BEFORE THE HEARINGS COMMITTEE

IN THE MATTER	**of hearings on submissions concerning the proposed One Plan notified by the Manawatu-Wanganui Regional Council**

SECTION 42A REPORT OF FLEUR MASEYK
ON BEHALF OF HORIZONS REGIONAL COUNCIL
CONCERNING INDIGENOUS BIOLOGICAL DIVERSITY

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1. INTRODUCTION

My qualifications/experience

1. My name is Fleur Jennifer Foster Maseyk. I have a Bachelor of Science (ecology) and a Master of Science (in plant ecology (weed biology) and conservation biology). Both degrees were awarded by the University of Auckland. I have over ten years of post-graduate work experience, having been employed as a terrestrial ecologist variously in New Zealand and overseas, for the Department of Conservation, the Mauritian Wildlife Foundation, and Wildland Consultants prior to Horizons.

2. I have worked for Horizons for four years in various positions, including Research Associate, Strategy Review Officer and Environmental Scientist. For the last year I have held the role of Senior Environmental Scientist – Ecology within the Regional Planning and Regulatory Group.

3. As a Research Associate I was involved with the wetland prioritisation project before project managing and authoring the Regional Pest Plant Management Strategy review. Since the end of 2005 I have lead the terrestrial biodiversity science programme for the Region. Projects I have lead during this time include the assessment of natural areas (including wetlands and forest fragments) for ecological value and significance, and the prioritisation of sites for management. I have also been involved in the Regional Pest Animal Management Strategy review, and the research and monitoring aspects of the management strategy for Totara Reserve Regional Park. A core role of my position is the technical assessment of resource consent applications, and provision of technical advice to both the Consents and Compliance Teams.

4. I have been involved in the Proposed One Plan (POP) since becoming an Environmental Scientist with Horizons (2005). I was asked to lead the formulation of a framework for the protection of indigenous biodiversity on private land suitable for inclusion in a Regional Plan. I lead the technical aspects of the development of the approach for terrestrial biodiversity presented in the POP, and contracted and project managed Landcare Research to conduct core analyses. I compiled Schedule E, with the exception of Table E.3, the intention of which I contributed to, but which was mostly collated by my colleague James Lambie (Environmental Scientist – Ecology) in conjunction with input from key stakeholders.

5. I have read the Environment Court's practice note Expert Witnesses – Code of Conduct and I agree to comply with it.

2. EXECUTIVE SUMMARY OF EVIDENCE

6. Indigenous biodiversity and its protection have been identified by the community as an issue they would like Horizons to address. This community mandate is reflected in the LTCCP, and has been translated into the One Plan with indigenous biodiversity being one of the 'Big Four'. This inclusion is in-line with national policies and guidelines for indigenous biodiversity.

7. The Manawatu-Wanganui Region has experienced considerable loss of indigenous vegetation cover. There is a disproportionate distribution of indigenous biodiversity loss across the landscape, with the greatest degree of loss clearly aligned with lowland areas of the Region. This can be attributed to the rapid and almost complete clearance of indigenous vegetation and land conversion in these areas.

8. Continued decline in indigenous biodiversity will result in a continued disruption to the ecosystem services (eg. soil health and stability, flood retention, gas exchange) on which we rely. Protection of indigenous biodiversity is required to halt the decline of indigenous vegetation cover and indigenous biodiversity within the Region.

9. Named habitat types (based on indigenous plant species eg. kahikatea-pukatea-tawa forest) can be used to describe biological patterns in a more refined manner than the generic term 'indigenous vegetation'. Diversity of habitat types can act as a surrogate to indicate indigenous biodiversity. Protection of a given habitat type will result in protection of the species that live within, and rely on that habitat type. Conversely, a decline in the extent and diversity of habitat types will consequently be a decline in indigenous biodiversity.

10. Therefore, the proposed framework for the protection of indigenous biodiversity was based on habitat types rather than individual species. Habitat types were largely identified using predictive modelling. Comparisons between former and current extent of habitat types was conducted to determine degree of loss. Original and current extent of indigenous vegetation cover was primarily predicted using robust national spatial datasets and predictive models. The use of these national spatial datasets and predictive models is common practice for analysis of this sort, and for determining the need for priorities for protection of indigenous biodiversity. These datasets also serve as key reference data for expected spatial distribution of each habitat type.

11. Alternative methods where needed for identifying uncharacteristic, small, and unique habitat types. These methods include the use of substantiated expert opinion, and guidance from the national rare ecosystems project.

12. Most of the indigenous biodiversity occurring in the lowland areas is not well represented in the Public Conservation Estate. Therefore, the majority of remaining indigenous biodiversity in lowland areas of the Region does not fall under a consistent protection regime. Without protection, indigenous biodiversity will continue to decline and ultimately disappear from our Region.

13. Even small, modified and fragmented patches of indigenous biodiversity are worthy of protection as they continue to contribute to the landscape by way of provision of 'stepping-stones' and food sources. Protection of these areas now is providing indigenous biodiversity insurance for the future by ensuring the persistence of these species through time and retaining the potential for recovery.

14. Habitat types that occur in the landscape relatively more commonly and in larger, less fragmented patches are also worthy of protection. Protection of these habitat types will ensure continuation of ecological processes and function within habitat types and across the landscape, and prevent further decline in the extent and diversity of habitat types within the Region.

15. Although reduced from the intensive activities of the 19th and 20th centuries, direct human pressures on indigenous biodiversity (eg. vegetation clearance and wetland drainage) still exist. Non-human impacts (namely those of invasive pest species) represent the greatest contemporary threat to the long-term viability of our indigenous biodiversity. The two threats (human activities and invasive pests) occur on a different magnitude, but both require a policy response in order to ensure efficient protection of indigenous biodiversity.

16. A hierarchical system was developed by which to classify habitat types based on extent of former covering remaining. These habitat type classifications: 'Threatened', 'At Risk' and 'No Threat Category', allow for specific and appropriate levels of protection to be awarded dependent on the value and vulnerability of each habitat type. A fourth habitat type classification ('Rare') allowed for originally rare and highly unique habitat types to be included within the framework.

17. The proposed framework compares favourably with more traditional methods of identifying sites for protection – for example, assessing sites for ecological significance. The main difference between the two is the trigger for regulatory protection under the proposed framework is based on defined habitat types, not a schedule of discrete sites known to be ecologically significant. The identification of important habitat types, regardless of where they occurred in the landscape, removed the reliance on obtaining comprehensive knowledge of individual sites prior to affording protection to such sites.

18. An assessment of ecological significance is important at the patch scale to determine values of a site and thus inform the consent decision making process. Such an assessment will be conducted only once an area of habitat type falls into the consent process. Nationally standard assessment criteria are applied.

19. Schedule E outlines which habitat types fall into consideration, and provides criteria that determines inclusion (or exclusion) of areas of habitat type into the regulatory protection framework. The Schedule was the subject of considerable uncertainty and concern amongst submitters. This evidence illustrates the necessity for the provisions of Schedule E. However, while the fundamentals of the content remain, it is acknowledged that the presentation of this information could be improved. To this end, Schedule E has been redrafted. The redrafting, presented appended to this evidence, was influenced by internal evaluation of the effectiveness of the Schedule, and by submitters concerns and requests.

3. INTRODUCTION

20. The increased mandate for Regional Council involvement in the protection of indigenous biodiversity provided under the Resource Management Act (1991) Amendments (2003), and the identification by the community that indigenous biodiversity was important to them, combined with the development of second generation regional plans, afforded the opportunity for Horizons to initiate a Region-wide approach to indigenous biodiversity protection on private land.

21. Extensive public consultation that feed into the Long Term Community Council Plan (LTCCP) identified the protection of indigenous biodiversity as an issue the community wanted to see addressed. Driven by this community desire, indigenous biodiversity became one of the 'Big Four' of the POP.

22. It was assumed at the outset that past loss of indigenous biodiversity had a detrimental impact on the Region, and any continued, unabated decline would likewise have an adverse effect on the environmental, social and economic wellbeing of the Region and its communities. It was taken as given that continued indigenous biodiversity decline was therefore a concern of Horizons, and an issue worthy of inclusion in Regional Plans.

23. Given this base assumption, there was no protracted analysis, reporting or debate focusing on the effects of loss of indigenous biodiversity in the technical document that fed into the development of the POP (Maseyk, 2007). I consider this to be a safe

assumption, and one that is in line with the considerable national literature (Ministry for the Environment guidelines (2007a; 2007b); and the New Zealand Biodiversity Strategy), and in accordance with international conventions to which New Zealand is a signatory (eg. The Convention on Biological Diversity (ratified by the New Zealand Government in 1993).

24. In determining the degree of loss and the need for protection of indigenous biodiversity, there was no consideration of current proportion of indigenous vegetation cover under legal protection. This represents a difference in similar analyses conducted elsewhere (Walker *et al.*, 2005; Walker *et al.*, 2006).

25. This was primarily because the 'need for protection' included protection from all threats, and not just those that can be mitigated through legal protection. It has been the experience of the Manawatu-Wanganui Region that while persistence of indigenous vegetation cover has occurred where legal protection is present (eg. Public Conservation Land), characteristics of specific habitat types have not always been protected from deterioration or decline (eg. loss of northern rata from the Tararua Range and kamahi canopy from the Ruahine Range). Species loss (caused by invasive pests) can continue even within areas of habitat that have been afforded legal protection for a considerable amount of time. Consequently, as the consideration of the justification for protection includes direct threats that can be avoided through regulation as well as indirect threats that cannot be, 'the need for protection' encompasses both regulatory mechanisms and non-regulatory management.

26. Up until the notification of the POP, a comprehensive and consistent approach to protection of indigenous biodiversity across the entire Region was lacking.

27. The proposed approach focuses on the protection of habitat types and not individual species. This is because protection of a habitat type will provide flow-on protection for the species that live within, or rely on that habitat type.

28. Schedule E identifies explicitly what is considered to be habitat type for the purposes of the POP. 'Habitat' when applied in its purest sense is a very species-specific concept (Miller, 2000), and can include any area of vegetation that a species utilises at any point in its life-cycle or daily movements. However, this is not the meaning attached to the term as used in the POP. Rather, the POP uses 'habitat type' to describe particular groupings of plant species, and thus classify the differences seen between these groupings as different 'habitat types'. Plant species are used to determine this difference in groupings of species, as plants are the most visually obvious and easily predicted component of an ecosystem.

29. .Habitat types are used to identify difference in biodiversity pattern across the landscape. By differentiating between the variance in habitat type, difference in biodiversity pattern (species variance) is recognised.

30. Horizons does not currently hold comprehensive information on every patch of indigenous vegetation throughout the Region. By using a framework for indigenous biodiversity protection based on habitat types, a Region-wide approach could be implemented in the absence of such knowledge.

Key Messages

1. Indigenous biodiversity was identified by the community to be important to them.
2. Indigenous biodiversity is one of the 'Big Four' and its protection is of concern to Horizons.
3. A Region-wide approach is needed to ensure consistent and effective protection of indigenous biodiversity.
4. The protection of habitat types (based on indigenous vegetation cover) can act as a surrogate for the protection of indigenous biodiversity. Habitat types can effectively act as a protection umbrella as species within a given habitat type will be protected as well as the habitat type itself. Horizons' approach was therefore habitat driven not species driven to provide for greater indigenous biodiversity protection.
5. The approach developed needed to be able to be implemented throughout the Region in the absence of complete knowledge on discrete areas of indigenous biodiversity that needed protection.

Background to the formulation of the indigenous biodiversity component of Chapter 7, and specifically Schedule E

31. Horizons was familiar with the large scale loss of terrestrial biodiversity experienced by the Region, but had not, up till now, quantified the degree and extent of this loss in a consistent manner for the Region. Methodologies were required to analyse indigenous biodiversity across the landscape. Such analysis would assist with the identification of areas of pressure, and enable informed decision making around the need for and degree of protection mechanisms.

32. I commissioned Landcare Research Ltd (LCR) to describe and quantify the predicted previous and current indigenous vegetation cover for the Region. It was appropriate to outsource this analysis as LCR holds the most up-to-date datasets, has extensive experience in running analysis of this manner and experience in the application of

predictive spatial models, and possess the computer hardware with the capacity to run the analysis. The contract was led by Dr Jake Overton in Hamilton.

33. The data provided by LCR was used to shape the foundation for the framework as presented in the POP, specifically the use of 'habitat types', and the determination of the degree of loss of these habitat types. Fundamental ecological theories (eg. island biogeography, species-area curves, and extinction debt thresholds) were integrated into the analysis and provided guidance for thresholds on which classifications were based. These classifications were needed to distinguish differences in level of threat and pressure and thus, level of protection. This allowed for an associated rule stream that was refined enough to allow for these differences across the landscape. As the classifications would have direct ramifications for landowners (by way of triggering rules in the POP), it was crucial that the classifications were applied based on sound and reputable ecological science. During the formulation of the framework, consideration was also given to the published literature, the current understanding of approaches to biodiversity management, and alternative approaches elsewhere in the country.

34. External comment and contribution was solicited throughout the drafting of both the approach in general, and Schedule E specifically. Input was requested from those I knew to have a strong understanding of the application of predictive models and spatial databases, and/or a comprehensive knowledge of species and ecosystems within the Region and could comment from both a detailed local and big picture regional context (eg. Department of Conservation staff, local botanists, Fish and Game staff, and ecological consultants).

35. In addition to this informal contribution and critique of the proposed approach, the draft framework in its entirety was subject to critical peer review by internal and external colleagues (James Lambie, Environmental Scientist – Ecology; Alistair Beveridge, Manager – Biodiversity and Water Quality, Horizons; Tim Park, Greater Wellington Regional Council; and Nick Singers, Department of Conservation). My work (Maseyk, 2007) was also reviewed by Dr Overton (LCR) to ensure that I had not misunderstood or misapplied the data provided by him. Comments, criticisms and contributions were incorporated into the redrafted Schedule E.

36. I verbally presented the framework and methods of application of the national spatial databases and predictive modelling at the annual conference of the New Zealand Ecological Society (NZES) in November 2007. The NZES has been in existence since 1951, and currently has a membership of approximately 630 professional ecologists, academics and research scientists. The Society produces an internationally reputable peer-reviewed scientific journal twice a year. NZES conferences are held annually, and

are the primary vehicle to communicate with the ecological community outside the journal. Conference presentations frequently stimulate debate and generate informal critique, interest, or support. Presenting new work in these forums has the potential to elicit a strong response from the ecological community should it be perceived that ecological science was being applied inappropriately, or out of line with current thinking. In this sense, feed-back from such presentations can be useful as another avenue of informal peer review.

37. My presentation at the NZES conference in 2007, solicited a good degree of interest and encouragement from the audience. While there was inevitable comment on elements of detail, the feedback I received would indicate that the approach was not considered to be inappropriate, misleading or poorly thought-out.

38. Shortly after notification of the POP, the national priority publications 'Protecting Our Places' were released (April 2007) by the Ministry for the Environment. The approach to indigenous biodiversity as presented in the POP is entirely consistent with that outlined in the MfE documents. The Ministry published both a summary document (MfE 2007c) and a more substantial document (MfE, 2007b), which jointly outline the four national priorities for protecting indigenous biodiversity on private land as being:

    1. To protect indigenous vegetation associated with land environments that have 20% or less remaining indigenous cover.
    2. To protect indigenous vegetation associated with sand dunes and wetlands.
    3. To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystems types.
    4. To protect habitats of acutely and chronically threatened indigenous species.

    (abridged from Ministry for the Environment. 2007c)

39. A comparison of the MfE Guidelines provides further confirmation that Horizons' proposed approach is aligned with national trends for indigenous biodiversity management. I am of the opinion that the fundamentals of Horizons approach are likely to be increasingly mirrored in other Regional Plans as Regional Councils develop their respective second generation plans in light of the guidance supplied in 'Protecting Our Places'.

40. Since the POP was notified, we have had several opportunities to field-test the application of Schedule E, and have held several pre-hearing meetings (see evidence of Bettina Anderson) These opportunities have been invaluable, and identified areas that would benefit from some refining. These recommended refinements to Schedule E are discussed later in my evidence.

41. The opportunities to field-test Schedule E arose though landowners conducting activities which have had a detrimental impact on indigenous habitat types (compliance issues), and landowners inquiring about potential impacts of activities they were contemplating (provision of RMA advice). The type of activities that arose in these situations centred around vegetation clearance and wetland drainage and were variously motivated by commercial gain, intensifying land-use, allowing for building platforms, and clearing vegetation to allow for continued sun-shafts to an established home.

42. During the notification period I ran a workshop with Horizons Compliance and Consent Teams to solicit the views of those who will be charged with implementing the One Plan in a regulatory sense. This provided further opportunity to test for practicality of implementation and address any apparent shortcomings. Over the last 18 months I have also run workshops with the Environmental Management (Plants) Team who work with landowners in the non-regulatory sense (see evidence of Alistair Beveridge).

43. The meetings and workshops with staff and stakeholders served to not only refine and enhance Schedule E, but also to highlight that the effectiveness in the policy will largely come via the non-regulatory methods for indigenous biodiversity protection provided for in the POP.

Scope of evidence

44. This evidence has been prepared to provide technical supporting material for Schedule E of the POP.

45. As such, this evidence covers only terrestrial biodiversity and does not address aquatic biodiversity as it is dealt with elsewhere in the POP.

46. I have been heavily involved in the technical aspects (prioritisation of patches for management) of Horizons' non-regulatory terrestrial biodiversity programme (see evidence of Alistair Beveridge); this work is a separate exercise from identifying the need for protection and is not addressed within this evidence. This is because this programme is not a component of Schedule E.

47. This evidence does present:
    - the current state and distribution of terrestrial biodiversity within the Manawatu-Wanganui Region to reiterate the need for a policy response (by way of a regulatory and non-regulatory framework as presented in the POP);
    - technical justification for the habitat classifications (Rare, Threatened, At Risk and No Threat Category);

- consideration of how the proposed approach to indigenous biodiversity protection based on habitat types, compares to the more familiar approach of assessing individual (known) sites for ecological significance;
- the technical basis for Schedule E;
- revisions to improve the presentation of Schedule E within the One Plan; and
- recommendations to the Hearing Committee in relation to Chapter 7 and Schedule E.

4. METHODOLOGIES FOR DETERMINING PREVIOUS AND CURRENT INDIGENOUS VEGETATION COVER AND HABITAT TYPES

Describing indigenous vegetation cover

48. Indigenous vegetation cover can be described at various levels from the generic (eg. 'vegetation') to the informative (eg. named habitat type such as 'Podocarp forest'). The development of the POP indigenous biodiversity provisions built on various levels of describing indigenous vegetation (Table 1) with the aim of building towards being as informative as possible. Table 1 describes these different levels of defining indigenous vegetation cover, the details of which are discussed in the relevant sections of this evidence.

Table 1: A definition of the various levels of describing indigenous vegetation. For the first three levels, each level is more informative than the previous level. Habitat type classification does not provide any further definition of the vegetation, but does indicate status of any habitat types that fall within this classification. Habitat type classifications are linked to policies and regulatory methods within the POP, thus they provide information regarding the management of activities impacting on habitat types. Habitat type classifications are explained in Section 6.

Level of vegetation description	Definition	Example(s)	Reference
Indigenous vegetation cover	Generic term referring to all indigenous vegetation		
Vegetation structure	Based on species architecture OR	Treeland Tussockland	Atkinson 1985

Level of vegetation description	Definition	Example(s)	Reference
	dominant species	Scrub Flaxland	
Habitat type	Named for and defined by dominant vegetation	Kahikatea-pukatea-forest Podocarp forest	Leathwick, *et al.,* unpubl. Leathwick, *et al.,* 2005 Maseyk, 2007 Expert opinion
	Defined by physical environment and vegetation type	Dune slack Swamp	Johnson and Gerbeaux, 2004
	Named for structural vegetation class and defined by physical environment and dominant vegetation type	Grassland on active dunelands Tussockland land on stable dunelands	Williams, *et al.,* 2006
Habitat type classification	Status categories defined for the purposes of the POP. Habitat types can be classified by these categories according to proportional analysis of original cover OR as determined by the frequency and extent	Threatened At Risk No Threat Category Rare	Maseyk, 2007 Williams, *et al*., 2006

Using predictive models and comparative analysis

49. Predictive modelling can help describe potential compositional and spatial pattern of biodiversity across the landscape. In the absence of biological information, environmental

drivers (such as climate, landform and soil) which underlie predictive models can be used to approximate potential ecosystem character and pattern.

50. When the contemporary landscape is of a highly modified nature, as is characteristic for much of the Manawatu-Wanganui Region, it becomes difficult to determine previous vegetation and community pattern. In many cases throughout New Zealand, loss of indigenous vegetation cover occurred at a time and at a rate that detailed records of what was lost were not kept. This trend was mirrored in the Manawatu-Wanganui Region (Saunders (ed.), 1968; Peterson, 1973).

51. .In order to interpret current patterns of diversity across the landscape, the contemporary pattern needs to be put within the context of previous biological pattern. Comparative analysis of this sort is useful to identify magnitude and distribution of change or loss. This is essentially a consideration of representativeness on the landscape scale. Representativeness can be described as a comparison of biodiversity found in the contemporary landscape with that characteristic of the landscape at some time in the past. Consideration of representativeness in this manner is similar to the more familiar assessment of significance for discrete sites (Section 7). The key difference in approach as presented in the POP, is that assessment of representativeness is applied to specific habitat type across the Region, without defining discrete patches of this habitat in space. That is, consideration of the landscape patterns together as opposed to consideration of patches one at a time.

Predicting previous indigenous vegetation cover

52. The Land Environments of New Zealand (LENZ) (Leathwick *et al.*, 2002; Leathwick *et al.,* 2003) has become the nationally accepted tool by which to predict previous indigenous vegetation cover, and to determine representativeness of remaining indigenous vegetation cover. Therefore, previous indigenous vegetation cover was predicted for the Manawatu-Wanganui Region using LENZ.

53. .LENZ classifies New Zealand into units (land environments) that are internally similar to each other but which differ from other land environments regardless of where these land environments occur in the landscape. The environmental variables used for the classification are climate, landform and soil. These variables are important for their roles in driving geographic variation in biological patterns. Thus, land environments are an approximation of potential ecosystem character, and can therefore be used to determine potential vegetation cover prior to human settlement.

54. Environmental pattern can be applied as a surrogate for biodiversity pattern. Difference in land environment can be used to predict difference in ecosystem character (Figure 1).

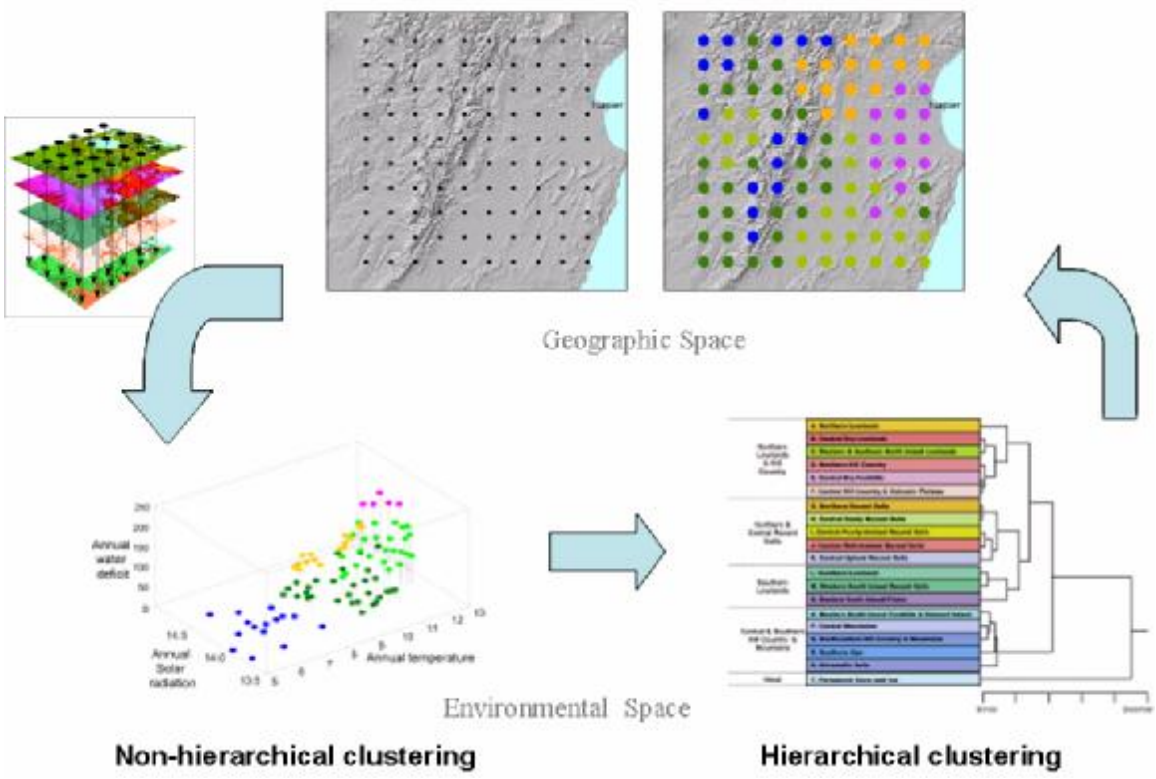


Figure 1: An overview of the LENZ classification. The difference between points in geographic space (top centre left) can be described by layers of environmental variables that exert influence on any given point in geographical space (top left corner). This variance can explain difference in environmental space (bottom left). Difference in environmental space can be clustered in a hierarchical manner (bottom right) which groups like with like and separates out differences. Therefore, the points in geographic space can also be grouped like with like (these are LENZ land environments) (top centre right). These differences in land environment can be used to predict difference in ecosystem character. (Image courtesy of Dr Jake Overton, Landcare Research Ltd, Hamilton).

