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PFAS INVESTIGATION AND MANAGEMENT PROGRAM

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RAAF Base Amberley



PFAS MANAGEMENT AREA PLAN REVISION 1

March 2025

ACKNOWLEDGEMENT OF COUNTRY

Defence acknowledges the Traditional Custodians of Country throughout Australia. Defence recognises their continuing connection to traditional lands and waters and would like to pay respect to their Elders both past and present.

Defence would also like to pay respect to the Aboriginal and Torres Strait Islander peoples who have contributed to the defence of Australia in times of peace and war.

ABOUT THIS DOCUMENT

This is the Defence PFAS Management Area Plan (PMAP) Revision 1 for RAAF Base Amberley.

This PMAP Revision replaces the PMAP for RAAF Base Amberley dated September 2020.

The purpose of this PMAP is to document Defence's plan to manage potential risks to human health and the environment from PFAS on and from RAAF Base Amberley. It provides an overview of the actions undertaken to date, ongoing and future actions.

The Department of Environment, Tourism, Science and Innovation (DETSI) has been consulted in the development of this document.

EXECUTIVE SUMMARY

In September 2020 the Department of Defence (Defence) published the RAAF Base Amberley PFAS Management Area Plan (2020 PMAP) for managing risks to human health and the environment from per- and poly-fluoroalkyl substances (PFAS) contamination associated with RAAF Base Amberley (the Base) and surrounding areas.

Since the 2020 PMAP, Defence has conducted ongoing monitoring and technical investigations to inform development of remediation action plans (RAPs). Technical investigations have comprised pre-RAP investigations and a mass flux study. A mass flux study is a technical investigation which identifies how PFAS is migrating across an area and is critical for informing PFAS management approaches.

Risk management actions may include remediation (clean-up) of PFAS, or other management measures that control exposure to PFAS. In managing PFAS contamination to reduce risks to human health and the environment, Defence prioritises:

- minimising exposure to PFAS;
- preventing or minimising migration of PFAS; and
- keeping the community informed.

Minimising PFAS movement from the Base will, in the long term, contribute to the reduction of PFAS concentrations in the surrounding environment. However, the process will take time and therefore other measures will also be implemented to reduce risks to human health and the environment.

A total of 31 PFAS Confirmed Primary Source Areas (CPSAs) have been identified across the PMAP Management Area. A CPSA represents an area where PFAS contamination sources were identified during the Preliminary Site Investigation (PSI) and Detailed Site Investigation (PSI) phase. A mass flux study was completed in 2023 (Senversa, 2023b) to support the PMAP and confirm which CPSAs should be the focus of remediation efforts. For RAAF Base Amberley, the mass flux study identified that:

- 99% of PFAS migrating from the Base is via stormwater, with approximately 1% migrating via groundwater;
- The vast majority of PFAS migrating from the Base via stormwater is related to three main catchment areas, as summarised below:
 - Catchment 3 (nine CPSAs): This is a catchment approximating the southern half of the airside portion of the Base, including of The Former Airside Fire Station;
 - Catchment 7 (three CPSAs): This is a catchment south of the airside portion of the Base, including the sewage treatment plant (STP) and Frogs Hollow Gully; and
 - Catchment 8 (six CPSAs): This is a catchment west of the airside portion of the Base, inclusive of the Former Topside Aviation Fire Training Area, Current Topside Aviation Fire Training Area, Waste Water Holding Tank and Temporary Storage Facility (TSF) associated with initial PFAS remediation works in Catchment 3.

The following presents a summary of risk management actions and remediation completed at RAAF Base Amberley:

- **Catchment 3 and Catchment 9:** Remediation works first commenced in Catchment 3 and Catchment 9 during 2017 and have been ongoing since this time. These remediation works have been completed as part of construction works associated with Battlefield Airlifter (BFA) and Growler related infrastructure project to the Base. Significant quantities of PFAS contaminated soils have been removed as part of these works, with some materials disposed

of offsite to landfill and materials containing relatively higher PFAS levels retained onsite beneath a cap in the TSF within Catchment 8 pending future remediation work. Investigations will be ongoing in relation to Catchment 3 during 2024 and 2025, with a remediation plan to be developed in 2025 and implemented during 2026-2027.

