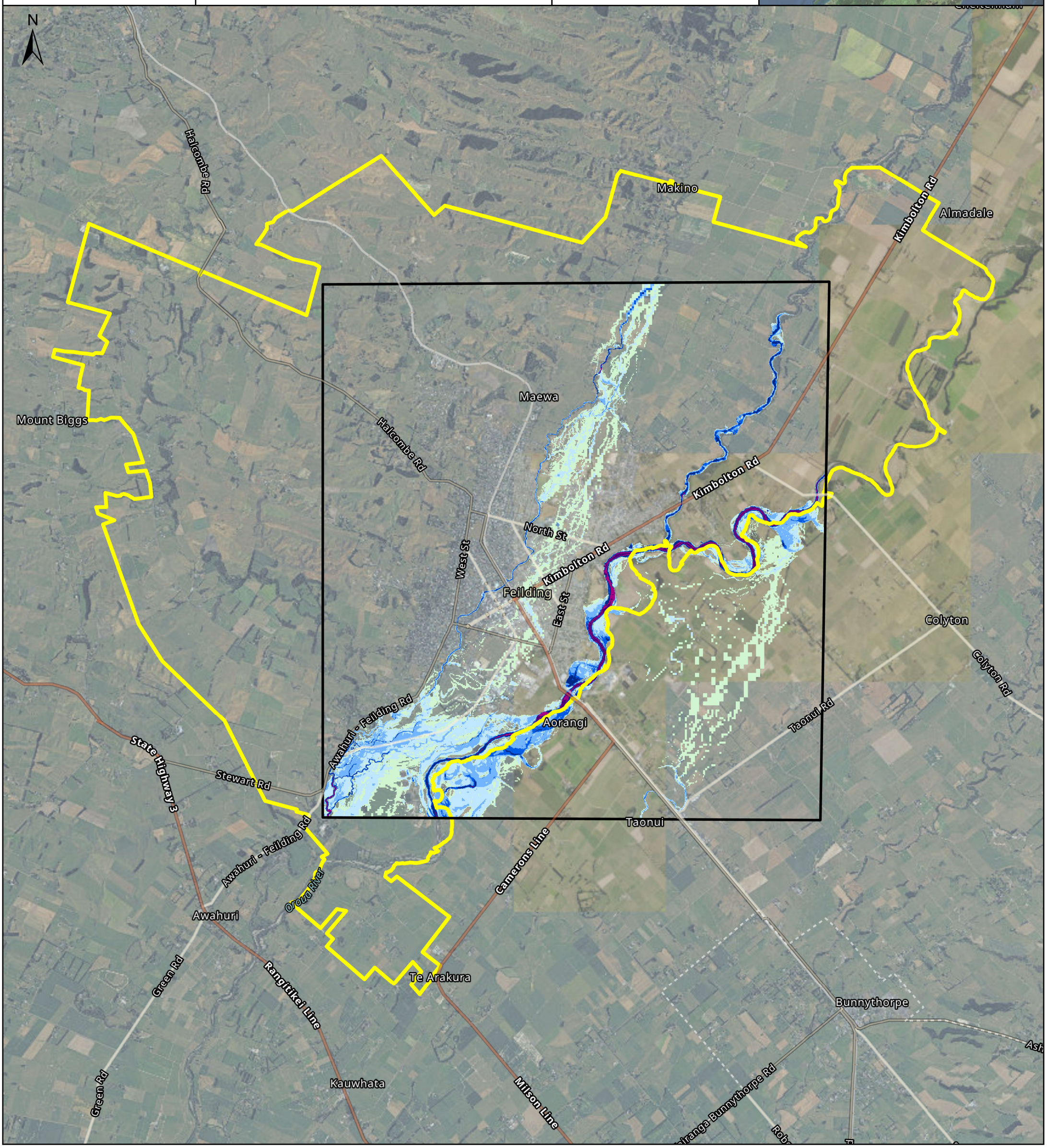
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 0 degrees warming due to climate change, sea level rise excluded