55. LENZ is a hierarchical system with four geographic scales. The higher the level the greater the number of land environments. (eg. Level I has 20 land environments while Level IV has 500 land environments) (Leathwick *et al.*, 2003). The data for this project was assessed at LENZ Level IV (500 land environments nationally), as Level IV is the most detailed and therefore appropriate level at which to determine regional difference.

By using LENZ, the patterns of distribution of previous indigenous vegetation cover were predicted.

Delimiting current indigenous vegetation cover

56. Current indigenous vegetation extent was delimited using the widely used national spatial database Land Cover Database2 (LCDB2) (Terralink, 2004). The LCDB2 is based on satellite imagery and translates this satellite image to land cover on the ground. The entire land cover of New Zealand has been identified and classified into land cover classes. Land cover classification for LCDB2 is a hierarchical development, building on the classes identified in LCDB1. The land cover classes that relate to indigenous vegetation cover determined current extent are provided in Appendix 1.

Predicting potential habitat types

57. Predicted indigenous vegetation cover could be more usefully defined by predicting groupings of plant species and thus classifying vegetation as specific forest and wetland 'habitat types'.

58. The 'Leathwick Predicted Potential Natural Vegetation Types (LPVT) (Leathwick, *et al.*, 2005; Leathwick, *et al.*, unpubl.) was used to predict habitat types and their distribution for the Region. Use of the LPVT dataset served to refine our analysis.

59. The LPVT defines forest pattern using statistical modelling techniques coupled with extensive forest composition data and 15 climate and soil layers. The predicted abundances for individual tree species were combined and classified to derive forest classes. Species abundance and forest composition was able to be predicted at a grid resolution of 100 m (Leathwick *et al*., unpubl.). Thus, biodiversity information is applied to predictions of vegetation cover to group like with like and delimit specific habitat type. This provides the best approximation for habitat type, not the distribution of a focal species.

60. The Wetlands of National Importance (WONI) project (Ausseil *et al.*, *in press*) data layer replaced the wetland data in LPVT. This provided more refined information on predicted wetland distribution.

61. The LPVT model was overlaid with LCDB2 data layers. This enabled the current vegetation cover to be expressed as specific habitat type. It was necessary to ensure that what was considered to be 'remaining habitat' was of the same composition (allowing for disturbance and threat-related modifications) as the original habitat. In order to do this,

a rationalisation of LCDB2 landcover classes against LPVT habitat types was conducted. The LCDB2 landcover classes considered to be representative of original habitat for each of the LPVT habitat types are provided in Appendix 2.

62. Parallel analysis of LENZ and LPVT allowed for more detailed classification of forest habitat type across the Region than could be provided by LENZ analysis alone. The habitat types have been assigned names. It is important to note that these names are labels only, and are not intended to be a habitat description. Habitat type names are a combination of species and forest type that can best indicate or characterise forest composition.

63. It is important to note that there are inherent limitations to predictive reconstruction of forest composition (Leathwick, 2001). Predictions of habitat type character are not necessarily perfectly replicated on the ground due to modification and compositional change. An example of this would be the loss of possum preferred species, or the decrease in abundance of timber species. We can expect to see variance between predicted habitat type and what is actually observed on the ground. Such limitations will be emphasised in areas which have experienced the greatest loss, or undergone change due to a major event (eg. volcanic events) (Leathwick, 2001). Variability in species composition and abundance will also exist between patches of the same habitat. These limitations do not threaten the validity of using the LPVT data layers. In the absence of any substantial biotic data for much of the Region, predictive modelling remains a sensible and robust tool.

64. A summary of the national spatial databases and predictive modelling tools used to derive and delimit previous and current distribution of indigenous vegetation and specific type with the Region is given in Table 2.

Table 2: A summary of the national spatial databases and predictive modelling tools used to derive and delimit previous and current distribution of indigenous vegetation and specific habitat type within the Manawatu-Wanganui Region. The spatial analysis involved was conducted for Horizons by Landcare Research Ltd (Overton, *et al.,* 2006). Habitat types and vegetation structure are defined in Table 1. (LENZ (Leathwick *et al*., 2002; Leathwick *et al.*, 2003); LPVT (Leathwick *et al.*, 2005; Leathwick *et al.*, unpubl.); WONI (Ausseil *et al.*, *in press*); LCDB2 (Terralink, 2004)).

Spatial Analysis	**Tools**	**Explanation**
Predicted Original Cover (defined by habitat type)	LENZ	Uses environmental drivers (eg. climate, landform and soil) to approximate potential ecosystem character, and can thus predict patterns of previous indigenous cover.
	LPVT	Defines forest pattern using statistical modelling techniques coupled with extensive forest composition data and environmental drivers. Predicted abundances for individual tree species were combined and classified to derive forest habitat types.
	WONI	The WONI dataset replaced the wetland data in LPVT, providing more refined information on predicted wetland distribution. Parallel analysis of LENZ and LPVT allowed for more detailed classification of forest habitat type across the Region, than would be provided by LENZ analysis alone.
Actual Current Cover (defined by vegetation structure)	LCDB2	LCDB2 translates satellite imagery to land cover on the ground. All of New Zealand is classified into land cover classes. Land classes that relate to indigenous vegetation cover were used to determine current extent.
Predictive Current Cover (defined by habitat type)	LCDB2 LPVT	The overlay of these two data layers enabled the current indigenous cover (as delimited by LCDB2) to be expressed as a more detailed classification of forest habitat type. A rationalisation between LCDB2 and LPVT ensured that the appropriate landcover class was considered against forest habitat type predicted by the LPVT analysis.

Application of these datasets elsewhere in New Zealand

65. Use of LENZ and LCDB2 to assess loss of former indigenous cover and representativeness of remaining cover has become a national standard (eg. Walker *et al.*, 2006; Brockerhoff, *et al.*, 2008) and is currently being widely used (eg. Ministry for the Environment, 2007b, other Regional and District Councils, Department of Conservation, private consultants).

66. The application of biological information (in the form of identified habitat types) is less common by virtue of being the next step in an evolving area of ecological science, namely refining the application of predictive models to make them more informative and to increase accuracy. The incorporation of biological information within the POP, is appropriate, consistent and repeatable. The framework is based on peer reviewed and nationally accepted statistical models and national spatial datasets.

67. By delimiting habitat based on biological information, and thus producing information more in line with biodiversity pattern across the landscape, we move away from the generic and somewhat meaningless 'indigenous vegetation'. The resulting analysis, provides more explicit guidance for a more specific and appropriate policy response.

Identifying habitat types by different means

68. The majority of the habitat types listed in Schedule E were identified using the predictive methodology outlined above. However, this methodology does not fully account for the full range of habitat diversity within the Region. An additional habitat type has been identified by expert opinion, and eight habitat types have been identified as being originally rare according to the national project to identify rare ecosystems (Williams *et al.*, 2006).

69. Uncharacteristic habitat types can exist undetected by predictive models. It is precisely the fact that some habitat types are uncharacteristic and species occur in unpredicted compositions and abundances that such habitat types tend not to be picked up by predictive models. Short-stature and non-woody habitat types are also currently excluded from this analysis yet contribute to the indigenous biodiversity of the Region.

70. These limitations can, to some degree, be overcome by the use of expert opinion to describe and spatially define distinctive habitat types. Such methodology is open to more subjectivity than the use of national spatial databases and predictive computer models. However, in the absence of more robust tools to identify such habitat types, the use of

expert opinion remains a valid method to identify some of the more obscure differences in indigenous biodiversity pattern throughout the Region.

71. Current national spatial datasets and remote sensing techniques tend to also be ineffective at identifying habitat types at a very fine scale and in delimiting non-forest vegetation cover. Therefore, naturally uncommon ecosystems such as those that are small, treeless, specialised, or those that occur in extreme environments (Williams *et al*., 2006) are not included in the predictive methodology used.

72. Consequently, rare habitat types that are present within the Region could not be remotely identified and classified by the same process as forest or wetland habitats. A national programme to identify rare habitats is being implemented by Landcare Research and funded by the Foundation for Research in Science and Technology (FRST). This eight-year programme (initiated in July 2005) will ultimately identify rare ecosystems, spatially define distribution, and identify threats to and management needs of rare habitat types.

73. 'Protecting our Places', the MfE priorities for indigenous biodiversity protection on private land identify originally rare habitat types as a national priority (Ministry for the Environment, 2007b and 2007c).

Key Messages

1. Robust national spatial datasets and predictive models were primarily used to determine original and current extent of indigenous vegetation cover and to define habitat types.
2. These datasets underpin the comparative analysis and determine the degree of loss of indigenous vegetation cover from the Manawatu-Wanganui Region. They also serve as key reference data for expected spatial distribution of each habitat type.
3. Using indigenous vegetation and defined habitat types is an appropriate surrogate for measuring indigenous biodiversity.
4. Using national spatial datasets and predictive models do not identify the full range of diversity amongst habitat types within the Region. Other methodologies need to be employed to allow for this shortfall where appropriate.
5. Alternative methods for identifying uncharacteristic and small and unique habitat types includes the use of substantiated expert opinion and guidance from the national rare ecosystems project.

5. PREVIOUS AND CURRENT INDIGENOUS VEGETATION COVER IN THE MANAWATU-WANGANUI REGION

Previous indigenous vegetation cover

74. Prior to the arrival of humans, the Manawatu-Wanganui Region was almost completely covered in indigenous vegetation. This cover was dominated by extensive forest cover (98% forest cover (Ewers *et al.*, 2006; Overton *et al*., 2006), fire-induced tussockland on the Central Volcanic Plateau, and large areas of wetland habitat and extensive dunefield along the west coast of the Region. This dunefield is the most extensive transgressive parabolic dunefield in New Zealand (Muckersie and Shepherd, 1995). Sub-alpine and alpine habitat dominated above the treeline.

75. The habitat types predicted to be previously present in the Region are given in Table 3, and the distribution of these habitat types is shown in Figure 2. The original extent of each predicted habitat type is provided in Appendix 3.

Table 3: Habitat types predicted to be previously present in the Manawatu-Wanganui Region. Habitat type names have been modified from those given in Leathwick *et al.* (2004) and Leathwick *et al.,* (2005) to make better sense within the context of the Manawatu-Wanganui Region, and to lend themselves better to policy documents (Maseyk, 2007). Habitat type names are labels only, and are not intended to be a habitat description.

Habitat Types Predicted from the Manawatu-Wanganui Region	
Alpine gravel and rock	Podocarp/black beech/mountain beech forest
Dunelands	Podocarp/kamahi forest
Estuarine open water	Podocarp/kamahi-beech forest
Hardwood/broadleaf forest	Podocarp/kamahi-silver beech forest
Hall's totara/broadleaf forest	Podocarp/red beech-kamahi-tawa forest
Hall's totara/silver beech-kamahi forest	Podocarp/tawa-mahoe forest
Kahikatea-pukatea-tawa forest	Red beech-silver beech forest
Kahikatea-totara forest	Rimu/tawa-kamahi forest
Mountain beech forest	Scrub, tussock-grassland and herbfield above treeline
Mountain beech-red beech forest	Silver beech forest
Podocarp forest	Wetland
Podocarp/broadleaf-fuchsia forest	

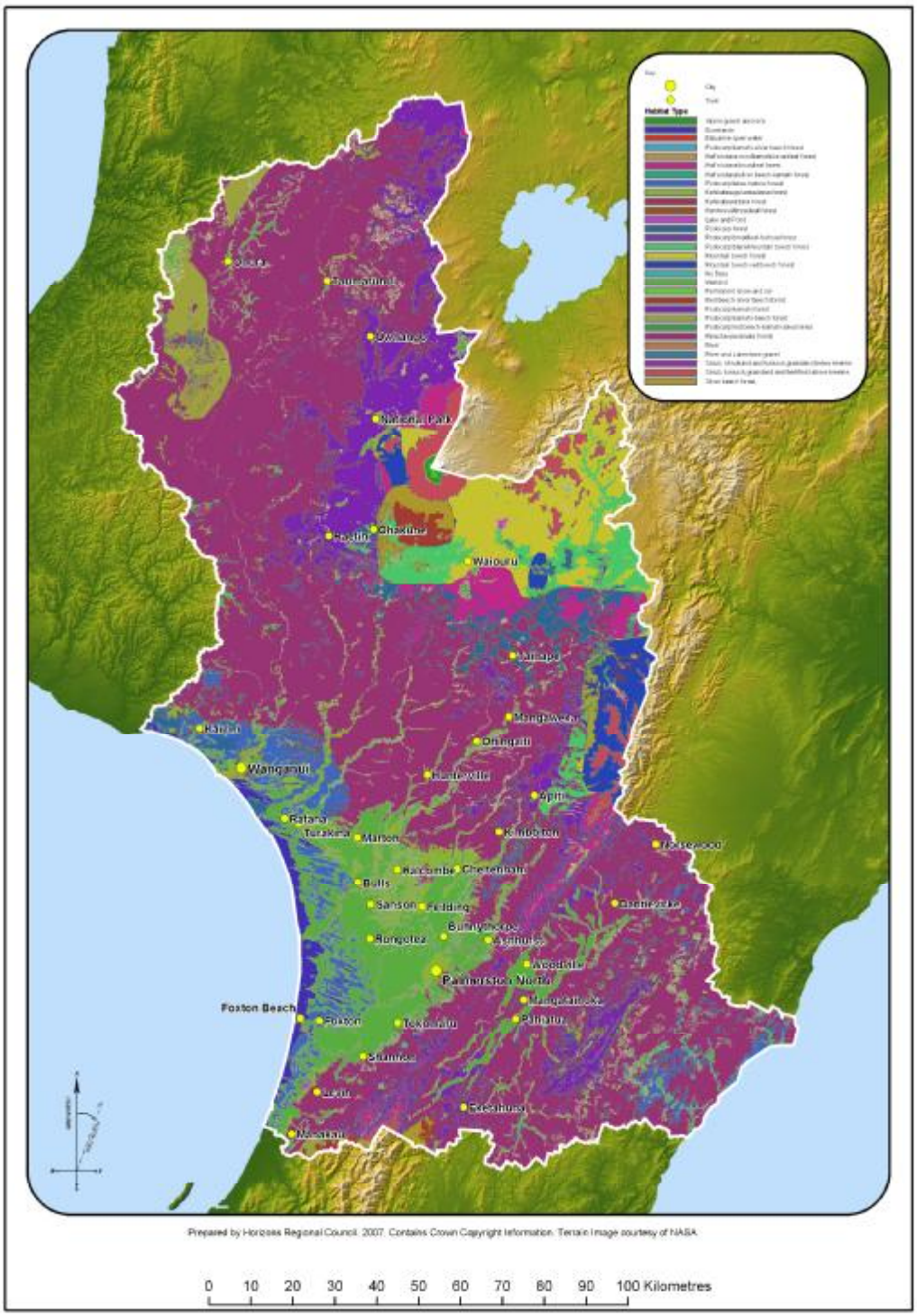


Figure 2: Predicted previous extent of indigenous vegetation defined by habitat type in the Manawatu-Region.

Current indigenous vegetation cover

76. The habitat types predicted to be currently present in the Region are the same as those predicted to be previously present (Table 3) with the exception of 'kahikatea-totara forest' which is no longer predicted from the Region.

77. The current extent for each habitat type is presented in Appendix 3. The distribution of the remaining indigenous vegetation cover is shown in Figure 3.

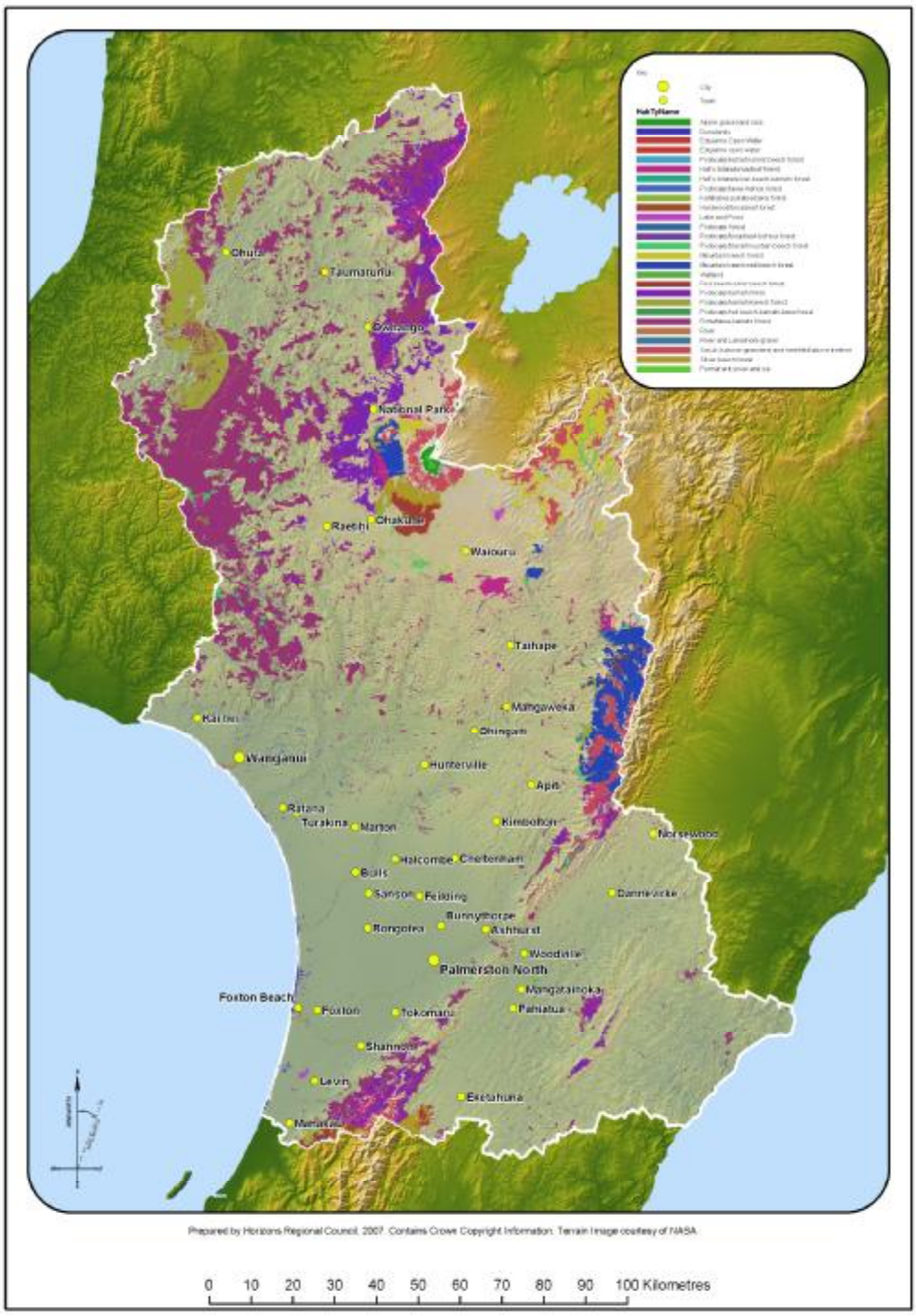


Figure 3: Current extent of indigenous vegetation defined by habitat type in the Manawatu-Region.

Additional habitat types

78. To date, only one habitat type (Kanuka forest) has been identified via expert opinion, but there is the potential that other habitat types could be identified in this manner.

What has been the extent of loss for indigenous biodiversity?

79. When considering habitat type to be a surrogate for indigenous biodiversity, a comparison of Figure 2 and Figure 3 reveals a considerable loss of indigenous biodiversity from the Manawatu-Wanganui Region. This loss is presented numerically in Table 4. Degree of loss of habitat can also be used as an indication of the degree of interruption to ecological process and reduced ecosystem function.

Table 4: Remaining indigenous vegetation within the Manawatu-Wanganui Region expressed as a proportion of predicted original cover (Overton *et al.*, 2006).

	Original cover (ha)	**Remaining Cover (ha)**	**Percent remaining (%)**
Generic indigenous forest cover Includes all vegetation structure (eg. forest, scrub, herbfield, grassland, shrubland, wetland etc.)	2, 220,554.375 (predicted by LENZ analysis)	749,288.688 (delimited by LCDB2 analysis)	33.7%
Specific named forest habitat type Restricted to indigenous vegetation cover classified as named habitat type (eg. forest and wetland habitats)	2,218,891.56 (predicted by LENZ and LPVT analysis)	489,853.58 (delimited by LCDB2 and LPVT analysis)	22.1%

80. The difference between the two percentages presented in Table 4 can be attributable to the exclusion of scrub and shrubland habitat (and other non-forest habitat) from the LPVT analysis.

81. This loss of indigenous vegetation cover has not been consistent across the landscape, with the lowland (<300 m asl) areas of the Region experiencing the most extensive decline, almost to the point of total loss. Figure 4 (map A) shows the elevation modelling for the Region and the current distribution of indigenous vegetation.

