



RNZAF Base Ōhakea PFAS Investigation

Long Term Monitoring Plan – version 2

June 2026

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✦ Prepared for

New Zealand Defence Force and Horizons Regional Council

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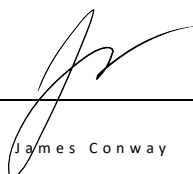
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Table of Contents

SECTION	PAGE
1.0 Introduction	1
1.1 Objectives	2
2.0 Site Description	2
3.0 Monitoring Plan	2
3.1 Groundwater Monitoring Locations and Rational	2
3.2 Surface Water Monitoring Locations	3
4.0 Sampling Frequency	3
5.0 Sampling Considerations	6
6.0 Recommended Reporting	6
7.0 References	6

Table of Figures

Figure 1: Monitoring Location Plan	8
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Table of Tables

Table 1: Groundwater Monitoring Locations	5
Table 2: Surface Water Monitoring Locations	5

1.0 Introduction

New Zealand Defence Force (NZDF) has been investigating the potential for contamination of ground, water and biota associated with the use and storage of products containing per- and poly-fluoroalkyl substances (PFAS) at Royal New Zealand Air Force (RNZAF) Base Ōhakea (the 'site' or 'Ōhakea'). Investigations at Ōhakea have identified PFAS in soil and water on base, as well as in the surrounding environment and neighbouring properties. Following multiple sampling investigations on-site and off-site, a comprehensive site investigation report 'CSIR' (PDP, 2019a) was produced by Pattle Delamore Partners Ltd (PDP) to compile and assess the sample results.

The investigation included predictions for the existing and future groundwater plume with the assistance of a 3D groundwater flow and solute transport model (PDP, 2019b). Predictions for the evolution of the plume were made for the short to long term (up to 125 years) and included the maximum predicted plume extent for various scenarios.

In response to this, PDP was engaged to produce a long-term monitoring plan (LTMP) for PFAS in surface water and groundwater (PDP, 2020). The monitoring recommendations were accepted by NZDF and Horizons Regional Council (HRC) and regular monitoring as per the LTMP (PDP, 2020) has been occurring at Ōhakea since October 2020.

A review of the LTMP was recommended after 5 years of regular monitoring and this was completed in 2026 (PDP, 2026a). As part of this review, the original groundwater model was updated with sampling data (from groundwater, surface water and soil samples) collected since 2019. The process and outcome of the model update is provided in PDP (2026b).

Based on the updated model outputs and review of the LTMP and monitoring data, recommendations for revising the LTMP were provided to NZDF and HRC for consideration in April 2026 (PDP, 2026a). Both parties have agreed to the recommended updates, and these are provided in this revised LTMP, referred to as LTMP version 2.

The LTMP v2 has been prepared for NZDF and HRC who hold joint responsibility for the monitoring and reporting described in this plan. It is understood that NZDF will be responsible for monitoring on NZDF land, and HRC will be responsible for monitoring on private or public land (that is not part of the NZDF estate).

1.1 Objectives

The purpose of long-term monitoring is to:

- ✧ Monitor PFAS in groundwater on-site and off-site;
- ✧ Monitor PFAS in surface water downstream of the site; and,
- ✧ Rationalise the number of sampling locations from previous investigation and monitoring phases to a smaller number of representative locations.

The objectives of monitoring are to:

- ✧ Track the concentrations of PFAS in surface water and groundwater at representative locations over time to enable stakeholders to monitor plume development; and,
- ✧ Support validation of the updated groundwater model produced by PDP (2026b).

2.0 Site Description

The monitoring plan covers the area of the predicted maximum plume extent (based on the model outputs). This extends from the Ōhakea Airforce Base in the north, the Makowhai Stream to the east and south and the Rangitikei River to the west.

Ōhakea is a large, operating airforce base with on-site residential dwellings alongside the buildings and infrastructure associated with the airfield.

The remainder of the area covered by the monitoring plan is pastoral and rural residential land use.

3.0 Monitoring Plan

3.1 Groundwater Monitoring Locations and Rational

Ongoing monitoring of groundwater is proposed to assess the status of the groundwater plume as it develops and to assist validation of the updated groundwater model predictions (PDP, 2026b).