Community

Feilding,
Manawatu District

Scale 1:57,000 at A3

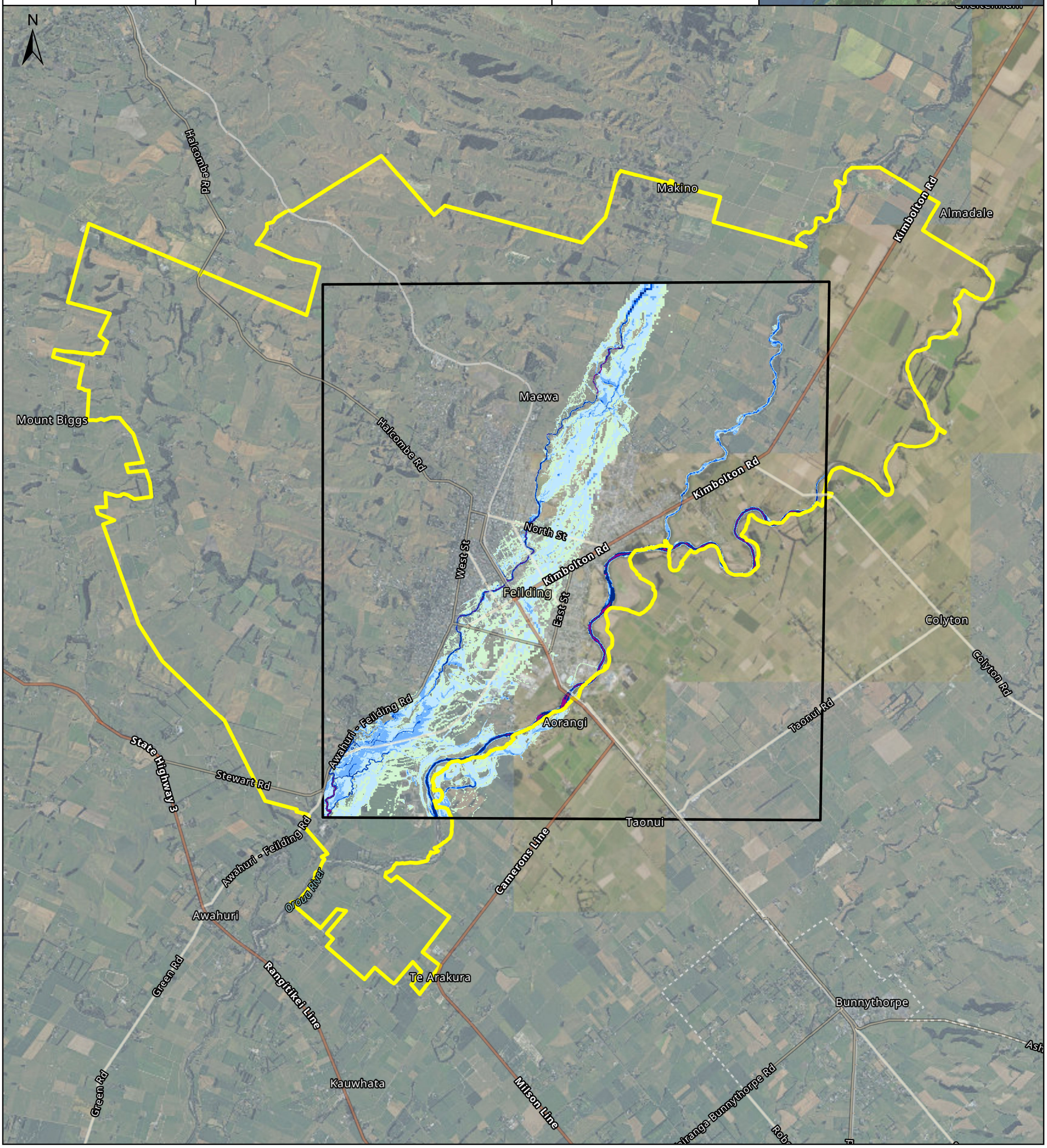
0 1.5 3 Km

Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 1 degree warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