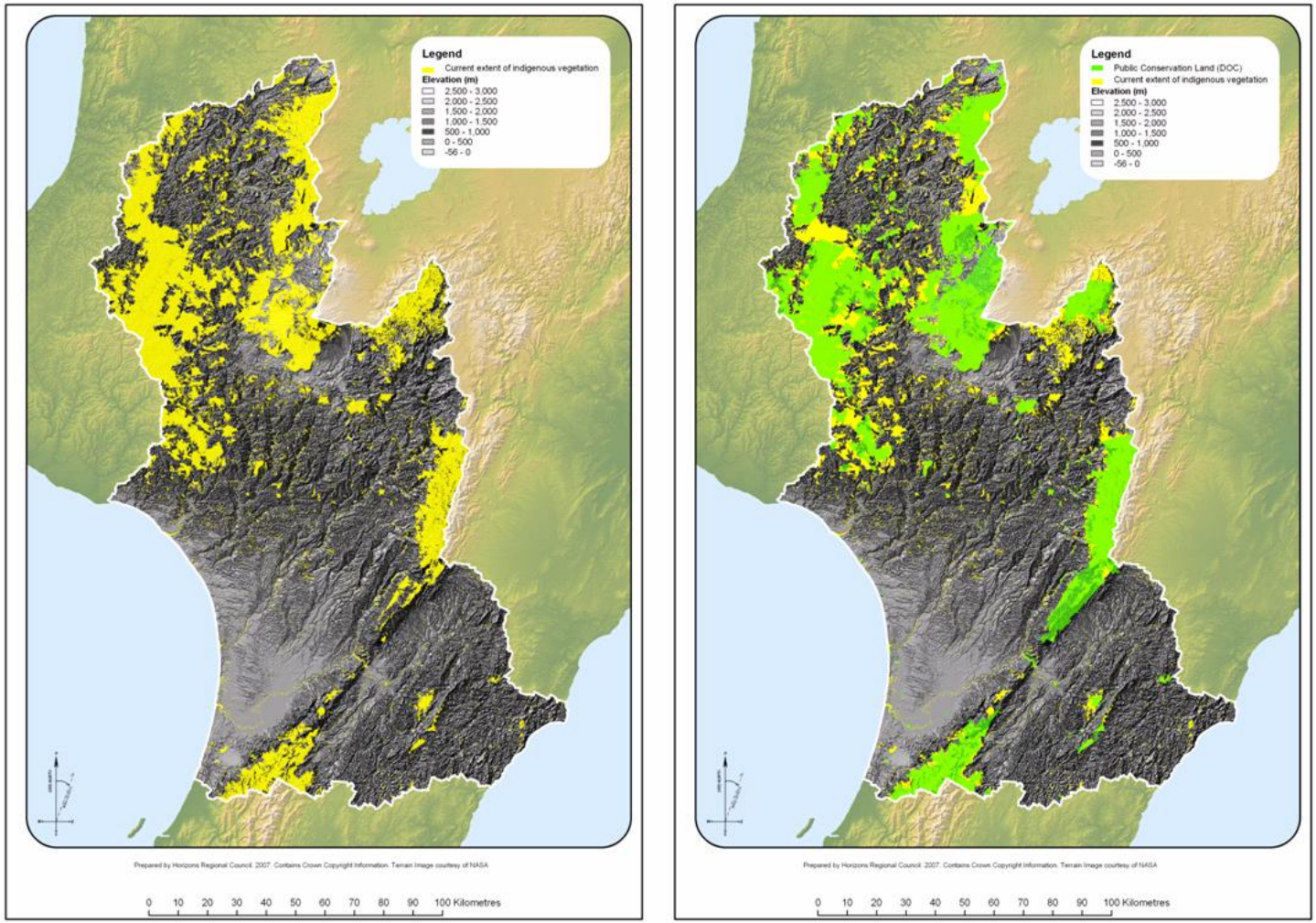


Figure 4: Map A: Elevation model for the Manawatu-Wanganui Region and current extent of indigenous vegetation cover (shown in yellow). Map B: Elevation model for the Manawatu-Wanganui Region, current extent of indigenous vegetation cover (shown in yellow), and Public Conservation Land vested in the Department of Conservation (shown in green). Current indigenous vegetation cover (shown in yellow) is mapped according to the LPVT and LCDB2 analysis (Overton *et al.*, 2006) (Section 2) all habitat types are mapped here in as one colour for simplicity. Elevation (m) above sea level is indicated by grey shading.

82. There is a clearly defined positive relationship between the suitability for human use of a landscape and the degree of habitat loss from that landscape. Those areas prone to fire or suited to agriculture and development (eg. lowland areas) have suffered almost complete loss of intact indigenous vegetation cover.

83. Of the 22.1% of remaining named habitat type (Table 4), the majority (17.8%) is within Public Conservation Land managed by the Department of Conservation (Figure 4 map B). This is not surprising as like the majority of remaining habitat, the majority of Public Conservation Land is also found at altitudes greater than 300 m asl (Figure 5).

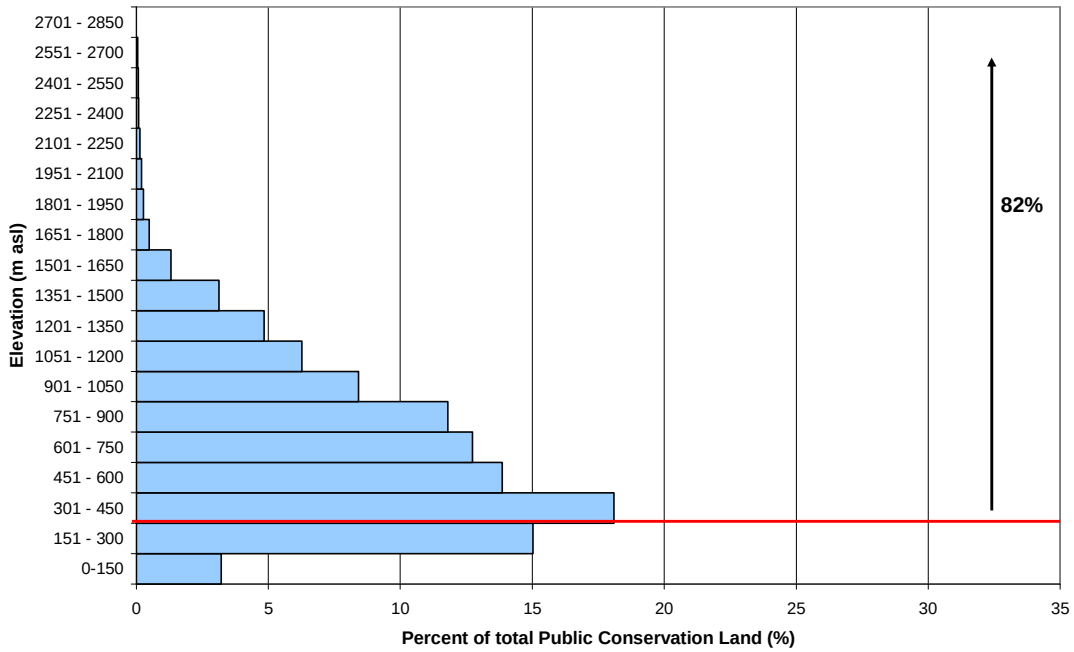


Figure 5: Histogram showing the percent of Public Conservation Land present at each elevation (m asl) within the Manawatu-Wanganui Region. The red line indicates 300 m asl (everything below which is considered to be lowland), above which (indicated by black arrow) lies 82% of the Public Conservation Land. (n = 395,171.1 ha).

84. Figure 5 shows a large proportion of the Public Conservation Land (18%) present between 300 – 450 m asl. This can be largely attributable to the Whanganui National Park, which although at relatively low altitude and comprises steep hill country. In addition, the area is wet and cold.

85. The indigenous habitat that remain in the lowland regions is mostly on private land, and largely unprotected legally. Covenants, such as a Queen Elizabeth II Trust (QEII Trust) Open Space Covenant are increasingly popular with many landowners. However, The

QEII Trust and other covenanting agencies have limited abilities to ensure compliance with covenant conditions and self-enforcement of covenant protection is inconsistent between landowners.

86. Kahikatea-totara forest, the one habitat type to disappear completely from the Region since human occupation, was never very common, (with a predicted original extent within the Region of only 21.9 ha (Appendix 3)), but none-the-less its disappearance from the Region does represent a decline in ecosystem diversity, and provides an example of the eventual ramifications of decline in extent of any given habitat type.

Key Messages

1. The region has experienced considerable loss of indigenous habitat. Loss of habitat directly equates to a loss indigenous biodiversity.
2. There has been a disproportionate distribution of indigenous biodiversity loss, with the areas most suited to human utility (eg. lowland, settled climate, productive areas) have experienced the most severe extent of loss, and those areas less suited to development (eg. steep, harsh climate, less productive areas) have experienced the least severe extent of loss.
3. Most of the indigenous biodiversity occurring in the lowland areas is not well represented in the Public Conservation Estate, and although some patches might be vested in (for example) Queen Elizabeth II Open Space Covenants, the majority of remaining lowland indigenous biodiversity does not fall under a consistent protection regime.

6. WHAT IS THE IMPACT OF THIS LOSS OF INDIGENOUS BIODIVERSITY?

62. Region-wide analysis has clearly shown that the extent of indigenous vegetation cover within the Manawatu-Wanganui Region has been reduced considerably, particularly on the lowlands of the Region, and that much of the remaining indigenous vegetation cover is highly representative of habitat type once common, and therefore, is of considerable ecological importance. Remaining indigenous vegetation cover is increasingly fragmented and degraded and ecological functions and processes within these habitat types have been compromised, or interrupted.

63. Large-scale loss of indigenous vegetation has resulted in a dramatic change in the landscape, shifting from one previously dominated by continuous indigenous vegetation cover to one characterised by a matrix of land-cover dominated by production land and human-settlement infrastructure. Indigenous vegetation has been largely reduced to patches throughout the landscape, often small discrete and isolated sites.

64. This loss has direct implications for the vegetation communities which comprise specific habitats, and for the species which are dependent on particular habitat type. Therefore, the losses are explicit at the landscape, habitat and species scale.

65. The change in landscape from previously extensive areas of habitat to scattered patches of remaining habitat, is a function of habitat fragmentation. Habitat fragmentation is a wide-ranging concept that has been interpreted by different authors with different definitions, measured in different ways and at different scales (Fahrig, 2003). Here, 'fragmentation' is considered to incorporate both habitat loss and dissection of habitat as these processes occur at the landscape scale, and is considered to result in a severely detrimental impact on indigenous biodiversity. The 'fragmented landscape' discussed in the context of the Manawatu-Wanganui Region is not considered to be the endpoint of a process conducted in previous temporal space, but rather an ongoing process, as ecosystems adjust to biotic and abiotic changes associated with habitat loss and fragmentation processes.

66. The change in habitat pattern across the landscape, and the increased proportion of exotic vegetation to habitat has negative implications for biodiversity, especially for specialist species with specific habitat requirements. Within the Manawatu-Wanganui Region species have become extinct (eg. huia, tieke [North Island saddleback]), reduced significantly in population size and distribution (eg. northern rata, kiwi, kereru), or restricted in geographical extent (eg. North Island robin).

67. The loss or reduced productivity of key species (such as the pollinators and dispersers) further compromises the long term viability of habitat. The increase in edge area, associated with the processes of habitat loss and fragmentation, exposes habitat to a detrimental change in abiotic factors (warming and drying influences of exposure, wind damage, changing light, temperature and moisture levels within a system). Habitat loss results in fragmented habitat which leads to further fragmentation and habitat loss.

68. This change in spatial configuration of habitat also interrupts important ecological processes (including dispersal, recruitment, energy transfer etc.). Thus, detrimental impacts of habitat loss and fragmentation are not restricted to only a spatial domain, but also temporal and functional domains (Lord and Norton, 1990). Interruptions to critical processes, or at critical points (temporal or functional) within a system, result in further degradation and ultimately continued and accelerated loss.

69. As the response of a population to environmental change is not always immediate, there can be a delay between habitat loss and eventual extinction of species, known as the

'extinction debt' (Hanski and Ovaskainen, 2001; Ewers *et al*., 2006). The rate through time at which this extinction debt is paid varies with the life systems of each organism and is therefore not consistent across biota.

70. The continued decrease in size and condition of remaining patches of indigenous habitat restricts the ability for movement of species and propagules between sites. Loss of species from the landscape, or depletion of species vigour, has consequent interruptions in the food-chain and disrupts trophic level processes. Fragmented and degraded areas of habitat are highly vulnerable to invasion by pest species (Timmins and Williams, 1991), resulting in further reduction in site and species vigour, a change in species composition and modification of the trophic levels. Pest invasions can ultimately lead to the collapse of the original ecosystem.

71. Continued loss in indigenous biodiversity will translate to decreases and interruptions to the ecological services that indigenous biodiversity provides. A more visually evident role of indigenous biodiversity, particularly in the Manawatu-Wanganui Region, is the role in soil health and stability. Less obviously, but no less important is the role in energy transfer and gas exchange for example. Indigenous biodiversity is a resource that we utilise directly and indirectly on many levels. A decline in indigenous biodiversity will result in decreased availability, efficiency and function of the resource on which we depend.

72. Continued decline of any given habitat type (within patches, and across landscapes) will eventuate in a change in vegetation composition, loss of species and ultimately complete disappearance of these habitat types from the Region. The consequence of which is a tangible reduction in the number of species, communities and ecosystems found within the Region.

73. Further, although there is only a small amount of indigenous vegetation on the lowlands its ecological importance is disproportionate to its total extent. The Region's remaining lowland habitats are not well represented in the Public Conservation Land.

Key Messages

1. There has been a dramatic change in the landscape, and indigenous vegetation has been largely reduced to increasingly isolated and fragmented patches throughout the landscape.
2. This change in indigenous biodiversity pattern has had negative implications for a number of habitat types and species (especially specialist species).
3. The loss, or reduction in abundance of key species (such as pollinators and dispersers) further compromises the long term viability of the Region's indigenous biodiversity.

4. A continued decline in indigenous biodiversity will result in a continued disruption to the ecosystem services on which we rely.

7. CONTINUED PRESSURES ON AND VULNERABILITY OF INDIGENOUS BIODIVERSITY

74. Initial loss was due to random, natural events (Table 5) and was balanced by the continuation of vegetation establishment processes and the formation of new habitat.

Table 5: Rates of loss of indigenous vegetation cover from New Zealand. Estimated proportions of remaining indigenous vegetation cover are expressed as percentages of New Zealand's land surface area (data from McGlone, 1989 and Ewers *et al.*, 2006)

Cultural History	Time Period	Primary cause and reasons for loss of indigenous vegetation cover. (Area and/or pattern of greatest loss)	Estimated indigenous vegetation cover as a proportion (%) of New Zealand remaining at end of period (percentage of original cover lost)
Pre-human	> 1000 BP	Natural fire, earthquake, volcanism, lahars, natural dune-building phases, climate change. (Random events)	98
Maori settlement	1000 BP – 1840	Human-induced fire, dune movement, natural events. Forest clearance to encourage bracken growth, allow for cross-country travel, and assist hunting efforts. (Dry, lowland, coastal and often eastern areas)	68 (30.6)
Post-Maori settlement	1840-now	Human-induced fire, mechanical clearance, over-grazing of sand country, dune movement, land conversion for intensive agriculture, horticulture, exotic forestry, settlement and infrastructure. (Lowland and areas of mild climate suited to development, but increasingly clearance of hill country and land previously unsuited for development).	23 (76.5)

75. Since human habitation of New Zealand indigenous vegetation cover was modified and lost as it was increasingly used as a resource (Park, 1995) , and removed to make way for human settlement. Animal species were also utilised as sources of food, feathers, and fat (McGlone, 1989; Wright *et al.*, 1995). This use and modification of the biodiversity resource increased with the wave of European settlement. Conversion of the landscape

rapidly accelerated as the need for productive land, settlement areas, and space for infrastructure and industry grew. The pattern of indigenous biodiversity loss in the Manawatu-Wanganui Region closely mirrored the trends elsewhere in New Zealand.

76. In the contemporary landscape, clearance and drainage to provide space continues but at a much slower rate. The continued pressures of such human activities are evident from monitoring over time, anecdotal accounts of illegal logging, and our own compliance incidents and resource consent inquiries. Invasive pest species have replaced human destruction as the primary source of degradation to indigenous biodiversity (New Zealand Biodiversity Strategy).

77. Change in character and pattern indigenous vegetation cover is a natural and dynamic process. In the Manawatu-Wanganui Region two obvious examples of the loss of one habitat type and the creation of another are the Rangipo Desert on the Central Volcanic Plateau (Gabites, 1986) and the parabolic dunes of the Foxton Ecological District (Cowie, 1962; Muckersie and Shepherd 1995). However, new areas and systems are not being created. Ecosystems that have been interrupted are not being allowed to recover. In such instances evolutional processes are also halted. The dynamics of the cycle of life are interrupted, with species and ecosystem loss occurring but species and ecosystem gain not occuring.

Vulnerability of remaining indigenous biodiversity

78. Much of the remaining indigenous vegetation throughout the Region has fallen below self-sustaining thresholds. Consequently, without protection and restoration measures, these remaining refugia of habitat will continue to degrade and collapse. This will result in continued biodiversity loss both at the site and at landscape scale.

79. This is particularly likely for those habitat types that have less than 20% of previous cover remaining. This is because species persistence is a function of habitat size and isolation, as described by island biogeography theory (MacArthur and Wilson, 1967). Extinction rates are determined by the size of habitat, while rate of colonisation of an area is a function of isolation (distance from other area). The theory shows a non-linear relationship between size and number of species, with larger areas of habitat supporting more species than smaller areas (MacArthur and Wilson, 1967; Rosenweig, 1995, Walker *et al.*, 2005), and thus species loss increases as area of habitat decreases (Figure 6)

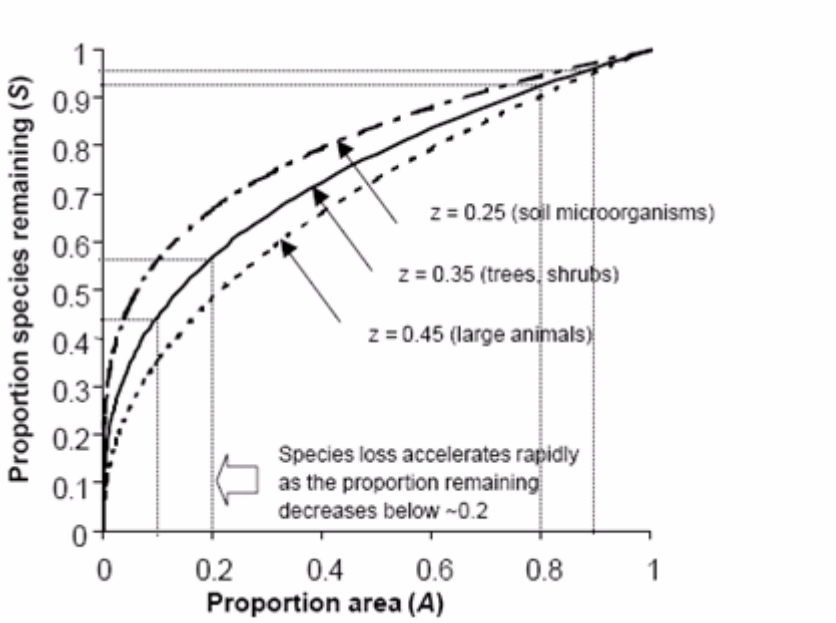


Figure 6: Generalised species-area curves taken from Walker *et al.* (2005). The proportions of species remaining (S) are presented in relation to the area (expressed as a proportion) of remaining indigenous habitat (A), and are given for biota of different body size. The dotted lines illustrate rate of loss of species with a decrease in habitat area.

80. Island biography has been applied to terrestrial ecology where fragments are 'islands' and the surrounding modified landscape is the 'sea'. While this application remains valid, the importance of scale is now also recognised (Rutledge, 2003).

81. The total amount of habitat is a fundamental determinant for species survival, regardless of how this habitat is spatially arranged across the landscape. (Rutledge, 2003). There is a drastic decline in species survival once a habitat extent drops below a certain threshold (Fahrig, 2001, Rutledge, 2003). This is known as the 'extinction threshold', a largely theoretical (Fahrig, 2003) concept that has been described by Fahrig (2002) as "the minimum amount of habitat required for a population of a particular species to persist in a landscape". This minimum amount of habitat is reached when mortality is equal to reproduction across the landscape (Fahrig, 2002). When considered collectively across a landscape, even small patches of habitat contribute to the habitat minimums required for species persistence. Therefore, any further loss in habitat extent will impact on species survival (Rutledge, 2003).

82. Extinction thresholds are species-specific (Walker *et al.,* 2005), and dependent on population dynamics in relation to habitat requirements, resource availability, patterns and processes of habitat use, and population models (eg. such as described by CE [colonisation-extinction] or BIDE [birth-immigration-death-emigration) models]) (Hanski

and Ovaskainen, 2001; Fahrig, 2002). What remains consistent is the trend of the curve, and the rapid decline in species persistence once the extinction threshold has been crossed (Walker *et al.*, 2005; Rutledge, 2003; Fahrig, 2001; Fahrig, 2002).

83. The species-area curve that approximates the species-area relationship for trees (and shrubs) has been used in this analysis to determine a theoretical extinction threshold. This is logical as trees can be determined by remote sensing and therefore remaining cover can be assessed. Further, the LPVT habitat types have been determined by distribution and association of dominant tree species.

84. Habitat types, species and ecosystems that have experienced considerable loss and remain in the landscape in fragmented and often isolated patches are more likely to succumb to processes of continual decline, and to have reduced capacity to recover from events (eg. compromised disturbance-recovery regimes). In the Manawatu-Wanganui Region, these patches of habitat type tend to be located within areas of high human utility and where land-use pressures are high and continual and consequently less likely to persist into the future without management.

85. It could be suggested that the smaller and more highly degraded areas are 'too-far-gone', and likely to collapse through biological and environmental processes in due course anyway, and thus do not warrant protectionist intervention. As illustrated above, the smaller more modified patches are indeed under considerable pressures. It is acknowledged that there still exist small pockets of indigenous vegetation that we do not expect to persist in the landscape for much longer. This acknowledgment has been translated into 'exclusion criteria' in Schedule E to effectively remove them from consideration for protection.

86. However, not all are beyond recovery in the long-term. In the short-term it is prudent to ensure the continued existence of such fragments throughout our landscape. Such fragments often have ecological roles external to their own internal functions and processes – for example, by providing 'stepping stones' (resting, breeding, cover) and/or food supplies for mobile species moving across the landscape, and maintaining seed sources and genetic diversity of component species.

87. Protection of even the small and fragmented areas is biodiversity insurance for the future. This is especially the case for the lowland areas (where patches tend to be smallest, most isolated, and most modified), as the indigenous biodiversity of the lowland areas is not found elsewhere and is rapidly disappearing.

88. Protection of purely the extent of cover, for any given habitat type, will not ensure longevity in the contemporary New Zealand environment as pest species, and land-use pressures are almost uniform on at least some components of an ecosystem across all habitat types, and across all landscape.

89. Invasive animal species can also impact heavily (eg. stoats in mountain beech forest, and possums, particularly in patches of Hall's totara/broadleaf forest and Podocarp/kamahi forest). The impact of pest plant species is more a function of patch condition, than total extent of remaining habitat across the landscape, and the smaller, irregular shaped (high proportion of edge) patches will be prone to invasion (from a number of pest plant species), especially those close to settlements (Timmins and Williams, 1991; Sullivan *et al.*, 2005).

90. As the impacts of pest species can not be regulated for (past banning their deliberate breeding and distribution) a comprehensive, region–wide approach to indigenous biodiversity protection that incorporates pest management is required.

Key Messages

1. Much of the remaining indigenous vegetation cover across the Region is of high ecological value.
2. Without protection, indigenous biodiversity will continue to decline and ultimately disappear from our Region.
3. Decline in indigenous biodiversity translates to a loss of ecosystem functions and processes on which we rely. Loss of indigenous biodiversity is a loss of an invaluable resource.
4. Small, modified and fragmented patches of indigenous biodiversity are worthy of protection as they continue to contribute to the landscape by way of provision of 'stepping-stones' and food sources. Protection of these areas now is providing indigenous biodiversity insurance for the future by ensuring the persistence of these species through time and retaining the potential for recovery.
5. Although reduced from the intensive activities of the 19th and 20th centuries, direct human pressures (eg. vegetation clearance and wetland drainage) still exist. These pressures require a policy response.
6. Non-human impacts (namely those of invasive pest species) represent the greatest threat to the long-term viability of our indigenous biodiversity. This ubiquitous threat also requires a policy response to ensure effective protection of indigenous biodiversity.

8. CLASSIFYING HABITAT TYPE INTO CATEGORIES ACCORDING TO THEIR EXTENT

91. Habitat types can be classified depending on their extent of cover and degree of threat faced by these habitat types. Three classifications ('Threatened', 'At Risk' and 'No Threat Category') were developed for this purpose.

92. The analysis of Overton *et al.*, (2006) and Maseyk (2007) showed that not all remaining habitat types were equally represented, or evenly distributed across the landscape, and ecological theory suggested that those that are less common will be more vulnerable to continued decline in the absence of protection.

93. Therefore the habitat types could be divided between classifications (based on loss) to reflect this difference seen in the landscape. Assigning classifications to habitat types allows for a policy response that is appropriate for the severity of decline and degree of vulnerability for those habitat types which fall within a given classifications.

94. Three classifications – 'Threatened', 'At Risk' and 'No Threat Category' (Table 6) were determined for those habitat types that were classified by analysis of proportional cover. A fourth classification, 'Rare', (Section 2) (Table 6) was determined by the frequency and extent of occurrence in the landscape (Williams *et al*., 2006). All habitat types identified by this report fall into one of these four classifications.

Table 6: The four habitat type classifications used in the Proposed One Plan. The hierarchical nature of the habitat type classifications reflects the variance in urgency of protection.