The results of the groundwater model update provide an indication of the future extent of the groundwater plume. In essence, the predictions from the updated model are very similar to the predictions from the original model (PDP, 2019b). Consequently, no changes to the groundwater monitoring locations are recommended. The one exception to this is location WS2. This well was the Base drinking water supply, which has now been decommissioned and removed so will no longer be monitored.

The recommended groundwater monitoring locations are summarised below.

3.1.1 On-site Wells

Three key PFAS source areas will be targeted using existing wells on-site, the historic Fire Training Area (FTA), the run-up pit (historically used for fire training) and the area adjacent to the diversion tank (which historically accepted foam from the hanger deluge systems). The existing NZDF wells recommended for ongoing monitoring are listed in Table 1 and displayed in Figure 1.

3.1.2 Off-site Wells

Ongoing monitoring of selected off-site wells is recommended to monitor/validate the interpreted plume edge/lateral extent with time. The off-site wells recommended for ongoing monitoring are listed in Table 1 and displayed in Figure 1. Some of these wells are privately owned wells. These wells have been monitored regularly; however future monitoring will require ongoing permission from landowners.

3.2 Surface Water Monitoring Locations

The surface water monitoring locations near to Base Ōhakea represent areas with historically elevated concentrations of PFAS. Additional locations along the Makowhai Stream are included to monitor the levels of PFAS downstream of the Base. The recommended surface water sampling locations are listed in Table 2 and displayed in Figure 1.

4.0 Sampling Frequency

The previous LTMP required biannual monitoring, with one monitoring round occurring during the summer groundwater low (March/April) and a second round during the winter groundwater high (September/October).

A review and trend analysis of the monitoring data (PDP, 2026a) showed limited to no evidence of seasonal trends and that in most locations, the concentrations of PFAS are relatively stable. It is therefore recommended that the frequency of groundwater monitoring is reduced to annual at all locations except for MW4. As MW4 is adjacent and upgradient of the Ōhakea managed fill site (which accepts PFAS impacted soils) it has been recommended that MW4 is monitored every 6 months as per the other monitoring wells around the managed fill.

One monitoring location showed statistically significant evidence of a seasonal trend - MW9 was found to have higher concentrations of total PFOS+PFHxS during summer rounds. As there is no evidence to suggest a seasonal trend at any other locations, it was recommended that monitoring is undertaken during the summer period (March/April). Further benefits of monitoring at this time of year are the longer daylight hours and the generally more favourable weather conditions for field work.

Several wells have had sample results consistently below the laboratory level of reporting (LOR) and modelling indicates this pattern is likely to persist in the short to medium term. Therefore, wells GW53, GW65, GW67 and GW106, GW107, GW108 and GW109 will be sampled every 5 years, unless the concentration of select PFAS¹ in upgradient wells exceed the historic ranges for those compounds in those wells (calculated as the 95% upper confidence limit of the mean of the previous monitoring results).

It is recommended that the integrity of these wells is visually checked during the annual groundwater monitoring. If any damage is noted, it should be repaired.

For some of the surface water monitoring locations, a potential increasing trend was noted, therefore, 6 monthly monitoring will continue for surface water.

The monitoring frequency is summarised in Tables 1 and 2.

¹ The select PFAS include PFOS, PFHxS and PFOA.