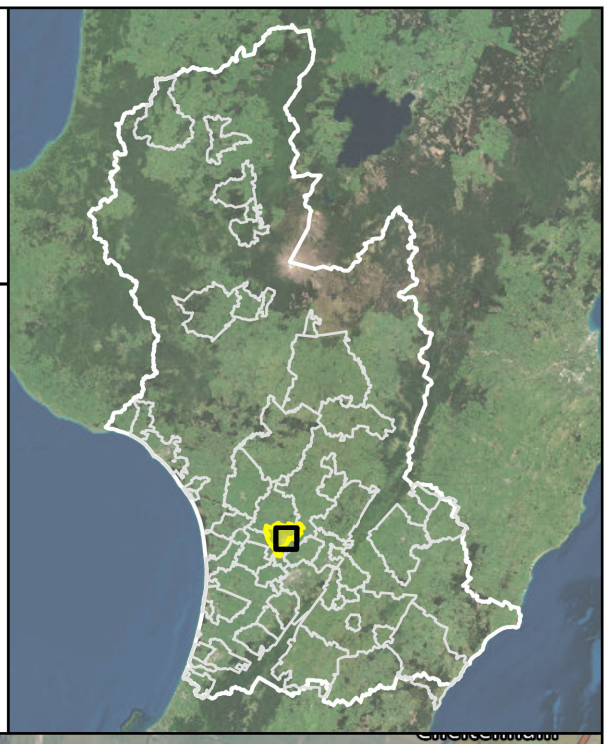
0 1.5 3 Km

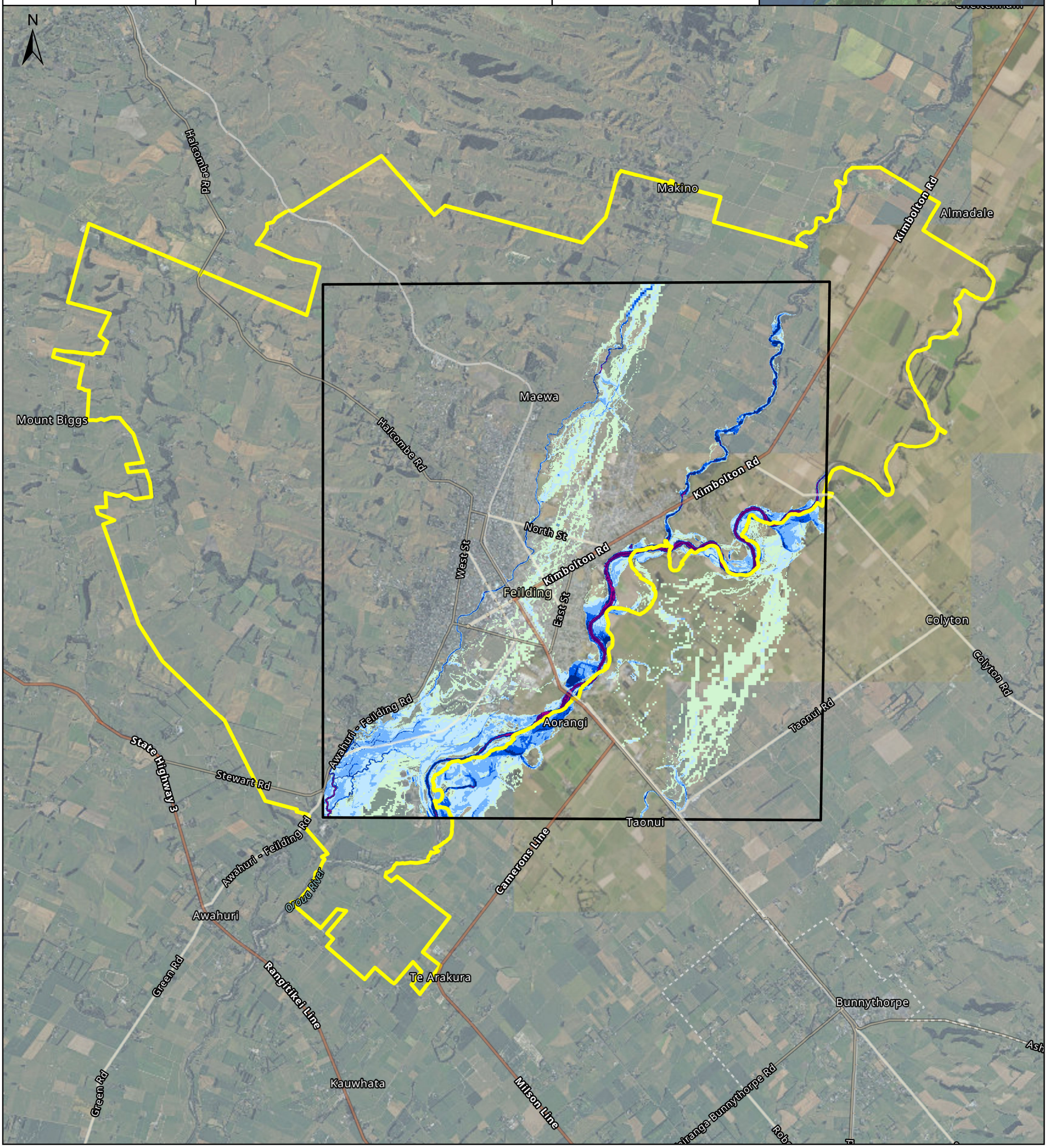
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On
13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 2 degrees warming due to climate change, sea level rise excluded