- **Catchment 7:** Defence has commissioned works to replace the existing STP within Catchment 7, with design work completed in 2022 and construction work commencing in 2023. The new STP has been designed to have PFAS treatment capability and is to be commissioned during 2025-2026, following which time the existing STP will be decommissioned, with a remediation plan to be developed in and implemented during 2026-2027.
- **Catchment 8:** Between 2020 and 2025, Defence has been conducting extensive investigations in relation to Catchment 8 in order to allow development of a remediation plan targeting a reduction in migration of PFAS via surface water. A remediation plan is to be prepared and implemented during 2025- 2026. In 2022, Defence designed and constructed a Water Treatment Plant (WTP) within Catchment 8 which captures and treats wastewater generated during fire training activities within the current Topside Fire Training Area, which may contain PFAS.

In addition to the above, Defence commissioned a PFAS treatment plant to treat water generated during fire training activities within the Fire Training School in 2023.

This PMAP revision sets out the updated plan to manage risks to human health and the environment from exposure to PFAS contamination from the Base. Defence will review, and if required revise the PMAP at regular intervals to ensure the PMAP remains current, relevant and prioritises the right actions to protect human health and the environment. Defence will continue to engage with the community, the Council, DETSI and other stakeholders to ensure information is available in an easily accessible form.

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GLOSSARY

AFFF	Aqueous Film Forming Foam
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure, as amended 2013
Base	RAAF Base Amberley
CSM	Conceptual Site Model
Defence	Department of Defence
DETSI	Department of Environment, Tourism, Science and Innovation
DSI	Detailed Site Investigation
ERA	Ecological Risk Assessment
HHERA	Human Health and Ecological Risk Assessment
HHRA	Human Health Risk Assessment
Management Area	The geographical area subject to Defence risk management actions. May include private or Defence owned detached properties beyond the boundaries of the Base
Off-site	Off-base (or other Defence property)
OMP	Ongoing Monitoring Plan
On-site	On-base (or other Defence property)
PFAS	Per- and polyfluoroalkyl Substances
PFAS NEMP	PFAS National Environmental Management Plan
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
RAP	Remediation Action Plan
Risk management actions	Remediation and management actions to address potential risks to receptors from PFAS contamination.
ROA	Remediation Options Assessment
Risk assessment(s)	The HHERA, HHRA and/or ERA
SFARP	So Far as Reasonably Practicable
Source	A source can be primary or secondary. Primary sources are generally areas where AFFF was used or stored. Secondary sources may be an accumulation of contamination in the environment, such as in soil, sediments, or surface water bodies.

Unless otherwise defined in this document, definitions provided in the NEMP or the ASC NEPM apply.

1 INTRODUCTION

1.1 Background and purpose

In September 2020 the Department of Defence (Defence) published the PFAS Management Area Plan ([2020 PMAP](#)) for RAAF Base Amberley (the Base) for managing risks to human health and the environment from per- and poly-fluoroalkyl substances (PFAS) contamination associated with RAAF Base Amberley (the Base) and surrounding areas.

Since the 2020 PMAP, Defence has conducted ongoing monitoring and technical investigations to inform development of remediation action plans (RAPs). Technical investigations have comprised pre-RAP investigations and a mass flux study. A mass flux study is a technical investigation which identifies how PFAS is migrating across an area and is critical for informing PFAS management approaches.

This assessment considered:

- progress made in the implementation of the 2020 PMAP;
- the outcomes of the mass flux study which provided a detailed understanding of the volumes and flow rates of PFAS leaving the Base, and at which locations;
- whether potential risks to human health or the environment from PFAS contamination have changed, based on data collected through the ongoing monitoring program and other studies; and
- a review of factors such as changes to government policy settings, site conditions and scientific methodologies and technology.

This PMAP revision sets out the updated plan to manage risks to human health and the environment from exposure to PFAS contamination from RAAF Base Amberley.

The PMAP revision has been developed in accordance with the PFAS National Environmental Management Plan (NEMP), which provides nationally consistent environmental guidance and standards for managing PFAS contamination. It is also consistent with Defence estate, environmental, and PFAS-specific strategies and guidance.