Table 1: Groundwater Monitoring Locations					
Location		HRC Bore ID	Sampling Point	Rationale	Monitoring Frequency
RNZAF Base Ōhakea	MW4	323153	Monitoring Well	Key source area (historic fire training area (FTA), adjacent to and upgradient of the Ōhakea managed fill.	Every 6 months
	WS1	323085	Tap	Farm bore downgradient of FTA and near site boundary with a long existing monitoring record.	Annual
	GW6	-	Well	Open well downgradient of key source areas and historically elevated PFAS concentrations.	Annual
	MW6	-	Monitoring Well	Key source area (run-up pit).	Annual
	MW9	-	Monitoring Well	Key source area (diversion tank for hangar deluge systems).	Annual
	GW111.1	323183	Monitoring Well	Downgradient of FTA.	Annual
	GW111.2	323185	Monitoring Well	Downgradient of FTA. Deeper well (~40 m) to monitor the vertical extent of PFAS.	Annual
	GW111.3	323187	Monitoring Well	Downgradient of FTA. Deeper well (~95 m) to monitor the vertical extent of PFAS and the deeper aquifer that may be used for groundwater abstraction.	Annual
Other (non-NZDF) private and public land	GW31	323091	Tap	Eastern plume edge.	Annual
	GW53	-	Tap	Eastern plume edge.	Every 5 years (with annual well integrity check)
	GW65	323019	Tap	Southern plume edge.	Every 5 years (with annual well integrity check)
	GW106	323175	Monitoring Well	Plume is predicted to approach and then encompass the shallow well into the future.	Every 5 years (with annual well integrity check)
	GW107	323177	Monitoring Well	Act as a sentinel monitoring location e.g., to monitor the predicted maximum lateral edge of the future plume.	Every 5 years (with annual well integrity check)
	GW108	323179	Monitoring Well	Plume is predicted to approach and then encompass the shallow well in the future.	Every 5 years (with annual well integrity check)
	GW109	323181	Monitoring Well	Plume is predicted to approach and then encompass the shallow well in the future.	Every 5 years (with annual well integrity check)
	GW112.1	-	Monitoring Well	Well near the centre of the main plume.	Annual
	GW112.2	-	Monitoring Well	Well near the centre of the main plume. Deeper well (~55 m) to monitor the vertical extent of PFAS.	Annual

Table 2: Surface Water Monitoring Locations		
Location	Rationale	Monitoring Frequency
SW6	Previous high PFAS concentrations leaving the base.	Every 6 months
SW33	Resurgence of high PFAS concentrations on the Makowhai Stream downstream of the base. Accessible from the road.	Every 6 months
SW36	Makowhai Stream just upstream from confluence with the Rangitikei River. To assess the maximum extent of PFAS in the Makowhai Stream.	Every 6 months
SW4	Upstream location to assess whether PFAS is present in the Makowhai Stream before entering the base boundary.	Every 6 months

5.0 Sampling Considerations

Below are some aspects that should be considered prior to sampling:

- ✧ Sampling should follow the methodology described in the document Sampling and Analysis of Per- and Poly-fluorinated Substances (MfE, 2018b).
- ✧ Water level measurements will be taken in all wells where this is possible.
- ✧ Sample locations located within the road reserve may require a traffic management plan and corridor access request issued by Manawatu District Council.
- ✧ Surface water should not be sampled during rain events or up to three days after a rain event.

6.0 Recommended Reporting

Sample results should be compared to the most recent guidelines for the protection of human health and the environment, and to historic sample results.

A summary email will be prepared following receipt of the 6-monthly surface water monitoring and provided to NZDF and HRC. An annual report will be prepared following the receipt of results of the annual groundwater monitoring. The report will cover both the on-base and off-base sampling locations and will include the results from the 6-monthly surface water monitoring. The annual report will be provided to NZDF and HRC.