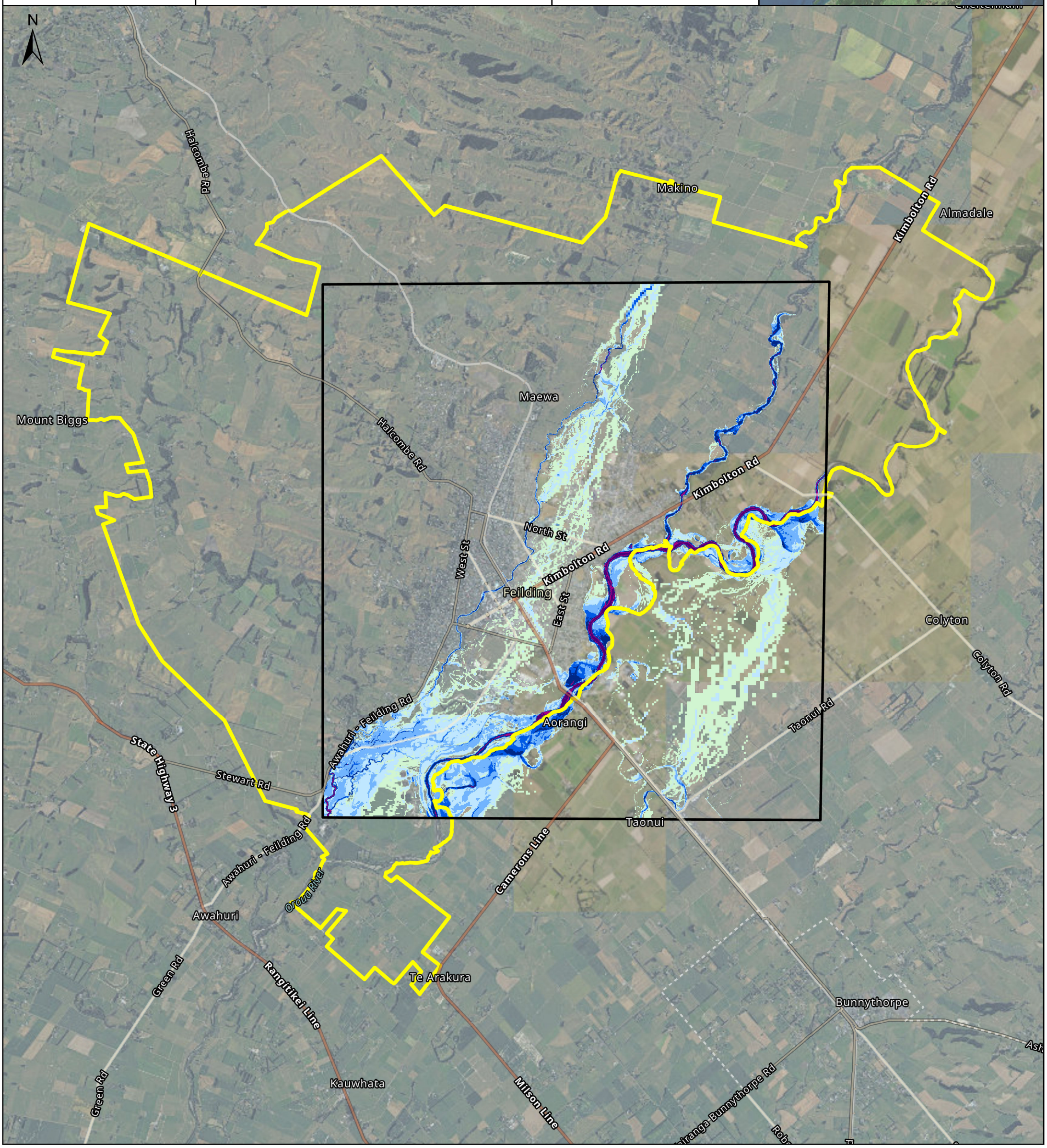
Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