Classification for Habitat types determined by the frequency and extent of occurrence within the landscape	
Classification	**Definition**
Rare	Habitat types that were originally (pre-human) uncommon in the landscape and remain so. Rare habitat types can be small in scale but geographically widespread or larger in scale but geographically restricted. These habitat types have been defined according to Williams *et al*., 2006.
Classification for Habitat types classified by comparative analysis of current cover with previous cover	
Classification	**Definition**
Threatened	Habitat types that have been reduced to 20% or less of former extent. Threatened habitat types are considered highly representative of former biodiversity pattern.
At Risk	Habitat types that have been reduced to 50% or less of former extent.
No Threat Category	Habitat types where 50% or greater of former extent remains. These habitats can provide habitat for threatened species, distinctive features, or contribute to ecological function at the landscape level. A high proportion of these habitat types are already protected as public conservation land.

95. The remaining extent and how this relates to the classification of each of the habitat types that were identified by proportional analysis can be expressed graphically (Figure 7).

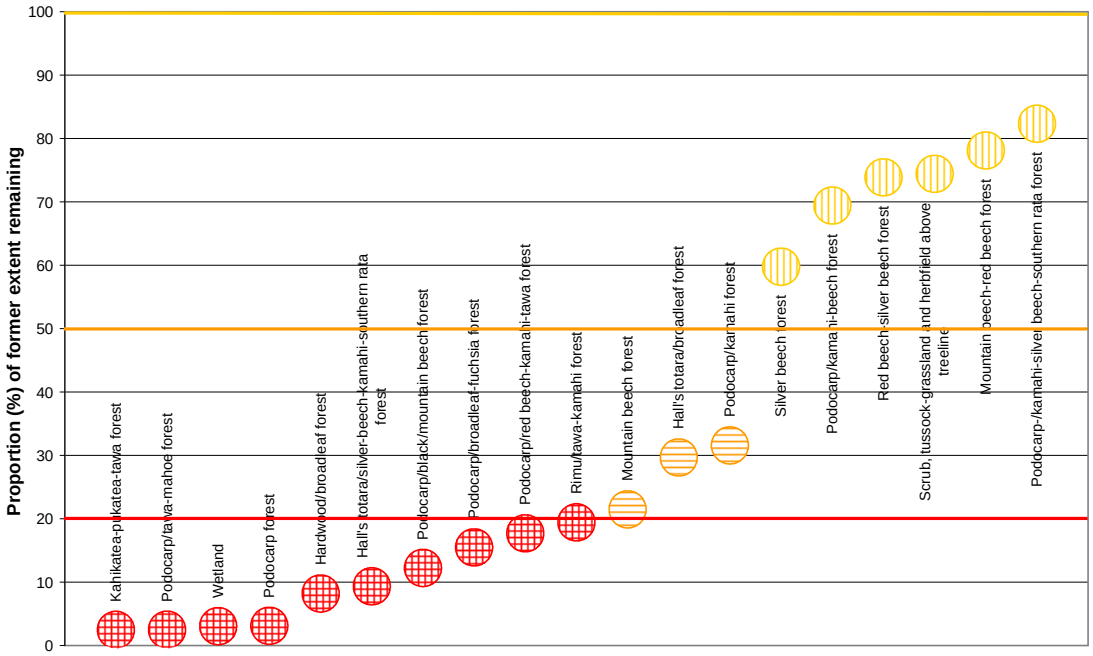


Figure 7: Habitat types (excluding Rare habitat types) identified in the Manawatu-Wanganui Region and remaining extent of each habitat type expressed as a proportion of previous extent. Habitat types below the horizontal red line are considered 'Threatened' habitat types (red hatched circles). Habitat types below the horizontal orange line are considered 'At Risk' habitat types (orange horizontal shaded circles). Habitat types below the horizontal yellow line are labelled 'No Threat Category' (yellow vertical shaded circles).

Threatened habitat type

96. The threshold used to assign habitat types to the Threatened classification are deduced from species-area curves and island biography theory as detailed in (Section 4).

97. Threatened habitat types are those that have been reduced to 20% or less of former extent and are therefore considered to be under-represented across the landscape. The majority (ten habitat types) of the identified habitat types within the Manawatu-Wanganui Region fall into the threatened category (Figure 7). These habitat types were previously dominant throughout the lowland areas of the Region, and now exist as highly fragmented, modified and often isolated patches throughout the lowland landscape (Figure 8). A very small proportion of Threatened habitat types are represented in Public Conservation Land,

as evident by the infrequency of DoC managed land in the lowland areas of the region (Figure 5).

98. Habitat resilience decreases, and susceptibility to incremental loss increases as the proportion of remaining habitat is reduced to 20% of former cover (Rutledge, 2003; Walker, 2005). Even small losses of Threatened habitat type have disproportionately negative impacts.

99. Habitat type that has been reduced to 20% or less of former cover is considered 'Threatened' for two fundamental reasons; (1) loss has been drastic and, (2) the risk of continued loss is high.

At Risk habitat types

100. Three habitat types within the Manawatu-Wanganui Region fall within the 'At Risk' status category (Figure 8). These habitat types fall within the 20–50% range of former habitat cover remaining and are considered 'At Risk', because these habitat types could easily trend downwards, conceivably to below sustainable thresholds if they are not protected.

101. The threshold (20-50% of former cover remaining) for the At Risk classification was deemed an appropriate threshold which would encapsulate habitat types that remained in the landscape in great enough extent to support the potential for ecological processes to function uninterrupted, and habitat types that were likely continue to decline in extent.

102. The majority of At Risk habitat type is found at elevations greater than 300 m asl (Figure 8). These patches of habitat will be providing an important role for soil health and stability where they occur on hill country.

103. Although At Risk habitat types are present across the landscape in greater extent (compared to Threatened habitat types), and remnant patches are generally larger and less isolated from each other, these habitat types remain vulnerable to the processes of habitat fragmentation and pest invasion.

104. Protection of At Risk habitat types can be seen as a precautionary measure by preventing further loss, fragmentation, interruption of ecosystem processes and ultimately decline to below the 20% threshold (thus becoming Threatened habitat type). In a sense, protection of At Risk habitat types is a biodiversity insurance policy.

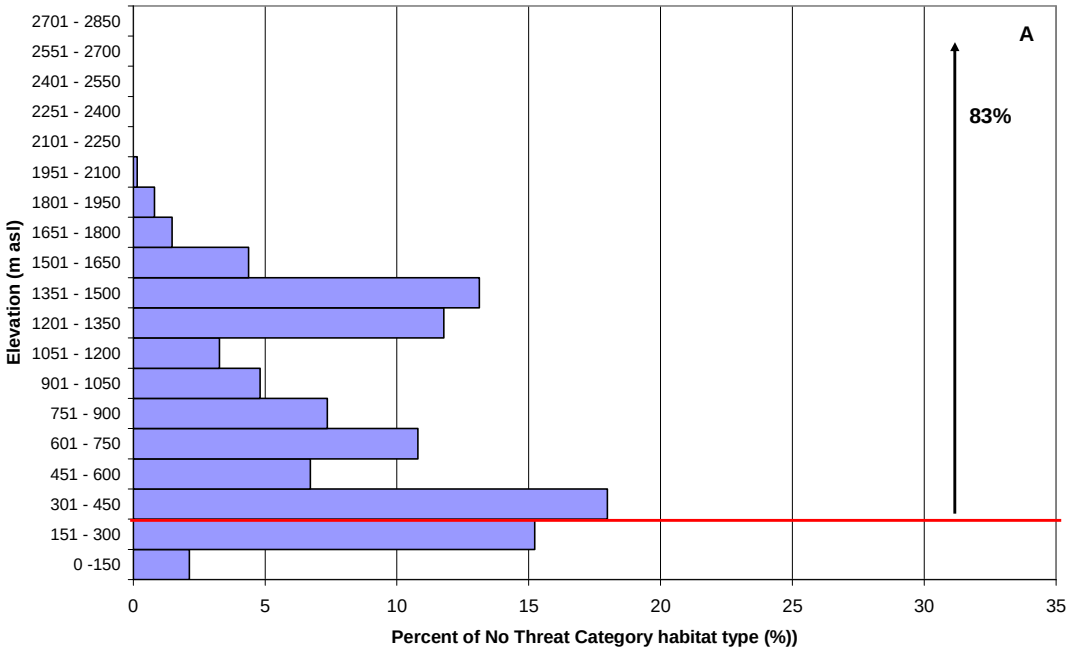
No Threat Category habitat types

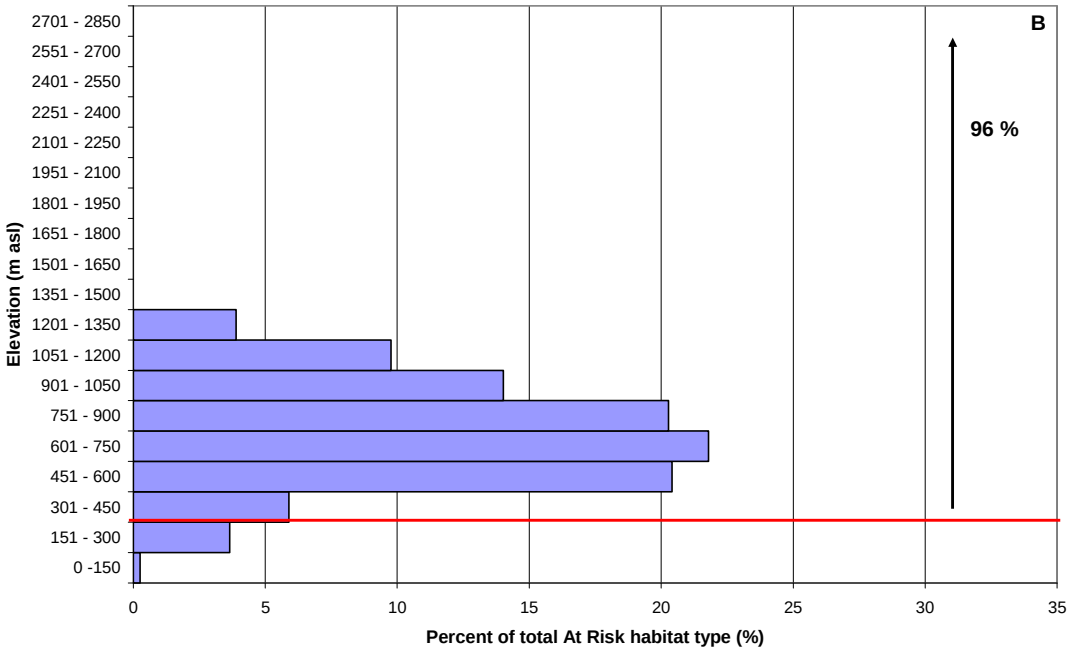
105. The term 'No Threat Category' is in reference to the high proportion of remaining extent of cover, and the low risk of immediate threat to the persistence of these habitat types. The term should not be mistaken to mean that these habitat types are immune to detrimental impacts of threats in general, be they human activities or pest species.

106. Of the habitat types within the Manawatu-Wanganui Region, six have been categorised as 'No Threat Category' habitat types. These habitat types tend to be spatially concentrated on landscape less amenable to development (ie. hill and mountainous areas) (Figure 8) and the persistence of habitat in these areas is largely due to the historic (and to some extent contemporary) lack of demand for the land. These habitat types are also well represented within the public conservation networks.

107. Patches of 'No Threat Category' habitat type tend to be larger, more continuous, and less isolated. Therefore, these patches tend to be more functionally and structurally intact, and more resilient to impacts of invasive species. The patterns of fragmentation (especially small, isolated patches with high proportion of edge habitat) are less evident or absent.

108. These habitat types are still important, through the provision of a raft of ecosystem services that large tracts of forest can offer (eg. soil health and stability, gas exchange), providing habitat for a number of species, and providing connections across the landscape. 'No Threat Category' does not equate to 'No Value Category'.





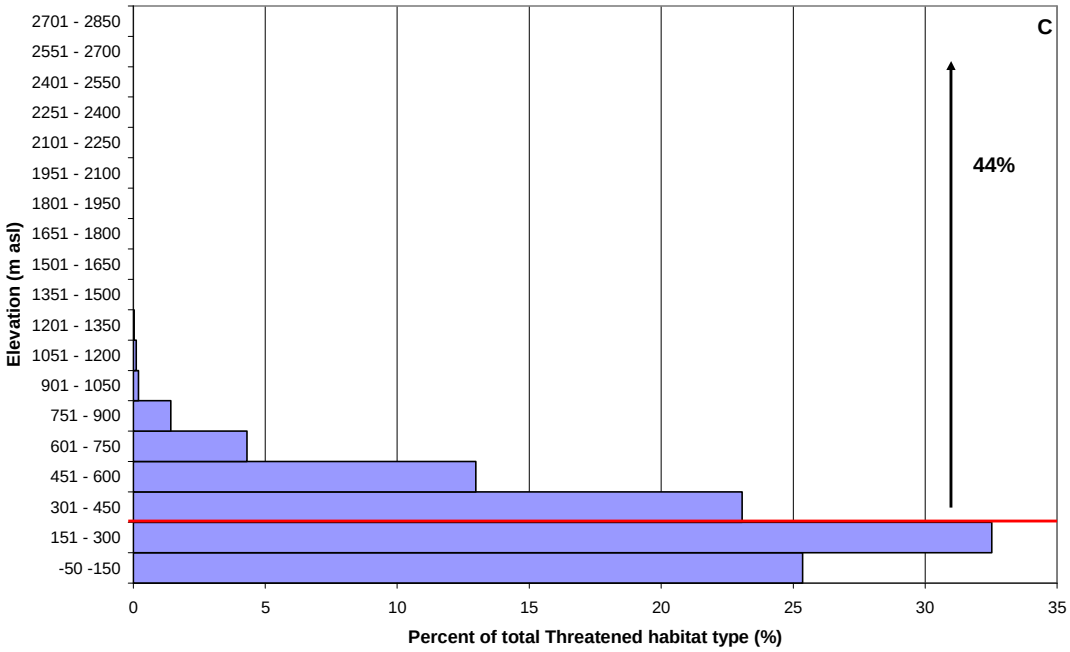


Figure 8: Histograms of percentage (%) of total area of all habitat types present at each elevation (m asl), for No Threat Category habitat types (A), At Risk habitat types (B), and Threatened habitat types (C).

Rare habitat types

109. Rare habitat types are those that were always uncommon in the landscape and remain so in present times. These unique habitats tend to comprise a high number of endemic species, a high number of threatened plant species (Williams *et al*., 2006*)*, and

contribute to diversity of habitat and ecosystem across the landscape. Therefore, although often small in scale, naturally rare habitat types contribute greatly to the Region's indigenous biodiversity. The disproportionately high contribution of rare habitats to regional biodiversity warrant their inclusion in any consideration of need for habitat protection.

Key Messages

1. Habitat types can be classified according to remaining extent and continued pressure. The difference in classification allows for a hierarchical policy response that is specific and appropriate to address the value and vulnerability of habitat type within each classification.
2. Threatened habitat types are highly representative of indigenous biodiversity once common in the Manawatu-Wanganui Region. These habitat types are also highly vulnerable to further loss, and ultimately extinction. Threatened habitat types require a high level of protection to ensure their long-term persistence.
3. At Risk habitat types are equally in need of long-term protection, but there is a rational assumption that the degree and urgency of protection is somewhat less than for Threatened and Rare habitat types.
4. Rare habitat types are highly unique ecosystems. Consequently, they represent a high proportion of the diversity of the Region, and support species not found elsewhere. Knowledge about these highly distinctive habitat types is growing. Protection of Rare habitat types ensures a more complete coverage of the indigenous biodiversity of the Region.

9. HOW DOES THIS PROPOSED FRAMEWORK COMPARE WITH ASSESSMENT OF 'ECOLOGICAL SIGNIFICANCE'?

110. The proposed framework compares favourably with the more traditional site by site assessment of ecological significance, is consistent, fair and in-line with Section 6 of the RMA.

111. There was some concern raised in the submissions to Schedule E regarding how the proposed framework of classifying habitat types (and by default patches of habitat) across the Region related to the more familiar approach of assessing individual (known) sites for ecological significance.

112. Assessing discrete sites for ecological significance evolved out of the Protected Natural Area Programme (PNAP) (Myers, *et al.*, 1987). The PNAP, a programme of the Department of Conservation which commenced in 1981, was the first comprehensive

attempt to assess remaining indigenous biodiversity on private land for ecological significance, and remains the largest nation wide reconnaissance dataset of this nature (Bellingham, 2001). Surveys where done at the Ecological District (Simpson, 1982; McEwen, 1987) scale. Sites were compared to each other and the best sites were classified as 'Recommended for Protection', with a view that such sites should be incorporated into Public Conservation Land to ensure a more representative protection of all ecosystems found within New Zealand. These sites simply become known as RAPs. The list of RAPs for respective Ecological Districts commonly formed the basis of schedules of protected areas within District Plans.

113. Through the decades, the criteria used to assess sites under the PNAP has been debated amongst the ecological community (Norton and Roper-Lindsay, 2004), refined and consolidated and become standardised (Environment Waikato and Wildland Consultants Ltd, 2002; Norton and Roper-Lindsay, 2004). The criteria commonly used for assessing ecological significance, along with definitions for this criteria as presented in Table E.4 of the POP are provided in Table 7. The definitions for these criteria as currently presented in the POP (Table E.4, Schedule E) are misleading as they currently refer to Water Management Zones (WMZ) and Water Management Sub-zones (WMS) as a spatial scale of assessing significance, although this is not the case. Water Management Zones or Sub-zones are an inappropriate spatial scale by which to assess ecological significance. All reference to WMZ or WMS as a component of the criteria used to assess ecological significance needs to be removed from the preamble to Table E.4, content of Table E.4 (as presented here in Table 7) and any other part of the One Plan.

Table 7: Criteria used for assessing ecological significance. The fourth criteria ('previously assessed sites'), although not a criteria for assessment of significance *per se* has been included to allow for previous assessments, including those conducted outside of Horizons own programmes. A site only has to meet one of these criteria to be considered ecologically significant. The criteria and definitions presented here are as currently incorporated into Schedule E of the POP, which require amending (see text). Words in ~~strikethrough~~ are recommended for removal from the text within the One Plan.

Criteria	Definition
Representativeness	• The site contains habitat type that is under-represented (20% or less known or likely former cover), assessed either at the national, regional, ~~water management zone, or water management sub-zone~~, Ecological District or Ecological Region.
Rarity and Distinctiveness	• The site supports one or more species that are classified as threatened (as determined by the New Zealand Threat Classification System); or • The site supports a species that is endemic to the Manawatu-Wanganui Region, ~~or any given Water Management Zone, or Water Management Sub-zone~~, or Ecological District or Ecological Region; or • The site supports a species, or community of species, that is distinctive to the Manawatu-Wanganui Region. Distinctiveness describes the uncommon presence, or unique assemblage of species or habitat at any given geographical location.
Ecological Context	• The site provides connectivity (physical connections) between two or more areas of indigenous habitat; or • The site provides an ecological buffer (is a closely adjacent site of similar, degraded or exotic habitat that provides protection) to another area of indigenous habitat, including aquatic habitat; or • The site is an area of indigenous habitat that forms part of an indigenous ecological sequence (connectivity between different habitat types across a gradient (eg. altitudinal or hydrological).
Previously Assessed Sites	• Any site assessed at a previous time, or by a previous agency, on criteria in keeping with the policies, objectives and criteria of this plan, to be of ecological significance.

113. With the standardisation of the criteria, assessing sites for ecological significance has become common around the country as a mechanism that serves to meet the requirements of the RMA (section 6) and to guide decision making. The resulting schedules of sites considered to be ecologically significant (commonly known as Significant Natural Areas or SNAs) under Section 6 has become a familiar feature in the plans of the councils which have undertaken the rather onerous task of identifying such sites.

114. The comparative analysis of predicted previous and actual current indigenous vegetation effectively provided a region-wide consideration of the degree of 'representativeness' of remaining indigenous vegetation cover. Representativeness can be described as a

comparison of biodiversity found in the contemporary landscape with that characteristic of the landscape at some time in the past. Representativeness is considered one of the most important criteria for the assessment of significance in terms of the Resource Management Act (Section 6(c)) (Norton and Roper-Lindsay, 2004).

115. Horizons has chosen to move away from lists of known sites, for two main reasons:
    a) the inherent errors found associated with site lists compiled from a desk-top exercise; and
    b) the cost (in terms of time and money) required to conduct an in-field assessment for all the patches of remaining indigenous vegetation within the Region.

116. The alternative approach (as detailed in Schedule E) is fair and consistent and importantly provides a mechanism for the implementation of a Region-wide focus despite the present knowledge gaps. The proposed approach has comparable outcomes to the more traditional site-by-site assessment of ecological significance as outlined in Table 8.

Table 8: A comparison of the habitat classifications presented in the POP with nationally accepted criteria for assessing significance. The second column of the table indicates whether a resource consent is required for activities within the corresponding POP habitat classification. A tick (yes) or cross (no) beneath any of the significance criteria indicates that habitat type within the corresponding POP habitat classification would meet that criteria. The last column in the table indicates whether a patch of habitat type corresponding to the POP habitat classification would be considered significant if a 'significance assessment' was conducted. This comparison can be done as a desktop exercise. A star (**«**) indicates that a field assessment, or consideration of existing information on a specific site, would be required to determine significance. See Table 7 for definition of significance criteria.

			Criteria for assessing significance			
		Resource consent required?	Representativeness	Rarity and Distinctiveness	Ecological Context	*Ecologically Significant?*
Habitat type Classifications	Rare Originally uncommon	Yes	û	ü	û	Yes
	Threatened Less than 20% of former cover remaining	Yes	ü	«	«	Yes
	At Risk Less than 50% of former cover remaining	Yes	û	«	«	Potentially (**«**)

	At Risk Within 20 m of an aquatic site of significance	Yes	û	«	ü	Yes
	At Risk Any habitat type known to contain a threatened species	Yes	û	ü	«	Yes
	No Threat category Greater than 50% of former cover remaining	No[1]	û	«	«	Potentially («)

[1] This table is considering requirement for resource consent only under the Schedule E requirements, and does not include requirements under other sections of the POP (eg. Controls on vegetation clearance on highly erodible land (Schedule A).

117. Analysis of Table 8 shows a close match between the Proposed framework presented in the POP and a desk-top assessment of ecological significance. Patches of habitat classified as either Rare, Threatened or At Risk (by definition of being within 20 m of an aquatic site of significance, or containing a threatened species) would be considered ecologically significant.

118. Activities within patches of habitat type classified as At Risk (by definition of less than 50% of former cover remaining) require a resource consent, although there is potential that any given patch may not be considered ecologically significant when assessed against the criteria presented in Table 7.

119. This slightly more conservative approach can be attributed to the accepted threshold for considering a given site to meet the assessment criteria of 'representativeness' as 20% (Table 7), and the threshold used to delimit the classification for At Risk habitat is 50% of former cover remaining.

120. However, there are only three habitat types classified as 'At Risk' (Section 6), with total predicted remaining cover of only 106,021.8 ha (Maseyk, 2007) (22% of all remaining habitat, or 4.8% of the Region's total land cover), and this more cautious approach to 'At Risk' habitat is not onerous. Nor is it likely to result in unnecessarily prohibitive outcomes.

121. On the other hand, 'No Threat Category' habitat types do not require a resource consent under the indigenous biodiversity rules presented in the POP, but could potentially be

considered ecologically significant when assessed against standard significance criteria (Table 8). The habitat types included in the 'No Threat Category' are primarily found at higher elevations and will be protected to some degree by the provisions of the rules in the POP associated with vegetation clearance on highly erodible land (Schedule A)).

122. There remains some risk that patches of ecologically significant indigenous vegetation will not be picked up by the proposed framework. It is difficult to quantify or estimate the extent of this risk in the absence of detailed information associated with much of the indigenous biodiversity within the Region. To a large degree, the non-regulatory methods of indigenous biodiversity protection will have the potential to compensate for this shortfall, where knowledge of these sites (and values) is available. There is some comfort in the fact that the habitat types classified as 'No Threat Category' are well represented within the Public Conservation Land (Section 6).

123. It should not be overlooked that there remains a likelihood that discrete sites, habitats of important species, and ecosystems contributing to essential process will not be encapsulated in the proposed framework. The important elements here, in my opinion, are:
    a) that this likelihood is considerably smaller under the proposed framework than in previous attempts at indigenous biodiversity protection throughout the Manawatu-Wanganui Region; and
    b) the non-regulatory methods (by far the most effective tool for indigenous biodiversity protection) has the potential to identify and fill these shortfalls.