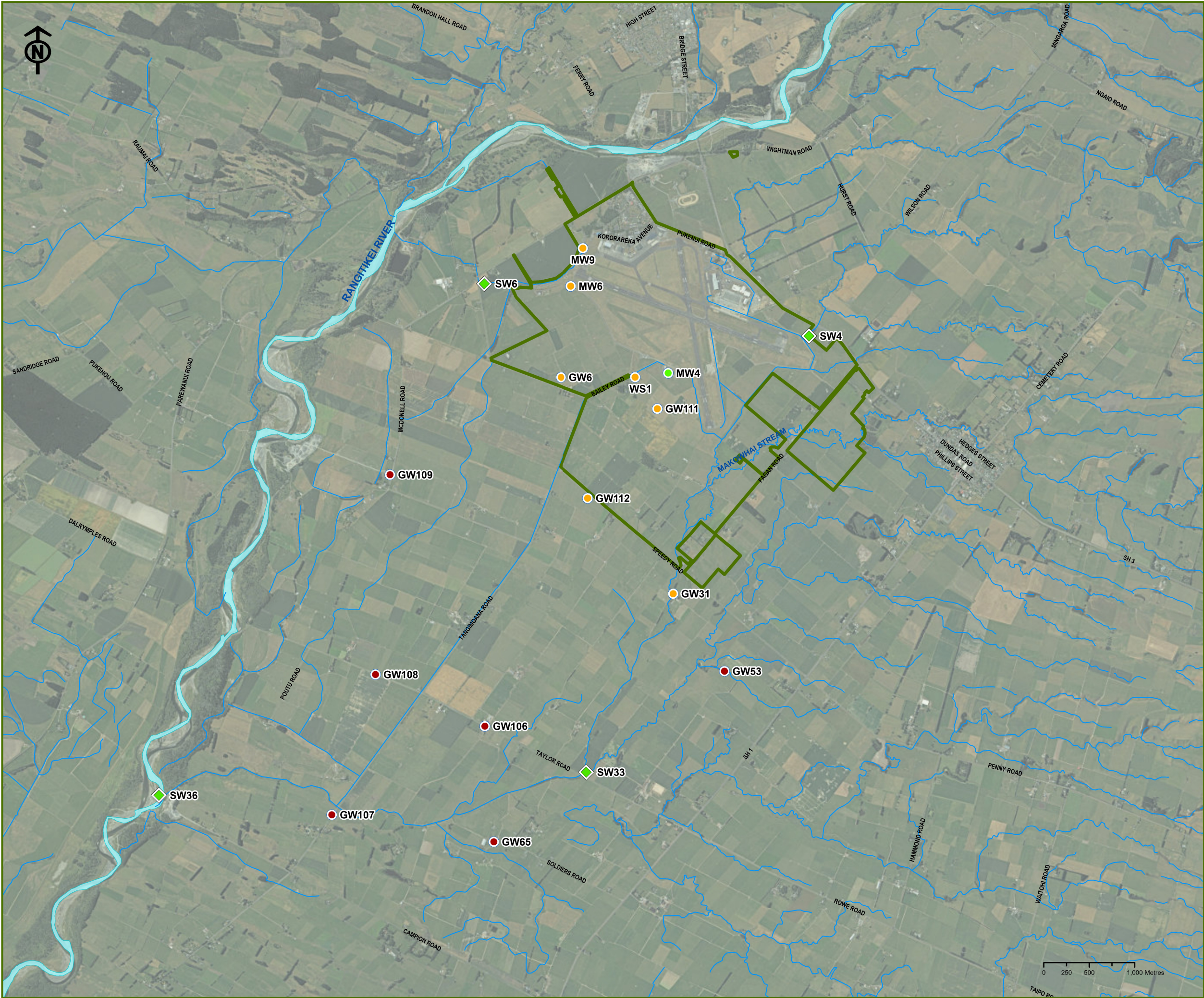
Data will be provided electronically via ESdat (to NZDF) and MS Excel format (to Horizons Regional Council) as well as the original lab data sheets.

7.0 References

- MfE, 2018b. *Sampling Protocols for Monitoring Per and Poly-fluorinated Compounds in Groundwater and Surface Water for New Zealand Defence Force - draft*. Ministry for the Environment, May 2018.
- PDP, 2019a. *RNZAF Base Ohakea PFAS Investigation: Comprehensive Site Investigation Report*. Report prepared for New Zealand Defence Force, May 2019.
- PDP, 2019b. *Ohakea Groundwater Model 2019: Technical Memo*. Report prepared for New Zealand Defence Force, June 2019.
- PDP, 2020. *RNZAF Base Ohakea PFAS Investigation: Long Term Monitoring Plan*. Report prepared for New Zealand Defence Force and Horizons Regional Council, April 2020.

PDP, 2026a. *Ōhakea Long Term Monitoring Plan Review*. Report prepared for New Zealand Defence Force, April 2026.

PDP, 2026b. *Updates to the Ōhakea PFAS Groundwater Model*. Report prepared for New Zealand Defence Force, April 2026.



- KEY:
- Surface Water Monitoring Frequency
-  6-Monthly
- Groundwater Monitoring Frequency
-  6-Monthly
 -  Annual
 -  5-Yearly
-  RNZAF Base Ōhakea Boundary
-  River/Stream/Drain

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RNZAF BASE ŌHAKEA
PFAS INVESTIGATION:
LONG TERM MONITORING PLAN
- VERSION 2

FIGURE TITLE:

MONITORING
LOCATION PLAN

SCALE:	FIGURE NO.:	ISSUE NO.:
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