0 1.5 3 Km

Legend
- Model Boundary
- Community Boundary

Flood Depth (m)
- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5



Prepared For

horizons REGIONAL COUNCIL

Prepared By

wsp

NIWA Taihoro Nukurangi

Prepared On

13/11/2025

Horizons Region Flood Vulnerability Assessment

Flood scenario: 0.5% annual exceedance probability, flood defences down, 3 degrees warming due to climate change, sea level rise excluded

Community
Feilding,
Manawatu District

Scale 1:57,000 at A3

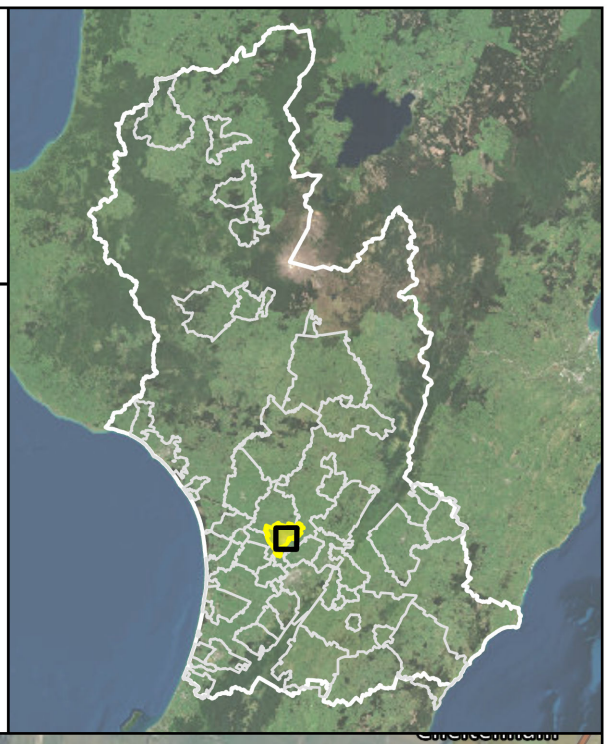
0 1.5 3 Km

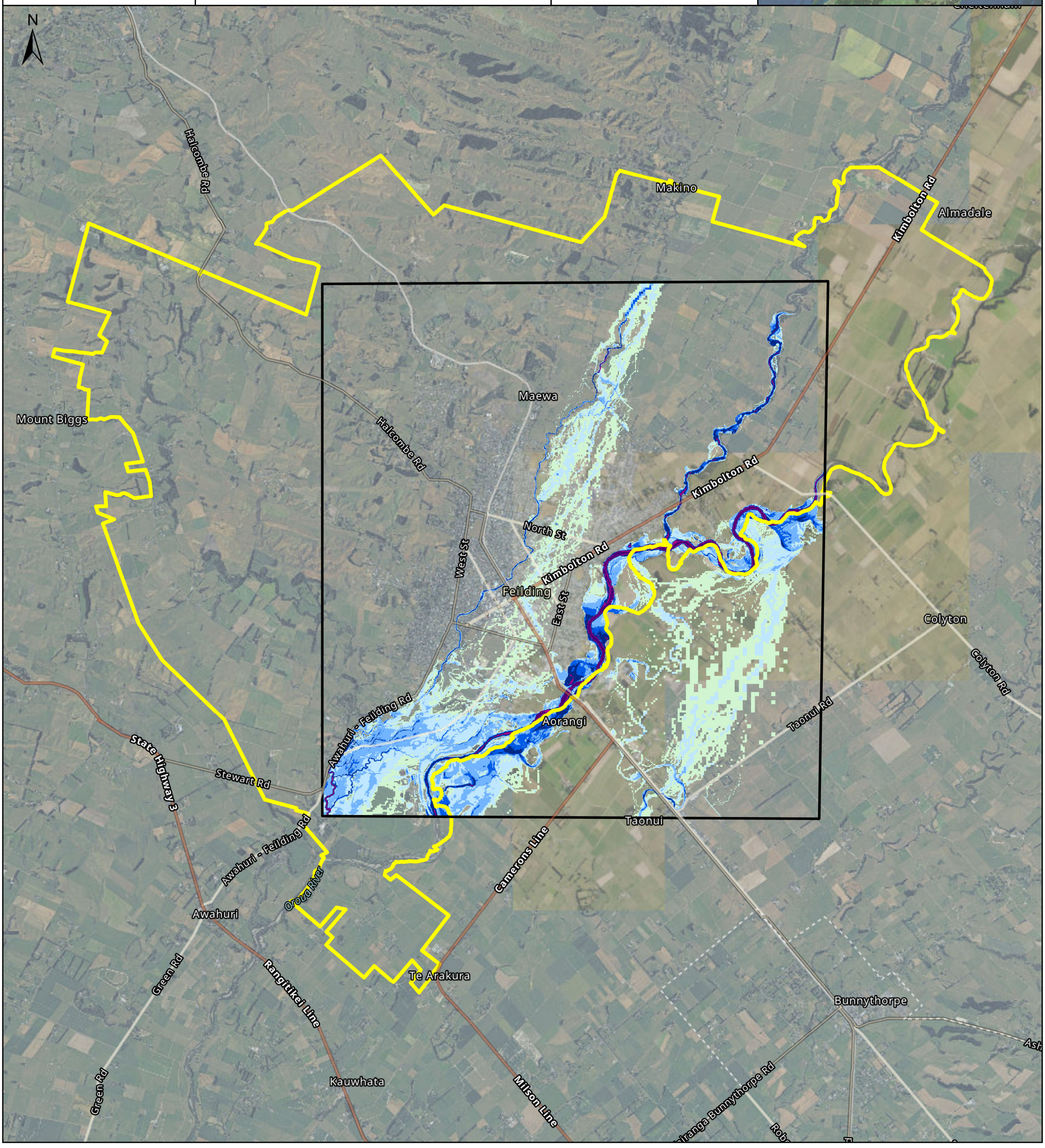
Legend

- Model Boundary
- Community Boundary

Flood Depth (m)

- 0.05 - 0.20
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 - 3.5
- >3.5





8 REFERENCES

Horizons Regional Council. (2025). *Horizons Infrastructural Asset Management Plan .* Horizons Regional Council.

Horizons Regional Council. (2025). *River Management and Drainage Infrastructure Asset Management Plan.* Horizons Regional Council.

Horowhenua District Council. (2024). *Economic Dashboard*. Retrieved from https://www.thcl.nz/site_files/46253/upload_files/HorowhenuaEconomic-dashboardDec24.pdf?dl=1