Spatial scale and the use of Water Management Sub-zones

124. Spatial scale is an important consideration when assessing ecological significance. Ecological significance is determined using Ecological Regions and Districts. Water Management Sub-zones, whilst used as locational indicators for criteria (Table E.2) to determine whether indigenous vegetation is considered habitat type for the purposes of the plan, were not used at any point in the evaluation of habitat type classification.

125. There has been some confusion as to the mapping unit used within Schedule E generally and its relevance to the assessment of significance specifically. What was needed was provision of some indication to landowners as to potential resource consent requirements. Other aspects of the POP (Schedule D) use Water Management Zones (WMZ) and Sub-zones (WMS) (McArthur *et al.*, 2007) as a mapping unit and the decision was made to adopt Water Management Zones Sub-zones (WMS)) for use in Schedule E. While this was largely a policy decision to aid with clarity and consistency throughout the POP, the WMS are not without some relevance to ecological difference across the

landscape. This is because several determinants of the WMS (such as natural watershed/catchment boundaries, underlying geology and catchment landuse type and future potential resource pressure) influence environmental determinants of indigenous vegetation (and terrestrial biodiversity) pattern. Sub-zones were chosen over WMZ to allow for more refined consideration.

126. It was acknowledged that it was unlikely the majority of landowners would be familiar which Ecological District or Region, and likely less aware which LENZ land environment they lived in. However, many landowners would be aware (or become aware) of WMS through surface water take consents and the like. Further, the use of WMS does provide a connection between the provisions for aquatic and terrestrial biodiversity, and provides a mechanism for an integrated management framework.

127. Water Management Sub-zones were intended to be locational triggers to indicate to landowners whether a rule applied to them. However in the POP, this was not clear and this has understandably resulted in considerable confusion amongst submitters.

128. It is important to reiterate that WMS were not used as a unit for the actual classification of habitat type, nor are they a spatial scale at which ecological significance would be assessed. The mapping unit for classification of habitat type, and assessment of sites at the patch scale is summarised as shown in Table 9.

Table 9: Mapping units employed for the classification (Rare, Threatened, At Risk, No Threat Category) of habitat type and patch scale assessment.

	Mapping Unit (Scale of assessment)	**Level of significance**
Rare habitat type	New Zealand	National
Threatened habitat type	Manawatu-Wanganui Region	Regional
At Risk habitat type	Manawatu-Wanganui Region	Regional
No Threat habitat type	Manawatu-Wanganui Region	Regional
Site assessment Assessment of discrete patch of Threatened, At Risk or No Threat Category habitat type	Manawatu-Wanganui Region Ecological Region or District	International, national, regional or local

129. Ecological Districts (Simpson, 1982; McEwen (ed), 1986) are considered the most logical spatial scale at which to assess ecological significance (Norton and Roper-

Lindsay, 2004), and would also have been a valid mapping unit for presenting Figure E.1 of Schedule E in the POP. The value of Ecological Districts when considering ecological significance at the patch scale is recognised and embedded in the assessment methodology of discrete sites as required by the resource consent process under the POP.

Key Messages

1. The initial trigger for requirement of a resource consent based on the framework presented in the POP compares favourably with likely outcomes of assessing remaining indigenous biodiversity on standard 'criteria for assessment of significance'.
2. The proposed framework provides a consistent, region-wide approach that allows for remaining indigenous biodiversity to be classified regardless of degree of information available pertaining to individual patches.
3. Assessment of significance for all remaining patches of indigenous vegetation throughout the Region would be logistically difficult, extremely time consuming and cost prohibitive.
4. Once incorporated into the resource consent process, each site is assessed against the national standard 'criteria for assessing significance'. Proposed activities are then considered and decision making informed in the context of this assessment.
5. The initial threshold to require a resource consent, might be perceived as slightly more cautious for those habitat types classified as 'At Risk' habitat types. However, the risk of being less conservative is great, and this risk is disproportionate to the regional impact of the proposed threshold, which is minimal.
6. The initial threshold to require a resource consent, might be perceived as less encompassing for those habitat types classified as 'No Threat Category habitat types. These habitat types are (to some degree), protected under land rules, and are well represented within Public Conservation Land.
7. The value of the non-regulatory methods within the POP should not be underestimated as an effective mechanism for indigenous biodiversity protection.
8. The Water Management Sub-zone (WMS) are a mapping unit not uncommon to many landowners, unlike Ecological Districts or LENZ Land Environments, and are therefore an informative mapping unit when used to indicate likely rule streams, as a trigger for inclusion within the consent process. The use of WMS also allow for a common thread between terrestrial and aquatic biodiversity, and provide a foundation for an integrated management framework.
9. WMS have not replaced Ecological Districts when considering significance at the patch scale, and are not part of the evaluation framework. Ecological Districts remain the primary spatial scale at which to assess significance.
10. The proposed approach effectively achieves the same end as more traditional approaches to assessment of significance (site by site), and provides a mechanism

for Region-wide protection of indigenous biodiversity in the absence of Region-wide knowledge. Importantly, the application of the framework is consistent and fair, and in-line with Section 6 of the RMA.

11. The proposed approach provides a more thorough protection framework for indigenous biodiversity in the Region than has previously been experienced. Some important elements of indigenous biodiversity (species, habitats, ecosystem processes) will be excluded despite this framework, but this is of a lower magnitude than in the past.

10. RECONSIDERING SCHEDULE E

130. Schedule E was the subject of the majority of the submissions received on the indigenous biodiversity provisions in the POP. Submission points clustered around the following points:
    - the justification for Schedule E in its entirety;
    - specific points of confusion within Schedule E;
    - the presentation of Schedule E; and
    - how Schedule E was to be implemented.

131. The justification for Schedule E has been presented earlier in this evidence (remaining indigenous biodiversity is in need of regulatory protection). In response to the remaining submission points, Schedule E in general has been re-drafted as presented in Appendix 4. Specific areas of change have been detailed below. Points raised in Horizons submission to the POP are incorporated here for completeness.

Treeland

132. Where habitat type occurs as treeland there is some scope for a degree of leniency on the level of protection afforded to such areas. However, treeland habitat does warrant protection in some instances. Habitat type were it occurs as treeland, and this scope for variance in level of protection, was not allowed for in the POP. It is recommended that this oversight is amended.

133. Treeland occurs where trees form a discontinuous upper canopy above either a lower canopy of predominantly non-woody vegetation (eg. pasture grasses) or bare ground. Treeland, whilst possibly not providing a fully functional, intact area of habitat, does contribute to the ecology of the local landscape by providing food sources, resting and roosting sites, and contributing to soil health and erosion prevention. Treeland can provide a reminiscent link to past vegetation cover characteristic in an area, thus

contributing to a sense of place. Treeland also retains the potential to revert, or be restored to functioning habitat, and as such can be assigned considerable value for its potential to contribute to the future extent of indigenous habitat.

134. Currently, the POP includes activities with a relatively benign impact on treeland habitat type under a Non-Complying status if the area of treeland is classified as habitat type (as identified Table E.1 and confirmed by criteria in Table E.2).

135. Protection of treeland should be retained where it is ecologically justified. However, undue blanket protection of individual trees where it is not warranted should be avoided. Conversations with Horizons policy staff would suggest that a practical solution to this issue could be achieved by way of a Restricted Discretionary Activity rule. This level of protection could be given to Rare, Threatened or At Risk habitat type where it occurs as treeland to allow activities such as:

- pruning of branches or trees for the purposes of creating light shafts or manoeuvring of farm machinery,
- removal of individual trees or branches for the purposes of safety, creating light shafts, or manoeuvring of farm machinery.

The matters that need to be considered in a rule of this type are:

- Prevention of complete felling of an entire area of treeland (if it meets the criteria outlined in Table E.2 of Schedule E.
- Protection of trees acting as a buffer to another area of indigenous vegetation considered to be habitat type (if it meets the criteria in Table E 2 of Schedule E.
- Protection of trees providing crucial life-supporting habitat to a threatened species (as listed in Table E.3).
- Protection of trees providing or contributing to a riparian buffer.

136. Amendments have been made to the redrafted Schedule E (Appendix 4) to reflect this recommendation.

Rare habitat types

137. It is likely that not all Rare habitat types that occur in the Region have been identified in Schedule E.

138. As Rare habitat types are by nature, not common in the landscape, and tend be small in extent, a very thorough and intimate knowledge of the Region is required to ensure a Rare habitat type has not been overlooked. The likelihood that some Rare habitat types (as identified in Williams, *et al.*, 2006) will be present within the Region but currently not

identified within Schedule E, is recognised. Further the national project for identifying Rare ecosystems is not yet completed. It is likely that the completion of that project, will indicate additional Rare habitat types known from the Region. Additionally, information pertaining to the presence of Rare habitat types held by other agencies may become available. With this in mind, it is acknowledged that the list of Rare habitat types as it is currently presented in Schedule E is incomplete, and will likely require building on as further substantive information comes to hand.

Habitat type definitions as presented in Table E.1

139. Submissions received on Table E.1 indicated the table was ambiguous. This ambiguity was contributed to in part by the inconsistency of the habitat type definitions, which shifted from indicative descriptions of likely species assemblages, to definitions of physical environment in which particular habitat types could be expected to be found, to lists of vegetation structural classes which might be present within a given habitat type.

140. Table E.1 has been re-presented in an attempt to overcome these issues (Appendix 4).

Addition of habitat types to Table E.1

141. Two habitat types are recommended for inclusion in Table E.1 to improve clarity around the classification of habitat types.

142. The habitat types 'Riparian margin' and 'Habitat type containing threatened species' have been classified as At Risk habitat types. The POP presented this information in the definition of 'At Risk' habitat types at the front end of Schedule E, as follows:

"At Risk habitats are areas of:

(a) indigenous vegetation of a type identified in Table E.1 as being at-risk, and which meet the criteria described in Table E.2 for determining whether an area of indigenous vegetation constitutes a 'habitat' for the purposes of this Plan

(b) any vegetation (whether indigenous or not) within 20 m of an area identified in Schedule D as being a site of significance aquatic

(c) any vegetation (whether indigenous or not), and including 'no threat category' habitat types identified in Table E.1) that contains, or could be reasonably contain, threatened plant and/or animal species as identified in Table E.3."

143. While At Risk habitat types that meet the definition outlined in (a) were listed in Table E.1, those that met the criteria in definitions (b) and (c) were not listed in Table E.1. This was inconsistent and added to confusion.

144. It is recommended that these habitat types are added to Table E.1 (as shown in Table 10) for consistency and clarity and that the front-end definitions of At Risk habitat type be edited accordingly. These suggested changes are presented in the redrafted Schedule E (Appendix 4).

Table 10: Habitat types recommended for listing in Table E.1 of Schedule E, taken from redrafted Schedule E (Appendix 4).

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description
Riparian margin	Any vegetation (whether indigenous or not, and including classified elsewhere in Schedule E) within 20 m of an area as identified in Schedule D as being a Site of Significance-Aquatic.	At Risk	Riparian margin vegetation can comprise, indigenous vegetation, exotic vegetation or a combination of both and of any structure[3]. This habitat type will vary greatly between patches in both structure and composition, and might be highly modified, contain artificial assemblages of species or include deliberately planted species (indigenous or exotic).
Habitat type containing species	Any vegetation (whether indigenous or not, and including vegetation that has not been classified elsewhere in Schedule E) that contains, or could be reasonably known to contain, any species as listed in Table E.3 of this Schedule.	At Risk	Riparian margin vegetation can comprise vegetation of any structure[3], indigenous vegetation, exotic vegetation or a combination of both. This habitat type is likely to vary greatly between patches in both structure and composition and might be highly modified.

145. An area of vegetation needs be classified according to Table E.1, and meet criteria presented in Table E.2 to be considered habitat for the purposes of this plan. Therefore, criteria have also been added to Table E.2 to incorporate the recommended addition of these two habitat types. The two recommendations (for both the addition of habitat types (Table E.1) and the addition of criteria (Table E.2) should be considered together.

Removal of habitat types from Table E.1

146. Twelve habitat types classified as 'No Threat Category' were included in Schedule E of the POP for completeness, and to indicate that this analysis had included all of the predicted habitat types within the Region. However, inclusion of these habitat types

does not add any value to the understanding or implementation of the indigenous biodiversity provisions and could sensibly be removed from Schedule E.

147. The first six habitat types do not support indigenous vegetation, are infrequent or do not occur on private land, or are addressed elsewhere in the POP. The second six are all forest habitat types of the hill country and higher elevations. The reasons for recommending the removal of these habitat types from Schedule E are outlined in Table 11. The redrafted Schedule E (Appendix 4) reflects these recommended changes.

Table 11: Habitat types currently listed in Table E.1 which are recommended for removal from Table E.1 and from Schedule E.

Habitat type Name	Reason for removal from Table E.1
Alpine gravel and rock	Due to the nature of this habitat type, its persistence is not threatened by the activities that are managed under the indigenous biodiversity provisions of the POP. This is evident from the almost total lack of change between predicted original extent and current extent of alpine gravels and rocks. This habitat type will largely occur within the Public Conservation Estate, and indigenous species that utilise the alpine gravels and rock will be covered by the Department of Conservation.
Estuarine open water	The No Threat Category for this habitat type has resulted because the analysis considered only open water and did not take into account wetland habitat associated with such open water. As all wetland habitats are classified as either Rare or Threatened, listing 'Estuarine open water' as a No Threat Category habitat type leads to confusion. The severe loss of wetland habitat types within the Region justifies removing the confusion to ensure that all wetland habitat types are afforded the highest level of protection.
Lake and pond	The No Threat Category for this habitat type has resulted because the analysis considered only open water and did not take into account wetland habitat associated with open water. As all wetland habitats are classified as either Rare or Threatened, listing 'Lake and pond' as a No Threat Category habitat type leads to confusion. The severe loss of wetland habitat types within the Region justifies removing the confusion to ensure that all wetland habitat types are afforded the highest level of protection.
Permanent snow and ice	Areas above the treeline dominated by permanent snow and ice do not occur (or occur infrequently) on private land within the Region. Due to the nature of this habitat type, its persistence is not threatened by the activities that are managed under the indigenous biodiversity provisions of the POP. This is evident from the lack of change between predicted original extent and current extent of permanent snow and ice.
River	Schedule E deals specifically with terrestrial indigenous biodiversity. Listing Rivers as a habitat type in Schedule E does not contribute to either the intention of Schedule E, or

Habitat type Name	Reason for removal from Table E.1
	the provision for aquatic indigenous biodiversity as outlined in Schedule D. Management of river systems is covered elsewhere in the POP (eg. Schedule D).
River and lakeshore gravel	It is not the intention of Schedule E to manage the Region's fluvial resource. Gravel extraction activities are controlled elsewhere in the POP. Provision for indigenous species that utilise gravel fields (eg. wading bird species) is provided elsewhere in the POP (eg. as Sites of Significance – Riparian, Schedule D)
Podocarp/kamahi-silver beech forest Mountain beech-red beech forest Podocarp/kamahi-beech forest Red beech-silver beech forest Silver beech forest Scrub, tussock-grassland and herbfield above treeline	These six habitat types have been classified as 'No Threat Category' as more than 50% of the former cover is remaining. These are habitat types of the hill country and higher elevations, and are well represented within Public Conservation Land. Under the framework presented in the POP, 'No Threat Category' habitat types fall outside the resource consent process. As all other indigenous vegetation excluded from the provisions of the POP are not listed in Schedule E, it is inconsistent and unnecessary to include these six habitat types in the Schedule. **Other mechanisms for protection of indigenous vegetation excluded from Schedule E:** Where any vegetation exists within 20 m of a Site of Significance – Aquatic, or contains a species as listed in Table E.3 (Schedule E) it has been classified as At Risk habitat type (Table E.1). This includes vegetation of the type defined by these habitat types. Vegetation clearance on highly erodible land (Schedule A) is managed elsewhere in the POP. These rules also covers vegetation of the type defined by these habitat types.

Criteria provided in Table E.2

148. Table E.2 has undergone minor redrafting for clarity and to incorporate changes recommended earlier in this section. Five criteria are recommended to be included in Table E.2 (Appendix 4).

149. The second step of implementing Schedule E is determining whether the patch of habitat type in question meets any of the criteria present in Table E.2 (criteria either include or exclude patches from the rule stream). Table E.2 was presented in the POP divided by vegetation structure. This added layer of division and associated definitions made Table E.2 rather formidable.

150. Minor changes to Table E.2 have focused on combining criteria for the different habitat types, thus making the presentation clearer. This in conjunction with the interpretation

guidance added upfront of Schedule E should make the implementation of Table E.2 more straightforward. These changes are presented in the redrafted Schedule E (Appendix 4).

151. Criteria were added to section (a) of Table E.2 to incorporate consideration of Rare, Threatened or At Risk habitat types were they occur as treeland (see above) as follows:

vii. Areas of Threatened habitat type where it occurs as treeland over at least 1 ha. Or
viii. Areas of treeland over at least 1 ha within any Water Management Sub-zone coded red (Figure E.1). Or
ix. Areas of treeland over at least 2 ha within any Water Management Sub-zone coded orange or yellow (Figure E.1). Or

152. Criteria pertaining to the habitat types recommended for addition to Table E.1 ('riparian margin' and 'Habitat type containing threatened species' see above) are recommended as follows:

xx. An area of vegetation of any size or species composition (including exotic vegetation, but excluding exotic pasture) within 20 m of an area identified in Schedule D as being a Site of Significance – Aquatic. Or
xxi. An area of vegetation that of any size or species composition (including exotic vegetation, but excluding production forestry) that contains or is known to contain a species as listed in Table E.3

153. The criteria suggested in the previous two paragraphs are included in the redrafted Schedule E in Appendix 4.

Rationalising the threatened species included in Table E.3

154. Table E.3 of the POP included a lengthy sub-set of threatened species found within the Region. A number of these species did not need to be listed in this table as their protection was already provided for within the POP, there existed other protection mechanisms, or a regulatory framework was not the most appropriate response to the threats faced by a particular species. Consequently, the list could be rationalised considerably as presented in Appendix 5. Further the wording of Schedule E that defined exotic vegetation habitat type if it contained a threatened species included production forestry. It is recommended production forestry be excluded from the provisions of Table E.3.

155. Protection of threatened species contributes to the protection of indigenous biodiversity throughout the region. A loss of species from the Region equates to a decline in indigenous biodiversity within the Region, and if the species plays an important role within an ecosystem, the loss of that species can have trickle down effects which detrimentally impact on other species. Therefore, it is appropriate that provision for protection of threatened species is provided in the POP, where such species occur on private land, persistence is jeopardised by human activity, and the species are not protected for elsewhere in the plan.

156. Further, protection of habitats of acutely and chronically threatened indigenous species is National Priority 4 of the MfE priorities for the protection of indigenous biodiversity on private land (MfE, 2007b and 2007c).

157. It is not the intention of the POP to undertake species management (this mandate sits firmly with the Department of Conservation). Therefore the provisions of Schedule E provide for the protection of habitat types which support threatened species, not the protection of the species *per se.*

158. This approach does result in a discrepancy for the protection of individual plants (for example) where they are the threatened species, and individual plants where they provide habitat for a threatened species. This is because in the former case the habitat for the individual plant of a threatened species is the paddock (for example) in which it stands, while in the later case the individual tree itself is the habitat for another threatened species.

159. It was not intended to include plantation forestry into a rule-stream, however, the current wording of Schedule E does this. The consequences of which would effectively result in the requirement of a resource consent to prune, thin or harvest. It is acknowledged that many areas of plantation forestry already currently manage their estate for the protection of threatened species (eg. New Zealand falcon and kiwi), and that industry standards and international certification processes (Brockerhoff, *et al.,* 2008) drive and monitor such initiatives.

160. Should additional habitat types be included in Table E.1 in the future, a number of species proposed for inclusions by submissions would be unnecessary, as their protection will be provided by the provisions of Table E.1.

161. Recommended changes to Table E.3, and the reasons for the recommended changes, are provided in Appendix 5, with the amended table included in the redrafted Schedule E presented in Appendix 4.

162. It is important to note that exclusion from Table E.3 does not indicate a lack of significance of excluded species, nor suggest that they are not considered to be threatened species within the Manawatu-Wanganui Region. Threat status according to New Zealand Threat Classification Systems (Molloy *et al.,* 2002; Hitchmough *et al*., 2005) or the revised system (Townsend, *et al*., 2008) once it has been adopted, and any revised threat lists that accompany this new system, should be used whenever assessing a patch of habitat type according to the assessment of significance criteria as required by the consent process

Removal of Table E.4

163. Table E.4 does not add value to Schedule E and it is recommended that it be removed from the Schedule.

164. The use of criteria to assess ecological significance (as presented in Table E.4) does not determine whether an area of vegetation falls into the consent process or not. Rather, it is applied *once* the consent process has been initiated in order to determine ecological value of a patch of habitat type, and thus is used to guide the decision making process and in determining the scope of consent conditions.

165. The criteria were initially included in Schedule E (Table E.4) to indicate that all consent applications had a standard assessment processes attached to them, that could be applied in a similar fashion by officers and which was in line with current ecological thinking. However Table E.4 served to provide more confusion than clarity, and as they do not play any part in determining the need for a consent, it has been decided it would be sensible to remove them from Schedule E.

Habitat type names

166. Schedule E of the POP includes misleading use of the species 'southern rata' within the habitat type names of two habitat types. The use of 'southern rata' should be removed from Schedule E.

167. The habitat types determined by the predictive modelling are given identifying labels (Leathwick *et al*, 2005; Leathwick *et al.,* unpubl.). These labels have been adopted, and in some cases modified (Maseyk, 2007) for use within Schedule E and are referred to as 'habitat type names'.

168. Two habitat type names ('Hall's totara/silver beech-southern rata forest' and 'Podocarp/kamahi-silver beech-southern rata forest') include southern rata. Southern rata is very uncommon in the Manawatu-Wanganui Region, and certainly does not occur frequently enough to justify its inclusion in a habitat type name. Removal of the reference to southern rata will bring the One Plan in-line terrestrial biodiversity technical report (Maseyk, 2007), and more accurately reflect the species assemblages observed from the Region.

169. It is recommended that the use of 'southern rata' should be removed from use in habitat type names and any description of these habitat type. The redrafted Schedule E reflects this recommendation (Appendix 4).

Key Messages

1. A schedule is an effective mechanism for applying the indigenous biodiversity provisions within the One Plan.
2. Redrafting of Schedule E has attempted to increase clarity and provide a more effective mechanism for the presentation of criteria to identify habitat type for the purposes of the One Plan. This redrafted Schedule E is presented in Appendix 4 and incorporates all the changes as discussed.
3. Two habitat types are recommended for addition to Table E.1 and 12 habitat types are recommended for removal from Table E.1.
4. Habitat type descriptions and definitions have been clarified and definitive references included.
5. Table E.3 (the threatened species table) can be rationalised considerably, and attempts have been made to do this.
6. Table E.4 does not add value to Schedule E and is recommended for removal.
7. Inclusion of more habitat types into Table E.1 could make the need for some species to be added to Table E.3 as requested in the submission process redundant.
8. Horizons knowledge about Rare habitat types (descriptions and location) is currently incomplete. Such information is likely to be built on into the future, and this will need to be incorporated protection mechanisms as appropriate.
9. Schedule E currently includes activities impacting on areas of treeland where they are classified as Rare, Threatened or At Risk habitat type. This has the potential to apply undue blanket protection to individual trees.

11. Recommendations

1. Retain the Region-wide focus to indigenous biodiversity protection as presented in the POP.

2. Retain the recognition of different levels of loss, threat and vulnerability through the hierarchical classification of habitat types.
3. Retain regulatory methods to manage the threats posed to indigenous biodiversity by human activities.
4. Retain non-regulatory methods to manage the threats posed to indigenous biodiversity by invasive pest species and indirect human activities.
5. Remove all reference to Water Management Sub-zones (WMS) where it appears in Schedule E and throughout the One Plan that might indicate WMS are used as a component of the evaluation framework.
6. Include text referring to 'Ecological Districts and Ecological Regions' as the spatial scale at which ecological significance is determined within Table E.4 itself, and in the preamble to Table E.4.
7. Remove all reference to Water Management Sub-zones from Table E.4 itself, and in the preamble to Table E.4.
8. Remove Table E.4 from Schedule E and include the content of Table E.4 within the policies of Chapter 7 (with reference to Recommendations 6 and 7 of this evidence).
9. Retain the use of WMS only for locational triggers within the criteria in Table E.2.
10. Remove the habitat types 'Estuarine open water', 'Lake and pond', 'Alpine gravel and rock', 'Permanent snow and ice', and 'River', 'River and Lakeshore gravel' from Table E.1.
11. Remove all forest habitat types identified as 'No Threat Category' from Table E.1.
12. Amend Table E.2, to reflect consideration of treeland as indicated in criteria (a) vii, (a) viii, and (a) ix in the redrafted Schedule E in Appendix 4.
13. Include provisions for Rare, Threatened or At Risk habitat types where it occurs as treeland to be managed less restrictively, while maintaining protection of treeland where appropriate.
14. If Recommendation 13 is accepted amend interpretative flow diagram in Schedule E to reflect this variance in rule stream for treeland habitat.
15. Exclude 'production forestry' (excluding where it fits the description of habitat type in Table E.1) from the provisions of Schedule E, specifically Table E.3.
16. Retain species within Table E.3 as indicated in Appendix 5.
17. Remove species from Table E.3 as indicated in Appendix 5.
18. Remove reference to southern rata from habitat type names and descriptions in Schedule E, except where referring to habitat type names as per Leathwick *et al*., 2005.
19. Adopt the entire redrafted Schedule E as presented in Appendix 4.

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Web Sites

The New Zealand Biodiversity Strategy:
http://www.biodiversity.govt.nz/pdfs/picture/nzbs-whole.pdf

13. APPENDIX 1: INDIGENOUS LAND COVER CLASSES OF THE LANDCOVER DATABASE 2 (LCDB2)

Table 11: Land cover classes of the Land Cover Database 2 (LCDB2) as sourced from the Ministry for Environment website. Shaded rows indicate land cover classes considered to be indigenous.

1st Order Class	LCDB1 Class	LCDB2 Class
Artificial surfaces	Urban Area	1. Built-up Area
	Urban Open Space	2. Urban Parkland/Open Space
	Mines and Dumps	3. Surface Mine
		4. Dump
		5. Transport Infrastructure
Bare, or Lightly Vegetated Surfaces	Coastal Sand	10. Coastal Sand and Gravel
	Bare Ground	11. River and Lakeshore Gravel and Rock
		12. Landslide
		13. Alpine Gravel and Rock
		14. Permanent Snow and Ice
		15. Alpine Grass/Herbfield
Water Bodies	Inland Water	20. Lake and Pond
		21. River
		22. Estuarine Open Water
Cropland	Primarily Horticulture	30. Short-rotation Cropland
		31. Vineyard
		32. Orchard and Other Perennial Crops
Grassland	Primarily Pastoral	40. High Producing Exotic Grassland
		41. Low Producing Grassland
	Tussock Grassland	43. Tall Tussock Grassland
		44. Depleted Grassland
	Inland Wetland	45. Herbaceous Freshwater Vegetation
Sedgeland Saltmarsh	Coastal Wetland	46. Herbaceous Saline Vegetation
		47. Flaxland
Scrub and Shrubland	Scrub	50. Fernland
		51. Gorse and/or Broom
		52. Manuka and/or Kanuka
		53. Matagouri
		54. Broadleaved Indigenous Hardwoods
		55. Sub-Alpine Shrubland
		56. Mixed Exotic Shrubland
		57. Grey Scrub
Forest		60. Minor Shelterbelts
	Major Shelterbelts	61. Major Shelterbelts
	Planted Forest	62. Afforestation (not imaged)
		63. Afforestation (imaged, post LCDB 1)
		64. Forest - harvested
		65. Pine Forest – Open Canopy
		66. Pine Forest – Closed Canopy
		67. Other Exotic Forestry
	Willows and Poplars	68. Deciduous Forest
	Indigenous Forest	69. Indigenous Forest
		70. Mangrove

14. APPENDIX 2: LAND COVER CLASSES (LCDB2) USED TO INDICATE PERSISTENCE OF ORIGINAL INDIGENOUS VEGETATION COVER

Table 12: Land cover classes from LCDB2 considered to indicate persistence of original cover for each LPVT habitat type. LPVT habitat types are described in Appendix 4. LCDB2 land cover classes are described in 13. APPENDIX 1. LCDB2 land cover classes considered to indicate a persistence of indigenous vegetation cover, but a change from the original habitat type are Manuka or Kanuka, Broadleaved Indigenous Hardwoods and Grey Scrub unless these land cover classes indicated original habitat type.

Habitat Type Name	**LCBB2 Land Cover Class considered to represent the same habitat type (original cover)**
Alpine gravel and rock	Alpine Gravel and Rock
Dunelands	-
Estuarine open water	Estuarine Open Water
Hall's totara/broadleaf forest	Indigenous Forest
Hall's totara/silver beech-kamahi forest	Indigenous Forest
Podocarp/kamahi-silver beech forest	Indigenous Forest
Podocarp/tawa-mahoe forest	Indigenous Forest Broadleaved Indigenous Hardwoods
Kahikatea-pukatea-tawa forest	Indigenous Forest
Kahikatea-totara forest	Indigenous Forest
Hardwood/broadleaf forest	Broadleaved Indigenous Hardwoods
Podocarp forest	Indigenous Forest
Podocarp/black/mountain beech forest	Indigenous Forest
Podocarp/broadleaf-fuchsia forest	Indigenous Forest
Mountain beech forest	Indigenous Forest
Mountain beech-red beech forest	Indigenous Forest
Wetland	Herbaceous Freshwater Vegetation
Red beech-silver beech forest	Indigenous Forest
Rimu/tawa-kamahi forest	Indigenous Forest
Podocarp/kamahi forest	Indigenous Forest
Podocarp/kamahi-beech forest	Indigenous Forest
Podocarp/red beech-kamahi-tawa forest	Indigenous Forest
Podocarp/kamahi forest	Indigenous Forest
Scrub, tussock-grassland and herbfield above treeline	Tall Tussock Grassland Depleted Grassland
Silver beech forest	Indigenous Forest

15. APPENDIX 3: ORIGINAL AND CURRENT EXTENT OF PREDICTED HABITAT TYPE IN THE MANAWATU-WANGANUI REGION

Table 13: Habitat type name, previous an current cover (ha) and the proportion (%) of former cover remaining for the habitat types identified as being presented within the Manawatu-Wanganui Region (Overton *et al.*, 2006).

Habitat Type Name	Previous Cover (ha) of habitat	Area (ha) of the Region remaining in same habitat	Proportion (%) of former cover remaining
Kahikatea-totara forest	21.875	0	0
Kahikatea-pukatea-tawa forest	66,786.063	1,636.875	2.45
Podocarp/tawa-mahoe forest	85,357.563	2,117.188	2.48
Wetland	232,254.188	7064.5	3.04
Podocarp forest	37,255.250	1,152.438	3.09
Dunelands	22,163.813	1,805.813	8.14
Hardwood/broadleaf forest	1,042.000	85.25	8.18
Hall's totara/silver beech-kamahi forest	2,208.813	206.25	9.33
Podocarp/black beech/mountain beech forest	55,561.875	6,797.438	12.23
Podocarp/broadleaf-fuchsia forest	591.375	91.625	15.49
Podocarp/red beech-kamahi-tawa forest	973.500	172.313	17.70
Rimu/tawa-kamahi forest	1,169,518.625	227,157.813	19.42
Mountain beech forest	93,182.938	20,017.500	21.48
Hall's totara/broadleaf forest	71,009.500	21,078.00	29.68
Podocarp/kamahi forest	205,695.250	64,926.313	31.56
Silver beech forest	14,876.813	8,891.563	59.76
Podocarp/kamahi-beech forest	57,728.375	40,084.000	69.43
Red beech-silver beech forest	13,378.375	9,881.438	73.86
Scrub, tussock-grassland and herbfield above treeline	42,860.813	31,909.563	74.44
Mountain beech-red beech forest	37,848.563	29,572.563	78.13
Podocarp/kamahi-silver beech forest	184.063	151.563	82.34
Estuarine open water	20.375	20	98.15
Alpine gravel and rock	1,704.375	1,703.688	99.95

16. APPENDIX 4: REDRAFTED SCHEDULE E

Schedule E: Indigenous Biological Diversity

Rare or Threatened or At Risk habitat types are areas of indigenous vegetation of a type identified in Table E1 as being "Rare" or "Threatened" or "At Risk" and which meets any of the criteria described in Table E2(a) for determining whether an area of indigenous vegetation constitutes a "habitat" for the purposes of this Plan and does not meet any of the criteria for in Table E2(b) for excluding the area from consideration as "habitat".

Indigenous vegetation refers to an assemblage of species that co-exist together and which provide resources for other species. Indigenous habitat is habitat comprised primarily of indigenous species, but which can include exotic species.

It is recommended that a suitably qualified expert is engaged for assistance with implementing Schedule E. This could be:

a) a consultant ecologist
b) Horizons staff (who will provide this service, including advice and a site visit where required in the first instance. It may be that following this initial provision of information, the proposal will require an Assessment of Ecological Effects to be provided as a component of the consent application. In such instances it is recommended that a consultant ecologist be engaged to conduct the assessment).

Horizons can in all cases, provide any spatial data and existing site information where available as relevant to the site and the proposed activity.

Interpreting Schedule E:

Q.1 Do I need a resource consent?

YES IF:

A. The area of vegetation is determined to be habitat type classified as 'Rare', 'Threatened' or 'At Risk' as described in Table E.1 **AND** meets any criteria in section (a) of Table E.2.

NO IF:

A. The area of vegetation is determined to be habitat type that is not classified in Table E.1
OR

B. The area of vegetation is determined to be habitat type classified as ‘Rare’, ‘Threatened’ or ‘At Risk’ in Table E.1 but **does not** meet any criteria in section (a) of Table E.2, or **does** meet any criteria in section (b) of Table E.2.

Q.2 What rule stream classification will my proposal be assessed under?

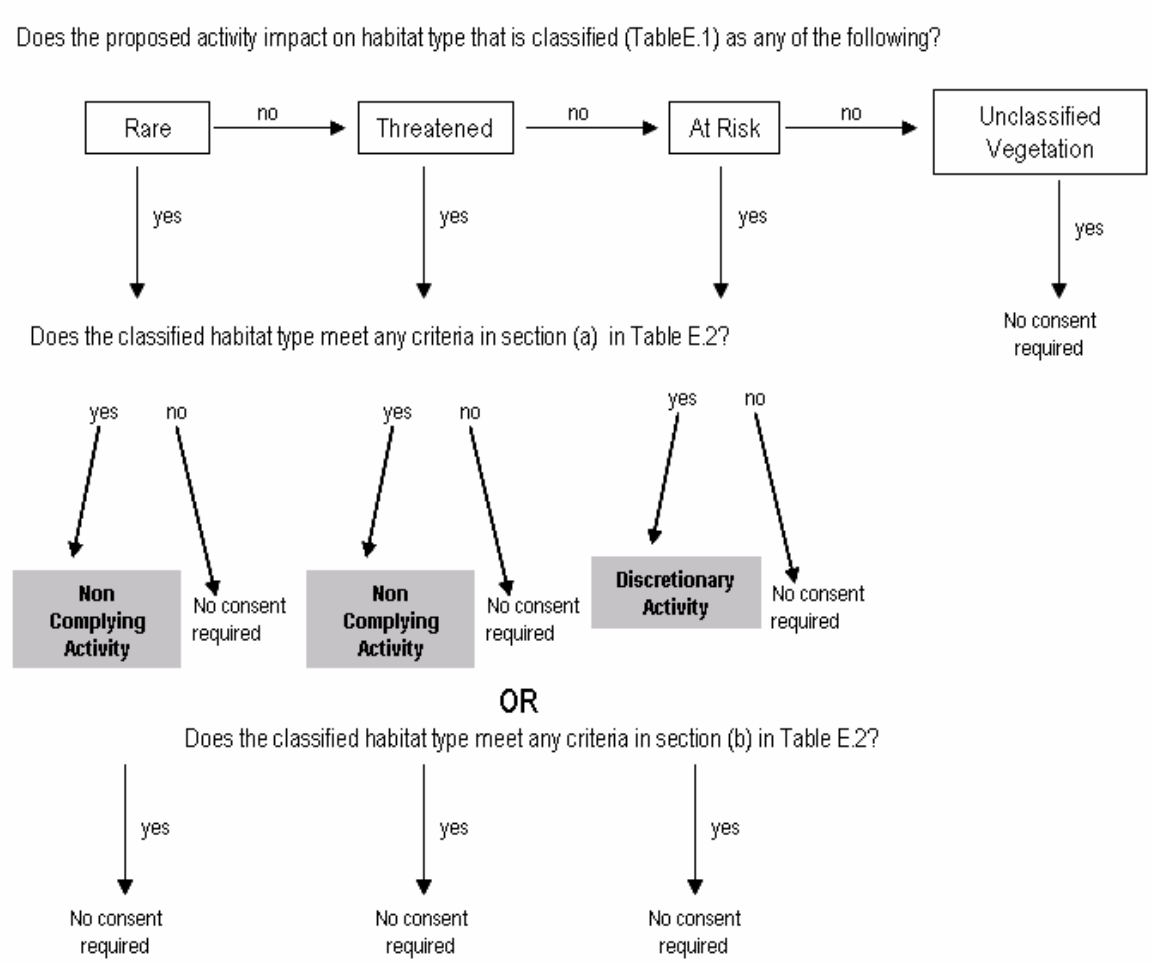

Table E.1:

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description[2]
Hall's totara/silver beech-kamahi forest	Hall's totara/silver beech-kamahi-southern rata As per Leathwick *et al*.,2005[1]	Threatened	This habitat type is found at higher elevations and is dominated by a canopy of silver beech, commonly in association with a high abundance of kamahi. Podocarp species such as Hall's totara, totara, rimu and miro can be emergent at lower elevations where the silver beech is less dominant. Northern rata may be scattered throughout, although its presence will be strongly influenced by the presence (current or historic) of possum.
Hardwood/broadleaf forest	Kauri/taraire-kohekohe-tawa forest As per Leathwick *et al*., 2005[1]	Threatened	The hardwood/broadleaf forest is dominated by tawa with kamahi, hinau, black maire, and northern rata also typically present. Kahikatea, rimu and/or totara may be emergent. Titoki and rewarewa may also be a feature. The subcanopy is likely to comprise common broadleaved species.
Kahikatea-pukatea-tawa forest	Kahikatea-pukatea-tawa forest As per Leathwick *et al*., 2005[1]	Threatened	This habitat type is likely to be characterised by the presence of the swamp forest species kahikatea and pukatea in association with tawa in the drier, better drained or raised areas. Matai, rimu and totara can be present but are restricted to better-drained soils. In areas where soils are poorly drained, titoki may be locally abundant in the drier areas of these soils. This habitat type can be found on lowland alluvium and floodplains.
Podocarp forest	Matai-kahikatea-totara forest As per Leathwick *et al*., 2005[1]	Threatened	Podocarp forest is likely to be dominated by the podocarp species matai, kahikatea or totara. The dominance of any of these species is dependent on the drainage capability of the soil and history of past disturbance. Totara and matai are likely to be more abundant on free-draining soils, with kahikatea likely to be dominate on poorly-drained soils. Broadleaved species (for example titoki, tawa, maire and fuchsia) are likely to be found in association with the podocarp species, but will be less common than the podocarp species.
Podocarp/black beech/mountain beech forest	Matai-totara/black beech/mountain beech forest As per Leathwick *et al*., 2005[1]	Threatened	This habitat type comprises black and mountain beech forest. Emergent podocarp species (eg. matai, totara, kahikatea, rimu or miro). Small broadleaved trees are also likely to be present. This habitat type can be found at mid-altitudinal zones in dry climates, on free draining, relatively fertile soils.

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description[2]
Podocarp/broadleaf-fuchsia forest	Matai-totara-kahikatea-rimu/broadleaf-fuchsia forest As per Leathwick *et al*., 2005[1]		Podocarp/broadleaf-fuchsia forest is dominated by common broadleaved species over which matai, totara, kahikatea or rimu may be present to varying degrees. Climbers and epiphytes are likely to be common. This habitat type tends to favour adequately drained and reasonably fertile soils. Although typically a feature of this habitat type, fuchsia is favoured by possums and may be uncommon in many areas.
Podocarp/red-beech-kamahi-tawa forest	Rimu-miro/tawari-red beech-kamahi-tawa forest As per Leathwick *et al*., 2005[1]	Threatened	Red beech, kamahi and tawa tend to dominate this mid-altitudinal habitat type. Podocarp species such as rimu and miro may be present scattered through the canopy, or as emergent trees. Broadleaved species may also be present in the subcanopy and understorey.
Podocarp/tawa-mahoe forest	Kahikatea-matai/tawa-mahoe forest As per Leathwick *et al*., 2005[1]	Threatened	Podocarp/tawa-mahoe forest is dominated by tawa and mahoe. Kahikatea and/or matai trees are likely to be present in the canopy or as emergent trees. Rimu and totara may also be present in low numbers. Tawa, mahoe, titoki, hinau, mairie or pukatea may also be present. The subcanopy is likely to comprise common broadleaf species. This habitat type is found on dry dune land and low hill country.
Rimu/tawa-kamahi forest	Rimu/tawa-kamahi forest As per Leathwick *et al*., 2005[1]	Threatened	This habitat type is dominated by tawa and kamahi with hinau, rewarewa and/or mahoe common. Rimu may be a feature of this habitat type, although its frequency will be dependent on the history of disturbance of the site. Miro and totara may also be present with kahikatea and matai likely to be less common. Pukatea is commonly likely to be present, particularly in valleys. Black beech may be locally common (eg. inland from Wanganui). Common broadleaved species are also likely to be present in the understorey.
Hall's totara/broadleaf forest	Hall's totara/broadleaf forest As per Leathwick *et al*., 2005[1]	At Risk	Hall's totara is a dominant component of this habitat type and may be emergent above the more common broadleaved species. Kamahi can also be a component of this habitat type, with matai and miro also likely to be present at lower altitudes. This habitat type is the dominant habitat type above 800 m asl and can be found in sites where beech is absent.

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description[2]
Mountain beech forest	Mountain beech forest As per Leathwick *et al*., 2005[1]	At Risk	Mountain beech forest is dominated by mountain beech, often occuring without many other tree species although mountain conifers and other species may be present in places. The understorey is typically sparse. Mountain beech forest is a common habitat type of the mountains (especially on eastern sites), occuring at higher altitudes where soils are thinner and less fertile. Mountain beech can tolerate cold temperatures and dry winds and mountain beech forest can be dominant in these areas.
Podocarp/kamahi forest	Rimu-matai-miro-totara/kamahi forest And Rimu-miro-totara/kamahi forest As per Leathwick *et al*., 2005[1]	At Risk	Podocarp/kamahi forest is characterised by podocarp species (rimu, miro, kahikatea, matai or totara) in varying dominance over abundant kamahi. The degree of dominance of each of the podocarp species will be dependent on soil drainage. Tawa, northern rata, hinau, mairie, fuchsia and/or mahoe may also be present.
Kanuka forest	Kanuka forest is dominated by almost pure stands of kanuka. Kanuka forest can be differentiated from kanuka scrub by size (greater than 2 m tall or 20 cm diameter (diameter at breast height (dbh) taken at 1.5 m above the ground).	Threatened	Manuka and common broadleaved species can also be present scattered through the canopy or comprising the understorey.
Lichenfield, tussockland, herbfield, shrubland, scrub[3] on Silicic-intermediate rock	Where lichenfield, tussockland, herbfield, shrubland or scrub occurs on coastal cliffs of silicic-intermediate rock. Silicic rock is igneous rock that is rich in silica (SiO_2). Silicic-intermediate rock has a silica content of between 52-63%. As per Williams *et al.,* 2006[4]	Rare	Vegetation types typically found in this habitat include lichen species, non-woody or low-growing semi woody herbs, tussocks, shrubs and scrub. Species characteristic of these vegetation types include, for example, Pimelea, sea primrose ,Selliera, flax, toetoe, Astelia, Hebe, daisy species, kawakawa, mahoe and broadleaved.
Grassland, sedgeland[3] on active dunelands.	Where grassland or sedgeland occurs on active dunelands formed on raw coastal sand. As per Williams *et al*., 2006[4]	Rare	Active dunelands are characterised by unstable sands. This continual instability of sand prevents the formation of soil and therefore the vegetation type that an active duneland can support is limited. Examples are Spinifex grassland and pingao sedgeland. Other indigenous species can also be present eg. sand convolvulus and sand Carex.

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description[2]
Grassland, tussockland, herbfield, shrubland[3] on stable dunelands	Where grassland, tussockland, herbfield, or shrubland occurs on stable dunelands formed on recent coastal sand. As per Williams *et al*., 2006[4]	Rare	Vegetation types typically found on stable duneland include; tussocks, low-growing or semi-woody herbs and shrubs. These vegetation types characteristically support, for example, toetoe, Selliera rotundifolia, sand Gunnera, native spinach, sand Coprosma, sand daphne, coastal tree daisy, pohuehue, tauhinu, Coprosma species and hangehange. Exotic invasive species are also a feature of stable duneland.
Tussockland, herbfield, scrub, forest[3] on inland duneland	Where scrub, tussockland, herbfield or forest occurs on inland dunelands formed on raw or recent sands inland. As per Williams *et al.,* 2006[4]	Rare	Vegetation types typically found on inland duneland include; tussock, low-growing or semi-woody herbs, shrubs, small trees and forest trees. These vegetation types characteristically support, for example, toetoe, flax, native spinach, manuka, kanuka, mahoe, lancewood, five-finger, hangehange, cabbage trees; titoki, akeake, ngaio, tawa, pigeonwood and mahoe.
Dune slack wetland	Dune slack wetlands are found in areas where wind has eroded hollows or depressions, or a topographically low area where water is permanently or seasonally ponded. As per Johnson and Gerbeaux, 2006[5] and Williams *et al.,* 2006[4]	Rare[6]	Dune slack wetlands typically support herbfields[3].
Ephemeral wetland	Ephemeral wetlands are usually of moderate fertility, and neutral pH, characterised by a marked seasonal high water table, ponding and drying. Change in water levels can be very dramatic to the point of complete drying and fluctuations between aquatic and terrestrial plant species can occur. Ephemeral wetlands are feed by ground water or an adjacent water body. As per Johnson and Gerbeaux, 2006[5] and Williams *et al.,* 2006[4]	Rare[6]	Ephemeral wetlands typically support turf habitat (generally < 3 cm tall). Turf habitat contains 62% of New Zealand's threatened or uncommon plants. Ephemeral wetlands can also sometimes support rushland[3] scrub.

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description[2]
Pakihi wetland	Pakihi wetlands are often found in association with bogs and fens. Pakihi wetlands are rain-fed systems on mineral or sometimes peat substrate of very low fertility and low pH and can be seasonally dry. As per Johnson and Gerbeaux, 2006[5] and Williams *et al*., 2006[4]	Rare[6]	Pakihi can be found on level to rolling or sloping land in areas of high rainfall and old soils. Pakihi can support restiads, sedges, fernland, heathland and shrubland[3].
Seepage and Spring wetlands	These wetlands are represented by areas of water that have percolated to the surface, with the volume of water present at seepages being less than that at springs. Substrates, nutrient levels and pH can vary from site to site. As per Johnson and Gerbeaux, 2006[5] and Williams *et al*., 2006[4]	Rare[6]	Seepages and springs can be found at the point of change of slopes, and places where the water table is raised. These wetlands can support sedgeland, cushionfield, mossfield or scrub.[3]
Swamp wetlands	Swamp wetlands are generally of high fertility receiving nutrients and sediment from surface water and groundwater. Substrates are generally a combination of peat and mineral. Standing water and surface channels are often present, with the water table either permanently, or periodically, above much of the ground surface. As per Johnson and Gerbeaux, 2006[5]	Threatened	Swamp wetland can be found on plains, valley floors and basins. Swamps can support sedges, rushes, reeds, flaxland, tall herbs, shrubs scrub and forest[3].