Horowhenua District Council. (2025). *Summary Annual Report / Te Pūgongo Whakarāpopoto ā-Tau: 2024-2025*. Retrieved from https://www.horowhenua.govt.nz/files/assets/public/v/1/council-documents/annual-reports/horowhenua-district-council-summary-annual-report-te-purongo-whakarapopoto-a-tau-2024-2025.pdf

Infometrics. (2024). *Outlook for the Tararua District Economy: for Tararua District Council*. Retrieved from https://www.tararuadc.govt.nz/__data/assets/pdf_file/0030/196077/Report-Infometrics-Outlook-for-the-Tararua-District-Economy-Recovery-2024.PDF

Land Information New Zealand. (2023, January 16). *NZ Suburbs and Localities*. Retrieved from https://data.linz.govt.nz/layer/113764-nz-suburbs-and-localities/

MfE. (2025). *Estimated number and valuation of residential properties within inundation/flood zones impacted by climate change.*

New Zealand Transport Agency. (2025). *Monetised benefits and costs manual - volume 1: procedures.* Retrieved from https://www.nzta.govt.nz/resources/monetised-benefits-and-costs-manual

NIWA. (2025). *Flood Frequency in the Horizons Region [Prepared for Horizons Regional Council].* National Institute of Weather and Atmospheric Research Ltd.

NIWA. (2025). *Regional Flood Modelling for Horizons Flood Vulnerability Assessment [Prepared for Horizons Regional Council].* National Institude of Weather and Atmospheric Research Ltd. .