Habitat Type Name	Defined As	Rule Stream Classification	Indicative Description[2]
Bog and fen wetlands	These wetland classes are often found in association with each other. Bogs are formed on peat with rainwater the only source of water. Bogs are nutrient poor, poorly drained and aerated and usually acid. The water table is usually close to or just above the ground surface. Fens are wetlands of low to moderate acidity and fertility with a substrate of predominantly peat. Receives ground water and nutrients from adjacent mineral soils. The water table is usually close to or just below the surface. As per Johnson and Gerbeaux, 2006[5]	Threatened	Bogs can be found on relatively level or gently sloping ground including hill crests, basins, terraces and within other wetland classes. Bogs can support mosses, lichens, cushion plants, sedges, grasses, restiads, ferns, shrubs and trees. Fens can be found on slight slopes (eg. fans), toes of hillsides, on level ground where peat hasn't accumulated much and can grade into swamp. Fens support restiads, sedges, ferns, tall herbs, tussock grasses and scrub.
Saltmarsh wetlands	Saltmarsh occurs within areas of tidal and saline influences. Water sources come from ground water and adjacent saline or brackish waters. As per Johnson and Gerbeaux, 2006[5]	Threatened	Saltmarsh can support herbfield, rushland, and scrub[3]. Saltmarsh wetlands can also include areas of mudflats.
Lakes and Lagoons and their margins (including dune lakes)	The lakes in the Manawatu-Wanganui Region are associated with dune, river (including ox-bow lakes) and volcanic activities. As per Johnson and Gerbeaux, 2006[5]	Threatened	Lakes can exist entirely within a swamp, or have elements of wetland habitat on the lake margins. Lakes can also be associated with terrestrial habitat on the lake margins.
Riparian margin	Any vegetation (whether indigenous or not, and including classified elsewhere in Schedule E) within 20 m of an area as identified in Schedule D as being a Site of Significance-Aquatic.	At Risk	Riparian margin vegetation can comprise, indigenous vegetation, exotic vegetation or a combination of both and of any structure[3]. This habitat type will vary greatly between patches in both structure and composition, and might be highly modified, contain artificial assemblages of species or include deliberately planted species (indigenous or exotic).
Habitat type containing species	Any vegetation (whether indigenous or not, and including vegetation that has not been classified elsewhere in Schedule E) that contains, or could be reasonably known to contain, any species as listed in Table E.3 of this Schedule.	At Risk	Riparian margin vegetation can comprise vegetation of any structure[3], indigenous vegetation, exotic vegetation or a combination of both. This habitat type is likely to vary greatly between patches in both structure and composition and might be highly modified.

[1] Leathwick, J., McGlone, M., Walker, S. and Briggs, C. 2005. *Predicted Potential Natural Vegetation of New Zealand* (poster), Landcare Research Ltd. Lincoln New Zealand. Manaaki Whenua Press. See also the accompanying paper: Leathwick, J., McGlone, M. and Walker, S. (unpublished). *New Zealand's Potential Vegetation Pattern.* Landcare Research, Lincoln New

Zealand. Some habitat type names have been modified in this plan for clarity and to make them more applicable to the Manawatu-Wanganui Region.

[2] Some species listed are likely to not be present, or be present in different abundances than indicated. Other species not listed here are also likely to be present. There will be differences in predicted composition and actual composition on the ground, particularly as a result of site modification and pest impacts.

[3] Vegetation structure is defined in Atkinson, I.A.E. 1985. Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. *New Zealand Journal of Botany 23:361-378*.

[4] Williams. P.A., Wiser, S., Clarkson, B., Stanley, M. 2006. A physical and physiognomic framework for defining and naming originally rare terrestrial ecosystems: first approximation. *Landcare Research Internal Report: LCO506/185*. Landcare Research New Zealand Ltd.

[5] Johnson, P. and Gerbeaux, P. 2004. *Wetland Types in New Zealand.* Department of Conservation, Wellington.

[6] Wetland habitat found on active, stable or inland dunelands have been identified as Rare habitat type according to Williams *et al*., 2006.

Table E.2:

(a) An area of any habitat type described in Table E.1, is also required to meet one of the following criteria to be considered habitat for the purposes of this plan:

i. Areas of indigenous tussockland, grassland or sedgeland (as defined in Table E.1) covering at least 0.2 ha.
ii. Areas of lichenfield, herbfield or mossfield (as defined in Table E.1) covering at least 0.1 ha. Or
iii. Open water associated with wetland habitat, excluding stock ponds less than 0.5 ha in area. Or
iv. Areas of naturally occuring indigenous wetland habitat either in association with open water (fresh or estuarine), or excluding open water, covering at least 0.1 ha. Or
v. Areas of continuous indigenous vegetation covering at least 0.25 ha within any Water Management Sub-zone coded red (Figure E.1). Or
vi. Areas of continuous indigenous vegetation covering at least 1 ha within any Water Management Sub-zone coded orange or yellow (Figure E.1). Or
vii. Areas of Threatened habitat type where it occurs as treeland over at least 1 ha. Or
viii. Areas of treeland over at least 1 ha within any Water Management Sub-zone coded red (Figure E.1) Or
ix. Areas of treeland over at least 2 ha within any Water Management Sub-zone coded orange or yellow (Figure E.1) Or
x. Areas of continuous indigenous vegetation covering at least 0.5 ha, where one or more other areas of indigenous habitat (covering at least 0.5 ha), is present up to 500 m away. Or
xi. Areas of continuous indigenous vegetation covering at least 0.5 ha that support indigenous understorey vegetation. Or
xii. Discontinuous indigenous vegetation present within 50 m of an area of continuous indigenous vegetation covering at least 0.5 ha. Or
xiii. Areas of indigenous covering at least 0.5 ha in gully systems. Or
xiv. Areas of continuous indigenous vegetation within 5 m of a river bed and covering at least 0.1 ha and extending at least 100 m along the length of the river. Or
xv. Areas of indigenous scrub or shrubland covering at least 0.2 ha on stable inland duneland within any Water Management Sub-zone coded red (Figure E.1), or on coastal cliffs of silicic-intermediate rock. Or
xvi. Areas of indigenous vegetation that have been established for the purpose of habitat manipulation including habitat creation, restoration and buffering, where such an area covers at least 1 ha as a discrete site or at least 0.5 ha where it is adjacent to an existing area of indigenous habitat. Or
xvii. Areas of indigenous habitat created at some time in the course of dune habitat restoration (including dune stabilisation). Or
xviii. Areas of indigenous vegetation that have been established in the course of wetland habitat restoration. Or
xix. Areas of artificially created wetland habitat covering at least 0.5 ha (excepting areas that met criteria (b)vi, (b)vii, (b)viii or (b)ix. Or
xx. An area of vegetation of any size or species composition (including exotic vegetation, but excluding exotic pasture) within 20 m of an area identified in Schedule D as being a Site of Significance – Aquatic. Or
xxi. An area of vegetation that of any size or species composition (including exotic vegetation, but excluding production forestry) that contains or is known to contain a species as listed in Table E.3.

(b) An area of any habitat type described in Table E.1, is not be considered habitat for the purposes of this plan if it meets one of the following criteria:

i. Areas of treeland excluding sites that meet any of the criteria viii – ix in section (a) of Table E.2. Or
ii. Woodlots of indigenous tree species planted for the purposes of timber harvest. Or
iii. Stock ponds less than 0.5 ha created for the purposes of stock watering, or water storage for the purposes of irrigation, (including old gravel pits but excluding lakes and areas of open water associated with wetland habitat).
iv. Damp paddocks, or paddocks subject to regular ponding, dominated by pasture species in association with wetland sedge and rush species. Or
v. Ditches or drains supporting raupo, flax or other wetland species (eg. *Carex* sp., *Isolepis* sp.), or areas of these species in drains or slumps associated with road reserves or rail corridors. Or
vi. A pond and/or barrier ditch system specifically designed and installed for the purpose of treatment of animal effluent. Or
vii. Habitat created and maintained for the purposes of waste water treatment. Or
viii. Habitat created and maintained in association with hydro electric power generation. Or
ix. Open water and associated vegetation created for landscaping purposes or amenity values where the planted vegetation is predominately exotic or includes assemblages of species not naturally found in association with each other, on the particular landform or at the geographical location of the created site. Or
x. Indigenous vegetation planted for landscaping, horticultural (including shelter belts) or private gardening purposes.

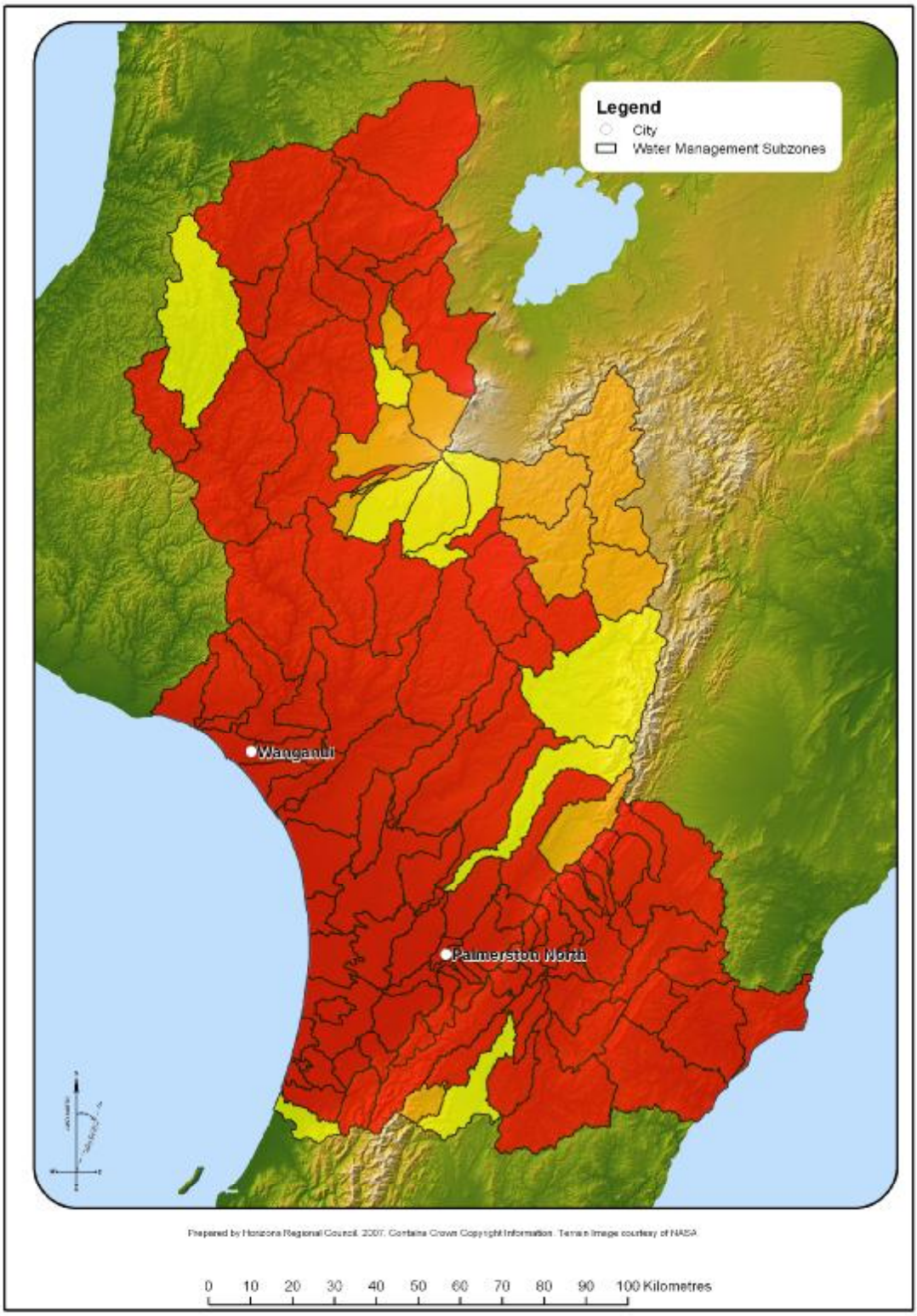

Figure E.1: Map of the Manawatu-Wanganui Region with Water Management Sub-zones coloured according to habitat type classification. Red coloured WMS indicate that where habitat exists within that WMS it is predominately Threatened habitat type. Orange coloured WMS indicate that where habitat exists within that WMS it is predominately Threatened or At Risk habitat type. Yellow coloured WMS indicate that where habitat exists within that WMS it is predominately vegetation not classified by this Schedule. This map is to be read in conjunction with criteria in Table E.2.

Any vegetation (whether indigenous or not, but with the exception of production forest) is considered to be At Risk habitat type for the purposes of this plan if it contains, or could be reasonably known to contain, a species listed in Table E.3.

When determining ecological assessment of a site through a resource consent process, threatened species classification should in all cases be determined by current national threatened species lists as per the current New Zealand Threat Classification System.

It is noted that the habitat type which the threatened species is utilising or reliant on, will be the focus of the consideration during the resource consent process, not management of the species *per se*. Species management of threatened species remains the mandate of the Department of Conservation.

Table E.3: Table E.3 lists a sub-set of threatened species listed in threatened species lists (Hitchmough, *et al*., 2005) and not an exhaustive list of threatened species that occur in the Manawatu-Wanganui Region. The species listed here are threatened species that occur in habitat type that is not adequately protected elsewhere in Schedule E or where populations in the Manawatu-Wanganui Region provide national strongholds for that species. The exclusion of a given species from this table does not indicate that species is not considered to be threatened.

Common Name	Scientific Name	Description	Status[1]	Water Management Zones Sub-zones where these species may occur
Vascular plants				
Gardners tree daisy	*Olearia gardnerii*	Divaricating shrub-small three found (up to 3 m) in Podocarp forest on alluvial terraces, associated with other divaricating shrubs and trees.	Nationally Critical	Rang_2f, Rang_2g
Sand daphne	*Pimelea* "Turakina"	A low growing, grey-green shrub of sand dunes.	Nationally Critical	Tura_1b, West_5, Whau_4
(none known)	*Myosotis pygmaea* var. *minutiflora*	Low growing short lived herb of coastal shingle habitats.	Nationally Vulnerable	Hoki_1a, Hoki_1b, Mana_12c, Mana_13a, Mana_13f, Ohau_1b, Rang_4a, Rang_4b, Rang_4d, Tura_1b, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7b, Whau_4

Common Name	Scientific Name	Description	Status[1]	Water Management Zones Sub-zones where these species may occur
Sand daphne Autetaranga Toroheke Sand pimelea	*Pimelea arenaria*	Prostrate coastal shrub (less than 30 cm) found on the landward side of the fore dunes, back hollows and blowouts. Small white flowers on the ends of the branches.	Gradual Decline	Mana_13a, Rang_4b, Rang_4b, West_5, West_6
(none known)	*Selliera rotundifolia*	A prostrate coastal mat-forming herb (up to 700 mm in diameter), growing in dune fields in seasonally damp swales (ephemeral wetlands) and occasionally found along the margins of slow flowing tidal streams.	Gradual Decline	Mana_13a, Rang_4b, Rang_4b, West_5, West_6
New Zealand sow thistle Puha Shore puha	*Sonchus kirkii*	Biennial to perennial herb up to 1m tall of coastal habitat, usually on cliff faces in or around damp seepages.	Gradual Decline	Akit_1b, Akit_1c, East_1, Hoki_1a, Hoki_1b, Mana_12c, Mana_13a, Mana_13f, Ohau_1b, Owha_1, Rang_4a, Rang_4b, Tura_1b, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7b, Whau_4

[1] Follows Hitchmough. 2002. New Zealand Threat Classification System lists. Biodiversity Recovery Unit, Department of Conservation. Wellington.

15. APPENDIX 5: JUSTIFICATION FOR SUGGESTED CHANGES TO TABLE E.3 OF SCHEDULE E

Table 14: Reasons for including or excluding each of the threatened species as currently presented in Table E.3 of Schedule E of the POP. For clarity the Water Management Sub-zone information has been removed from this rendition of the table.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Birds				
White heron, Kotuku	*Egretta alba modesta*	Found in wetlands, estuaries and damp pasture.	Nationally Critical	Remove. Rules covering wetland habitat types are adequate for the protection of this species.
Australasian bittern, Matuku	*Botaurus poiciloptilus*	Found in tall, dense beds of raupo and reds in freshwater wetlands and wet pasture.	Nationally Endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species.
Blue duck Whio	*Hymenolaimus malachorhynchos*	Found in fast flowing and turbulent stream and rivers in forest hill country.	Nationally Endangered	Remove. Protection will fall under provisions for Sites of Significance – Aquatic in Schedule D.
Kaka (North Island)	*Nestor meridionalis septentrionalis*	Found in large native forest tracts	Nationally Endangered	Remove. There are more effective mechanisms for this species protection (eg. non-regulatory mechanisms, pest control and Wildlife Act). Habitat is partially protected elsewhere in the plan (land clearance on highly erodable land rules). A large proportion of habitat is within Public Conservation Land.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
New Zealand falcon Karearea	*Falco novaeseelandiae* "bush"	Found in native and pine forest and bush patches.	Nationally Vulnerable	Remove. There are more effective mechanisms for this species protection (eg. non-regulatory mechanisms, pest control and Wildlife Act). Habitat is partially protected elsewhere in the plan (land clearance on highly erodable land rules). A large proportion of habitat is within Public Conservation Land. Production land is excluded from this provision.
Wrybill Ngutu-parore	*Anarhynchus frontalis*	Over winters in the North Island estuaries.	Nationally Vulnerable	Remove. Protection will fall under provisions for Sites of Significance – Aquatic in Schedule D and for wetland habitat type.
Kiwi (North Island brown)	*Apteryx australis mantelli*	Found in forest, scrubland and undeveloped farmland, swamps and pine forest particularly where native vegetation remains in gullies.	Serious Decline	Remove. There are more effective mechanisms for this species protection (eg. non-regulatory mechanisms, pest control and Wildlife Act). Habitat is partially protected elsewhere in the plan (land clearance on highly erodable land rules). A large proportion of habitat is within Public Conservation Land. Production land is excluded from this provision.
Banded dotterel	*Charadrius bicinctus*	A small wading bird of gravel beaches and river beds.	Gradual Decline	Remove. Protection will fall under provisions for Sites of Significance – Riparian in Schedule D.
Banded rail, Mohu-pereru	*Gallirallus philippensis assimilis*	Found in saltmarsh and rush covered freshwater wetlands.	Sparse	Remove. Rules covering wetland habitat types are adequate for the protection of this species

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Marsh crake	*Porzana pusilla affinis*	Found in raupo swamps.	Sparse	Remove. Rules covering wetland habitat types are adequate for the protection of this species
North Island Fernbird Matata	*Bowdleria punctata vealeae*	Secretive bird of dense scrubby vegetation associated with drier wetlands, rush and tussock frost flats, saltmarshes, and low manuka scrub.	Regionally Uncommon	Remove. Rules covering wetland habitat types are adequate for the protection of this species where it occurs in wetland. The current threat status of this species is not considered critical to warrant inclusion.
Spotless crake, Puweto	*Porzana tabuensis plumbea*	Secretive bird of freshwater wetlands with raupo or sedges.	Sparse	Remove. Rules covering wetland habitat types are adequate for the protection of this species
North Island robin, Toutouwai	*Petroica australis longipes*	Found in mature native forest, sometimes seen in mature exotic forest and old scrub.	Regionally Uncommon	Remove. There are more effective mechanisms for this species protection (eg. non-regulatory mechanisms, pest control and Wildlife Act). Habitat is partially protected elsewhere in the plan (land clearance on highly erodible land rules). A large proportion of habitat is within Public Conservation Land. The current threat status of this species is not considered critical to warrant inclusion.
Freshwater fish				
Brown mudfish	*Neochanna apoda*	A cigar-shaped, sandy grey-brown coloured fish of 175 mm in length. The head is small with a large mouth with equal length jaws and fleshy lips. Brown mudfish occupy clear water in a range of habitats including spring-fed streams, wetlands, pools of water within podocarp forest, overgrown creeks and even un-maintained roadside and farm drains.	Regionally Vulnerable	Remove. Protection will fall under provisions for the Sites of Significance – Aquatic in Schedule D.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Giant kokopu	*Galaxias argenteus*	A dark-coloured stout fish (length of about 240 mm) with a long broad head and a large mouth with about equal length jaws and thick, fleshy lips. Giant kokopu are found in streams and wetlands not far from the sea, not venturing very far inland. Affect ed by loss of riparian spawning habitat	Regionally Vulnerable	Remove. Protection will fall under provisions for the Sites of Significance – Aquatic in Schedule D.
Short-jawed kokopu	*Galaxias postvectis*	A Large (150-200mm, but can reach 350mm), sleek fish, with a long bluntly pointed snout that overhangs mouth and lower jaw distinctly receding. Affected by loss of riparian spawning habitat	Regionally Vulnerable	Remove. Protection will fall under provisions for the Sites of Significance – Aquatic in Schedule D.
Banded kokopu	*Galaxias fasciatus*	Banded kokopu can be distinguished from the other galaxiid species by the presence of the thin, pale, vertical bands along the sides and over the back of the fish. Adult banded kokopu usually live in very small tributaries where there is virtually a complete overhead canopy of vegetation. This vegetation does not have to be native bush.	Regionally vulnerable (pers. comm. expert)	Remove. Protection will fall under provisions for the Sites of Significance – Aquatic in Schedule D.
Lamprey	*Geotria australia*	A jawless fish with a toothed, funnel-like sucking mouth, which bores into the flesh of other fishes to suck their blood. Lampreys live mostly in coastal and fresh waters, although at least one species, *Geotria australis*, probably travels significant distances in the open ocean. Affected by loss of riparian spawning habitat	Regionally vulnerable	Remove. Protection will fall under provisions for the Sites of Significance – Aquatic in Schedule D.
Terrestrial invertebrates				
Snail	*Powelliphanta traversi tararuaensis*	Giant carnivorous land snail.	Nationally Endangered	Remove. Known from only a few areas and are largely already protected.
Snail	*Powelliphanta traversi traversi*	Giant carnivorous land snail.	Nationally Endangered	Remove. Known from only a few areas and are largely already protected.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Moth	*Asaphodes stinaria*	A moth with mid brown fore wings with two narrow transverse white bands and pale brown hingwings, from forest edge and grassland habitats, including wetlands and tussock grasslands. Coastal to montane.	Nationally Endangered	Remove. Protection will fall under the provisions for wetland habitat type where it occurs in wetland habitat types. Large areas of tussockland are managed by MOD or DoC. Obscure species, monitoring will be onerous.
Black Katipo spider	*Latrodectus atritus*	Coastal spider found in a variety of sand-dune systems associated with driftwood, vegetation, or stones. They usually inhabit foredunes and dune swales but have been found associated with dunes several kilometres from the sea.	Serious Decline	Remove. Protected by CMS and under provisions for wetland habitat type.
Katipo spider	*Latrodectus katipo*	Coastal spider found in a variety of sand-dune systems associated with driftwood, vegetation, or stones. They usually inhabit foredunes and dune swales but have been found associated with dunes several kilometres from the sea.	Serious Decline	Remove. Protected by CMS and under provisions for wetland habitat type.
Forest ringlet	*Dodonidia helmsii*	Forest butterfly. The reported larval host plant is *Gahnia setifolia,* growing in beech forests.	Gradual Decline	Remove. Not a well known species, detection during an AEE survey potentially difficult and expensive. Beech forest is well represented within Public Conservation Land. Threat status is not considered critical to warrant inclusion.
Mammals				
Short-tailed bat (Northern) (Central), Pekapeka	*Mystacina tuberculata rhyacobia*	A bat with grey-brown fur, long ears and a tail that pierces the tail membrane. Restricted to old growth indigenous forest. Forages in the forest interior and generally flies within 10m of the ground.	Nationally Endangered / Range Restricted	Remove. There are more effective mechanisms for this species protection (eg. non-regulatory mechanisms, pest control and Wildlife Act). Habitat is partially protected elsewhere in the plan (land clearance on highly erodible land rules). A large proportion of habitat is within Public Conservation Land.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Long-tailed bat (North Island), Pekapeka	*Chalinolobus tuberculata*	A bat with dark brown fur, short ears and tail within the tail membrane. Tail membrane with a distinct pouch. Found in indigenous and exotic forest, this bat is an aerial insectivore, flying high and swallow-like.	Nationally Vulnerable	Remove. There are more effective mechanisms for this species protection (eg. non-regulatory mechanisms, pest control and Wildlife Act). Habitat is partially protected elsewhere in the plan (land clearance on highly erodible land rules). A large proportion of habitat is within Public Conservation Land.
Reptiles				
Small-scaled skink	Oligosoma microlepis	A smooth skinned grey, striped lizard with prominent dark stripes on each side.	Regionally Vulnerable	Remove. Requires expert knowledge, and therefore owners will need to be informed. Non-regulatory methods and DoC provisions better serve the protection of this species.
Pacific gecko	*Hoplodactylus pacificus*	A velvety skinned lizard in a variety of shades of brown and grey, with paler patches which may be stripey, or irregular markings. Lives on the ground, but will climb trees. Found in a variety of habitats	Gradual Decline	Remove. Will be largely protected by provisions in Table E.1 of the POP. The current threat status of this species is not considered critical to warrant inclusion.
Wellington green gecko	*Naultinus elegans punctatus*	A velvety skinned bright green that inhabits in scrub and forest areas especially kanuka and manuka.	Gradual Decline	Remove. Protection of this species will be better served by other mechanisms. The current threat status of this species is not considered critical to warrant inclusion.
Speckled skink	*Oligosoma infrapunctatum*	A smooth skinned lizard with distintly speckled back and tail.	Gradual Decline	Remove. Protection of this species will be better served by other mechanisms. The current threat status of this species is not considered critical to warrant inclusion.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Striped skink	*Oligosoma striatum*	A smooth skinned dark brown, striped lizard with prominent cream stripes on each side. It is found in epiphytes in standing trees as well as rotting ones on the ground.	Data deficient (Regionally Uncommon, Wanganui Conservancy)	Remove. Protection of this species will be better served by other mechanisms. The current threat status of this species is not considered critical to warrant inclusion.
Vascular plants				
(none known)	*Acaena rorida*	Small perennial herb from damp hollows in tussock grasslands and limestone ravines.	Nationally Critical	Remove. Only one known population which is adequately protected.
Sneezeweed	*Centipeda minima*	Prostrate annual herb of ephemerally wet areas – partially dried lake, pond or stream margins.	Nationally Critical / Regionally Uncommon	Remove. Rules covering wetland habitat types are adequate for the protection of this species.
Mudwort	*Limosella* "Manutahi"	Prostrate herb from mud or damp ground	Nationally Critical / Regionally Rare	Remove. Rules covering wetland habitat types are adequate for the protection of this species
Gardners tree daisy	*Olearia gardnerii*	Divaricating shrub-small three found (up to 3 m) in Podocarp forest on alluvial terraces, associated with other divaricating shrubs and trees.	Nationally Critical	Retain. The Manawatu-Wanganui Region is the strong-hold for this species.
Sand daphne	*Pimelea* "Turakina"	A low growing, grey-green shrub of sand dunes.	Nationally Critical	Retain. The Manawatu-Wanganui Region is the strong-hold for this species.
Turners kohuhu	*Pittosporum turneri*	A small tree (up to 8 m) with a divaricating juvenile and sub-adult form. Grows in montane to subalpine forest, and on frost flat margins and scrub alongside streams.	Nationally Critical	Remove. Only two populations found on private land within the Manawatu-Wanganui Region, neither of which are under threat.
Swamp greenhooded orchid	*Pterostylis micromega*	An orchid (150-380mm) with conspicuous green flower, found in bogs, fens, and swamps	Nationally Critical	Remove. Rules covering wetland habitat types are adequate for the protection of this species
Sebaea	*Sebaea ovata*	Annual erect herb (50-33 mm), growing in damp, sparsely-vegetated dune slacks, depressions, and associated sand plains. One of most threatened plant species in New Zealand.	Nationally Critical	Remove. Rules covering wetland habitat types are adequate for the protection of this species

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Water brome	*Amphibromus fluitans*	Grass of fertile, seasonally dry wetlands and edges of shallow lakes and lagoons.	Nationally Endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species
(none known)	*Crassula peduncularis*	Prostrate annual herb of seasonally damp coastal turfs, marine terraces, and ephemeral wetlands.	Nationally Endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species.
Hairy willowherb	*Epilobium hirtigerum*	Woody herb of coastal / lowland to montane habitats. A short-lived species of open ground, seepages on cliff faces, sparsely-vegetated wetland margins, braided riverbeds, lake edges, and swamps.	Nationally Endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species.
Nau, Cook's scurvy grass	*Lepidium oleraceum*	Woody herb found in fertile and friable coastal soils and rock crevices associated with seabird roosts.	Nationally Endangered	Remove. Unlikely to be significant populations on private land. Protection best served by other mechanisms.
(none known)	*Myosotis* "Volcanic Plateau"	Low growing short lived herb of alpine sand and shingle habitats.	Nationally Endangered / Regionally Vulnerable	Remove. Unlikely to be significant populations on private land. Protection best served by other mechanisms.
(none known)	*Myosotis pygmaea* var. *glauca*	Low growing short lived herb of open dry sandy / gravelly habitats.	Nationally Endangered	Remove. High potential of not being served well by the provisions of this table. Would be more appropriate to list in Sites of Significance – Riparian in Schedule D.
Mountain myrrh	*Oreomyrrhis colensoi* var. *delicatula*	Perennial herb of sub-alpine ephemeral wetlands flushed tarns.	Nationally Endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species.
Stalked adder's tongue fern	*Ophioglossum petiolatum*	Fern consisting of a wide sterile blade and a conspicuous fertile spike	Nationally endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Heart-leaved kohuhu	*Pittosporum obcordatum*	Divaricating tall shrub or small erect tree up to 5-8 m, growing in lowland alluvial forest, mainly in the east. Favours sites prone to summer drought and prone to water-logging, and frost during winter.	Nationally Endangered	Remove. Protected under the provisions of Table E.1 where it occurs in forest habitat types. Production land is excluded from the provisions of Table E.3, so inclusion in Table E.3 is not an appropriate mechanism for protection for this species where it occurs as single plants in paddocks.
(non known)	*Uncinia strictissima*	Rush-like sedge, forming dense tufts found in lowland scrub, swamps, lake margins and in damp clears within lowland forest.	Nationally Endangered	Remove. Rules covering wetland habitat types are adequate for the protection of this species where it occurs in wetland habitat type. Is not a commonly recognised species and would require expert knowledge to determine if a resource consent is required or not.
(none known)	*Myosotis pygmaea* var. *minutiflora*	Low growing short lived herb of coastal shingle habitats.	Nationally Vulnerable	Retain. Habitat types which support this species are not currently listed in Table E.1. There are not provisions for the protection of this species elsewhere in the POP.
(none known)	*Ranunculus ternatifolius*	Small perennial herb of damp sites in forests, scrub, and tussock grassland.	Nationally Vulnerable	Remove. Only known populations are on Public Conservation Land.
Kohurangi, Kirks Daisy	*Brachyglottis kirkii* var. *kirkii*	Daisy. An epiphytic tree of lowland to lower montane forests.	Serious Decline	Remove. Protected under the provisions of Table E.1 where it occurs in forest habitat types.
Sea sedge	*Carex litorosa*	Sedge of salty and brackish marshes.	Serious Decline	Remove. Rules covering wetland habitat types are adequate for the protection of this species

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Pua o te reinga, Dactylanthus Woodrose	*Dactylanthus taylorii*	A root parasite of about 30 cm diameter, with unbranched shoots of about 20 cm long with pinkish brown, scale-like leaves of about 15 mm. These shoots support spikes of tiny flowers when they emerge above the ground. This plant grows on the roots of about 30 native hardwood species.	Serious Decline	Remove. Partially protected under the provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.
Native carrot, New Zealand carrot	*Daucus glochidiatus*	Herb of coastal to montane cliff faces, rock outcrops, talus slopes, tussock grasslands and open forests	Serious Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion
Waiu-atua, sand milkweed, shore spurge, Sand milkweed	*Euphorbia glauca*	Perennial herbaceous coastal plant up to 1 m, with red stems, bluish-green leaves and milky sap. Grows on coastal cliffs, banks and talus slopes, sand dunes and rocky lake shore scarps.	Serious Decline	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion
Pygmy clubrush	*Isolepis basilaris*	A very small rush species 3-9 cm across. Leaves are bright green above and reddish-brown below. Grows in dune lakes, damp, sandy or silty margins of lagoons, tarns, ephemeral lakes and rivers in fresh or brackish water.	Serious Decline	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion
King fern, Para	*Marattia salicina*	Large fern favouring lowland forest karst habitats	Serious Decline	Remove. Partially protected under the provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.
Dwarf musk/matt leaved Mazus	*Mazus novaezeelandiae* subsp. *impolitus* f. *impolitus*	A perennial creeping herb of coastal damp hollows and sand flats, amongst sandy turf and coastal pasture.	Serious Decline	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Dwarf musk	*Mazus novaezeelandiae* subsp. *novaezeelandiae*	A perennial creeping herb of lowland swamp forest, pasture and forest margins.	Serious Decline	Remove. Partially protected by provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
(none known)	*Pimelea tomentosa*	An erect, grey-green, leafy shrub of open cliff tops, in scrub, frost flats, track sides and other seral habitats	Serious Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Kirk's kohuhu Thick-leaved kohukohu	*Pittosporum kirkii*	A small, openly-branched shrub which is usually epiphytic, rarely terrestrial in coastal to montane forest.	Serious Decline	Remove. Partially protected by provisions Table E.1. The current threat status of this species is not considered critical to warrant inclusion.
Greenhood	*Pterostylis paludosa*	A greenhood orchid up to 180 mm tall in peat bogs and heathlands, usually in well-lit sites amongst mosses and sedges.	Serious Decline	Remove. Mostly protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Yellow mistletoe Pirita Piriraki	*Alepis flavida*	A parasitic shrub, mainly of beech.	Gradual Decline	Remove. Majority of populations are on Public Conservation Land. The current threat status of this species is not considered critical to warrant inclusion.
Jersey fern Annual fern	*Anogramma leptophylla*	A small fern of clay banks, rock faces and alluvial banks.	Gradual Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Sand tussock Hinarepe	*Austrofestuca littoralis*	Sand tussock up to 70cm tall found in coastal dunes particularly foredunes and dune hollows, and sandy and rocky places	Gradual Decline	Remove. Partially protected by the provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Climbing groundsel	*Brachyglottis sciadophila*	Slender, twining or tangling climber, often draped over host plant in a dense mass or creeping along ground. Lowland, along forest margins or in alluvial forest	Gradual Decline / Regionally Uncommon	Remove. Mostly protected by provisions of Table E.1. Most populations known from Public Conservation Land.
(none known)	*Coprosma obconica*	Divaricating shrub (2-3.5m) found in a range of habitats.	Gradual Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Coprosma pedicellata*	Shrub or small tree (up to 9m) of Kahikatea dominated alluvial forest.	Gradual decline	Remove. Protected by provisions of Table E.1.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
(none known)	*Coprosma wallii*	Divaricating shrub to small tree (up to 3 m) growing in a range of habitats on fertile substrate (alluvial, riparian and subalpine), in places with cold winters and dry summers. Never associated with broad-leaved canopy trees.	Gradual Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Crassula manaia*	Minute annual herb of coastal turf and associated fine silt and gravel.	Gradual Decline / Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Tufted hair grass, Wavy hair grass	*Deschampsia caespitosa*	An erect tussock of coastal to sub-alpine wetlands and lake margins.	Gradual Decline	Remove. Protected by provisions for wetland habitat type.
Pingao Golden sand sedge	*Desmoschoenus spiralis*	A coarse leaved, yellow sand-binding plant of coastal fore-dunes.	Gradual Decline	Remove. Protected by provisions of Table E.1.
Pygmy sundew	*Drosera pygmaea*	Small red, red-purple or green rosette forming carnivorus herb. Coastal to subalpine, usually in pakihi shrublands and adjoining wetlands, especially peat bogs.	Gradual Decline	Remove. Protected by provisions for wetland habitat type.
Sand spike sedge Spikesedge	*Eleocharis neozelandica*	Small, leafless, duneland wetland sedge Damp sand flats, often near streams or in places where fresh water filters through the sand at depth or in ephemeral wetlands. Currently only known from one site in the Region.	Gradual Decline	Remove. Protected by provisions for wetland habitat type.
Marsh willowherb	*Epilobium chionanthum*	A small, clumped herb with white flowers found in swamps and wet swards of grasses or sedges near lake and river margins, or in bogs. (below 900m)	Gradual Decline	Remove. Protected by provisions for wetland habitat type.
Sea holly, coastal eryngo	*Eryngium vesiculosum*	A small herb of coastal gravel fields.	Gradual Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Gunnera,	*Gunnera arenaria*	Small-leaved prostrate coastal species of damp sand ground, dune slacks and swales, and along tidal river margins and coastal sandstone bluffs.	Gradual Decline	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
New Zealand iris Mikoikoi	*Libertia peregrinans*	An iris with hard copper orange coloured leaves (15–70 cm long) with prominent dark orange veins. A primarily coastal or lowland species of sandy, peaty or pumiceous soils. It may be found growing in dune slacks and swales, on the margins of swamps, in open poorly draining ground under scrub.	Gradual Decline	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Melicytus flexuosus*	Divaricating shrub (to 5 m) growing on fertile alluvial terraces and flood plains, often on forest margins and in scrub.	Gradual Decline	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Scarlet mistletoe Korukoru Pirita Roeroe	*Peraxilla colensoi*	A parasitic shrub up to 3 m across, mainly in silver beech forest.	Gradual Decline	Remove. Partially protected by provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.
Red mistletoe Pikirangi Pirita Roeroe Pirinoa	*Peraxilla tetrapetala*	A parasitic shrub up to 2 m across, mainly in coastal to montane beech forest.	Gradual Decline	Remove. Mostly known from Public Conservation Land. The current threat status of this species is not considered critical to warrant inclusion.
Sand daphne Autetaranga Toroheke Sand pimelea	*Pimelea arenaria*	Prostrate coastal shrub (less than 30 cm) found on the landward side of the fore dunes, back hollows and blowouts. Small white flowers on the ends of the branches.	Gradual Decline	Retain. Partially protected by provisions of Table E.1. The Manawatu-Wanganui Region is the national strong-hold for this species.
Swamp buttercup	*Ranunculus macropus*	Semi-aquatic to aquatic rosette herb, usually found in coastal to lowland raupo dominated wetlands.	Serious Decline	Remove. Protected by provisions for wetland habitat type.
Raukawa	*Raukaua edgerleyi*	A large shrub or small tree up to 10m tall with separate Adult and juvenile phases. Prefers cloud forests.	Gradual Decline	Remove. The current threat status of this species is not considered critical to warrant inclusion.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
(none known)	*Selliera rotundifolia*	A prostrate coastal mat-forming herb (up to 700 mm in diameter), growing in dune fields in seasonally damp swales (ephemeral wetlands) and occasionally found along the margins of slow flowing tidal streams.	Gradual Decline	Retain. Partially protected by provisions for wetland habitat type. This species is endemic to the Manawatu-Wanganui Region.
New Zealand sow thistle Puha Shore puha	*Sonchus kirkii*	Biennial to perennial herb up to 1m tall of coastal habitat, usually on cliff faces in or around damp seepages.	Gradual Decline	Retain. Partially protected by provisions for wetland habitat type The Manawatu-Wanganui Region is the national stronghold for this species.
Teucridium	*Teucridium parvifolium*	A shrub (up to 2 m) with small leaves. Grows along fertile stream sides and river terraces in lowland dry forest and podocarp-broadleaf forest. Can also grow in forest margins, clearings and amongst scrub.	Gradual Decline	Remove. Partially protected by provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.
White mistletoe Taapia pirita Tupia	*Tupeia antarctica*	A shrubby parasite to 1 m diameter of forest or scrub habitat (often in regenerating vegetation).	Gradual Decline	Remove. Partially protected by provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.
Swamp nettle	*Urtica linearifolia*	Sparingly branched herb which inflicts a painful sting. Found in fertile swamps, lakes and river margins, swampy shrubland and forest.	Gradual Decline	Remove. Protected by provisions for wetland habitat type
(none known)	*Brachyglottis turneri*	A tall herb (daisy) (of stream margins)	Range Restricted / Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Sand Coprosma	*Coprosma acerosa*	Coastal shrub in sand dunes and dune hollows.	Range Restricted	Remove. Partially protected by provisions of Table E.1. The current threat status of this species is not considered critical to warrant inclusion.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Willowherb	*Epilobium astonii*	Heavily branched, erect perennial herb forming compact bushes up to 300. A subalpine to alpine species (760-1370 m a.s.l.) usually found on cliff faces, often along canyon and gorge walls, sometimes on exposed boulders along ridge lines	Range Restricted	Remove. Likely to occur primarily on Public Conservation Land. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Leptinella dispersa* subsp. *rupestris*	Creeping, perennial herb forming loose patches or compact turf depending on local conditions. Inhabits the margins of freshwater swamps and wetlands bordering saltmarsh, sometimes in deep hollows or on shaded cliff faces.	Range Restricted	Remove. Partially protected by the provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Myosotis eximia*	Low growing perennial herb, found on limestone cliffs and talus slopes.	Range Restricted	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Simplicia buchananii*	A grass with a preference for base-rich substrates and semi-shaded situations in forest or near rock overhangs.	Range Restricted	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Feeble bent	*Agrostis imbecilla*	Delicate, slender, tufted perennial grass, 150-350 mm tall. A montane, subalpine to alpine species of damp sites within tussock grassland.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Gossamer grass	*Anemanthele lessoniana*	Erect, tufted perennial grass. Sea level to montane forest, forest margins, scrub and on cliff faces and associated talus.	Sparse / Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Parsley fern Patotara	*Botrychium australe*	Red-green (bronze) to bright green, fleshy fern. A species of open ground, short and tall tussock grassland, forest clearings, shrubland, river flats, reverting pasture and seasonally flooded ground.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Mistletoe Dwarf mistletoe Leafless mistletoe	*Korthalsella salicornioides*	Succulent mistletoe, much branched, green, yellow-green, red-green to orange-green plant parasitising exposed branches and branchlets of host. Most commonly found parasitic on kanuka/manuka	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
(none known)	*Lepilaena bilocularis*	Annual, aquatic herb of lakes, brackish water, or slow-flowing rivers. Usually found in shallow fresh water habitats not far from the coast.	Sparse	Remove. Partially protected by provisions for wetland habitat types. The current threat status of this species is not considered critical to warrant inclusion.
Native musk Maori musk Native monkey flower	*Mimulus repens*	Mat-forming, succulent, perennial herb. Strictly coastal in permanently damp or soggy, saline mud or silt soils.	Sparse	Remove. Protected by the provisions of Table E.1.
Leafless pohuehue Leafless muehlenbeckia	*Muehlenbeckia ephedroides*	Prostrate twiggy shrub of coastal to sub-alpine fertile gravel to sandy soils	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Myosotis spathulata*	Prostrate perennial herb, on or near rock outcrops, under rock overhangs, on ledges or amongst rubble in forest or shrubland.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Olearia quinquevulnera*	Shrub 2.2 x 2 m. Montane to subalpine, on valley floors, on forest margins, clearings, amongst rocks, below cliffs and in subalpine scrub, often in poorly drained or permanently wet soils.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Fierce lancewood	*Pseudopanax ferox*	Small tree up to 8 m tall. In grey scrub overlying pumice, on recent alluvial (coarse gravels), limestone outcrops, boulder fall, cliff faces, talus slopes and scarps. Also found as a sparse component of seasonally drought-prone but otherwise cold and wet alluvial forests.	Sparse / Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Koheriki	*Scandia rosifolia*	Semi-erect to somewhat openly sprawling, woody, aromatic shrub up to 1 x 1 m. Usually on cliff faces, clay banks or amongst boulders, often found along cliffs lining river gorges, more rarely in scrub.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Stegostyla atradenia*	Orchid favouring infertile substrates, especially clay podzols and pumice soils, usually in thick leaf litter under kanuka/manuka.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.

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New Zealand spinach Kokihi Tutae-ikamoana	*Tetragonia tetragonioides*	Widely trailing perennial herb of the coastal strand zone often growing along beaches amongst driftwood, and sea weed but also in sand dunes, on boulder and cobble beaches, on cliff faces and rock ledges.	Sparse	Remove. Protected by provisions of Table E.1.
Sun orchid	*Thelymitra formosa*	Very stout orchid which at flowering is up to 0.8 m tall. Stem dark red-green or dark green. Mainly found in lowland to montane wetlands, scrub and open forest.	Sparse	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion
Bristle fern	*Trichomanes colensoi*	Colony forming fern of dark recesses, rock faces and overhangs usually near to or partially immersed in water.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Trisetum drucei*	Dense, tufted grass up to 600 mm. A cliff dwelling species preferring calcareous mudstones, siltstones, sandstones, and marble and limestone.	Sparse	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Native angelica	*Gingidia montana*	Prostate montane herb	Regionally Rare	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Maori dock, New Zealand dock, Runa	*Rumex flexuosus*	A rhizomatous herb with broadly oval leaves	Regionally Rare	Remove. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Coprosma virescens*	Divaricating shrub inhabiting forest edges and scrub.	Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion.
Matagouri, Wild Irishman	*Discaria toumatou*	Divaricating shrub inhabiting forest edges and scrub.	Regionally Uncommon	Retain. Found in habitat types not currently listed in Table E.1. Distribution of this species within the Manawatu-Wanganui Region is unusual and therefore biological distinctive.
	Schoenus nitens	Wetland sedge 5-25 cm tall with pale green leaves with purplish tips growing in moist dune hollow and brackish swamps near the coast.	Regionally Uncommon	Remove. Protected by provisions for wetland habitat type.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
Native cleaver, native bedstraw	*Galium trilobum*	Perennial herb with straggling, slender stems, 10-70cm long. Leaf stems 0.5-3mm long. Leaves 2-10mm long Lowland to upland. In shady, damp and wet places, such as forest margins, scrub, stream and lake sides, moist pastures and tussockland, shrubland, rushland in seepage and near swamp	Regionally Uncommon	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Green mistletoe	*Ileostylus micranthus*	A coastal to lowland mistletoe that prefers shrubland and secondary regrowth.	Regionally Uncommon	Remove. Is in fact quite common in region, and also hosts on a range of exotic tree species.
Dwarf mistletoe	*Korthasella clavata*	Coastal to subalpine mistletoe. Usually found parasitising shrubs within grey scrub communities, also found on shrubs and trees within montane alluvial forest.	Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion
Native mint, Mokimoki	*Mentha cunninghamii*	Prostrate herb of lowland to high montane grassland and open habitats, such as cliffs, river banks, lakesides, sometimes in swampy ground.	Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion
Alpine yellow forget-me-not	*Myosotis australis* "yellow"	Low mat herb with yellow flowers, found in tussock grasslands.	Regionally Uncommon	Remove. The current threat status of this species is not considered critical to warrant inclusion
Small prostrate milfoil	*Myriophyllum votschii*	Small branching bright green herb with leaves only 1-3 mm long, growing in coastal damp sands, inland on lake margins and in shallow waters.	Regionally Uncommon	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Giant maiden-hair	*Adiantum formosum*	Tall, widely creeping fern from alluvial forest and gorge sides. Usually found in shaded sites amidst drifts of leaf litter. It rarely grows in full sun.	Vagrant	Remove. Largest population is on Public Conservation Land.
New Zealand sneezewort	*Centipeda aotearoana*	Annual to short-lived perennial prostrate herb forming circular patches 10-30 cm diameter, from open damp ground, lake, tarn and river margins, ephemeral wetlands, and drains.	Data Deficient	Remove. Mostly protected by provisions for wetland habitat type.

Common Name	Scientific Name	Description	Status[1]	Recommend to Retain or Remove from Schedule E. Reason for recommendation is provided in brackets
(none known)	*Euchiton polylepis*	Stoloniferous, perennial daisy of lowland to subalpine in damp places, especially stream sides and damp hollows in grassland, cliffs and rocky places.	Data Deficient	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Papataniwha	*Lagenifera montana*	Small herb with leaves in a rosette at base of plant from subalpine to alpine seeps, cushion bogs, swamps, lake and tarn margins, wet tussock grassland and stream banks, 600-900m altitude, occasionally lower.	Data Deficient	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
(none known)	*Pimelea aridula* agg.	Erect schrub up to 1 m tall of Lowland to montane grassland and rocky places	Data Deficient	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Greenhood	*Pterostylis irwinii*	A large, slender, long leaved orchid from damp areas in light scrub or near forest tracksides.	Data Deficient	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.
Grassland wheatgrass	*Stenostachys laevis*	Perennial grass of tussock grasslands, grey scrub, shaded cliff faces, lake sides and flushes.	Data Deficient	Remove. Partially protected by provisions for wetland habitat type. The current threat status of this species is not considered critical to warrant inclusion.

[1] Follows Hitchmough. 2002. New Zealand Threat Classification System lists. Biodiversity Recovery Unit, Department of Conservation. Wellington.