NIWA Open Data. (2022, January 20). *NZ Local River Names (REC2 Layer)*. Retrieved from Niwa Open Data: https://data-niwa.opendata.arcgis.com/datasets/NIWA::nz-local-river-names-rec2-layer/about

Palmerston North City Council. (2024). *Pūrongo Ā-Tua Annual Report 2024/2023*. Retrieved from https://www.pncc.govt.nz/files/assets/public/v/6/documents/council/annual-reports/annual-report-summary-2024-25.pdf

Rangitīkei District Council. (2024). *Pūrongo ā-Tau Annual Report Summary 2023/24*. Retrieved from RDC-Annual-Report-Summary-2023_24-Web.pdf

RiskScape. (n.d.). *RiskScape*. Retrieved from https://www.riskscape.org.nz/

Ruapehu District Council. (2025). *Summary Annual Report 2023/2024*. Retrieved from https://www.ruapehudc.govt.nz/repository/libraries/id:2dyphjrmg1cxby65trfv/hierarchy/sitecollectiondocuments/annual-reports/Annual%20Report%20for%20Current%20Year/2023_24%20Summary%20Annual%20Report.pdf

Scheele, F., Benson, A., & Horspool, N. (2021). *Development of population models for risk assessment in New Zealand (GNS Science Report 2021/48).* GNS Science.

Stats NZ. (2025). *Horowhenua District*. Retrieved from https://tools.summaries.stats.govt.nz/places/TA/horowhenua-district

Stats NZ. (2025). *Manawatu District*. Retrieved from https://tools.summaries.stats.govt.nz/places/TA/manawatu-district#1075

Stats NZ. (2025). *Manawatu Whanganui Region*. Retrieved from https://tools.summaries.stats.govt.nz/places/RC/manawatu-whanganui-region

Stats NZ. (2025). *Palmerston North City*. Retrieved from https://tools.summaries.stats.govt.nz/places/TA/palmerston-north-city

Stats NZ. (2025). *Rangitikei District*. Retrieved from https://tools.summaries.stats.govt.nz/places/TA/rangitikei-district

Stats NZ. (2025). *Ruapehu District*. Retrieved from https://tools.summaries.stats.govt.nz/places/TA/ruapehu-district

Stats NZ. (2025). *Tararua District*. Retrieved from https://tools.summaries.stats.govt.nz/places/TA/tararua-district

Whanganui District Council. (2023). *Whanganui District Snapshot 2023*. Retrieved from https://www.whanganui.govt.nz/files/assets/public/v/2/research/whanganui-district-snapshot-february-19.pdf

WSP & NIWA. (2025a). *Horizons Flood Modelling & Mapping Guideline [Prepared for Horizons Regional Council].* WSP New Zealand Ltd & National Institude of Weather and Atmospheric Research Ltd.

WSP & NIWA. (2025b). *Current State Analysis [Prepared for Horizons Regional Council].* WSP New Zealand Ltd & National Institude of Weather & Atmospheric Research Ltd.

WSP & NIWA. (2025c). *Problem Definition Report and Asset Condition Review [Prepared for Horizons Regional Council].* WSP New Zealand Ltd & National Institude of Weather & Atmospheric Research Ltd.

WSP & NIWA. (2025d). *Horizons Flood Vulnerability Assessment - June Report [Prepared for Horizons Regional Council].* WSP New Zealand Ltd & National Institute of Weather and Atmospheric Research Ltd.

WSP & NIWA. (2025e). *Horizons Flood Vulnerability Assessment - August Report [Prepared for Horizons Regional Council].* WSP New Zealand Ltd & National Institute of Weather and Atmospheric Research Ltd.

WSP. (2025a). *Lower Manawatū Model [Prepared for Horizons Regional Council].* WSP New Zealand Ltd.

WSP. (2025b). *Moutoa Gates - Model Build Report to Support 2025 Operational Upgrades [Prepared for Horizons Regional Council].* WSP New Zealand Ltd.

horizons.govt.nz

24 hour freephone 0508 800 800
fax 06 952 2929 | **email** help@horizons.govt.nz
Private Bag 11025, Manawatu Mail Centre, Palmerston North 4442