PMAPs are reviewed and if required, updated periodically to account for changes in circumstances, such as progress in management and remediation, new data, changes in legislation, guidelines and policy, and advances in scientific information.

1.2 Management priorities

In managing PFAS contamination to reduce risks to human health and the environment, Defence prioritises:

- minimising exposure to PFAS;
- preventing or minimising migration of PFAS; and
- keeping the community informed.

1.3 Supporting information

The PMAP revision is based on information from a range of different investigations, human health and ecological risk assessments, remediation activities and relevant guidance. Details of these reports are provided in Appendix A, including web links where available.

The reports identified a range of elevated risks to receptors from exposure to PFAS, which are the focus of the risk management actions outlined in this document.

1.4 Limitations and assumptions

This document has been developed based on the information available at the time of preparation, and the following limitations and assumptions:

- Remediation technologies that are not considered viable or feasible for use at the Base or Management Area have been excluded (as recommended in PFAS NEMP). However, Defence will regularly review and assess remediation technologies and their applicability to the management of PFAS at the Base; and
- The application of Base infrastructure development and access constraints at the time of this report.

The PMAP will be revised if new information (such as revised guidelines, regulatory requirements, site data or remedial techniques) becomes available and the characterisation of risk changes, requiring a revised management or remediation approach.

2 MANAGEMENT AREA

The PFAS Management Area comprises RAAF Base Amberley and surrounding area, as shown on Figure 1 in Appendix C. The area is the primary area throughout which risk management actions and ongoing monitoring has been completed to date.

The PFAS Management Area encompasses:

- **The Base:** The Base is divided into 11 surface water catchment areas. The Base is currently an operating RAAF Base and is utilised for flying operations, bulk fuel storage, chemical and armaments storage, firefighting training, short-term accommodation, and support and maintenance activities. Some land is also used for residential and recreational / open space uses;
- **Land adjacent to the Base and Bremer River:** This area comprises the Bremer River adjacent to the western, northern and eastern boundaries of the Base and extends as far downstream as Cribb Park¹. This area includes private properties adjacent to the stretch of river adjacent to the Base as far downstream as Woodend Road Reserve. Private properties within this area are used for agriculture and rural residential purposes. Bremer River is also used for recreational purposes including swimming and fishing;
- **Land adjacent to the Base and Warrill Creek:** This area comprises land adjacent to the southern boundary of the Base and Warrill Creek downstream to the confluence with the Bremer River. This area includes private properties adjacent to the Base along this stretch of the creek. Private properties that lie within this area are used for agriculture and rural residential purposes.

Information about the management area environmental setting, such as climate, topography, geology, hydrology and various other aspects is provided in the Detailed Site Investigation (DSI) (CH2M Hill, 2018).

¹ Approximately 9.25km downstream of the Bremer River and Warrill Creek confluence.

3 EXTENT OF PFAS CONTAMINATION

This section provides an outline of the PFAS sources, transport pathways for migration of PFAS from a source area, and potential receptors such as humans and ecosystems that may be exposed to PFAS from the Base.

This information is described as a Conceptual Site Model (CSM), which is provided in Appendix B. As part of this PMAP revision, the CSM for RAAF Base Amberley and surrounding areas was reviewed for currency and updated. For more detailed information informing the CSM, refer to the reports listed in Appendix A.

This PMAP is based on the CSM, as it identifies:

- ongoing sources of PFAS and outlines the measures to control these sources;
- PFAS migration pathways and outlines the measures to minimise PFAS leaving the Base; and
- receptors (human or environmental) that might be exposed to PFAS, and what measures are in place to manage exposures.

3.1 Source areas

Source areas can be primary or secondary. Primary sources are generally areas of PFAS contamination where aqueous film forming foam (AFFF) was used or stored, for example, a fire training area. Secondary source areas contain an accumulation of PFAS contamination in the environment, such as in soil, sediment, groundwater or surface water, which has migrated from a primary source area.

The PFAS source areas, also known as confirmed primary source areas (CPSAs), which have been identified through previous investigations (Appendix A) is provided in Table 1. A map showing these source areas is provided as Figure 2 in Appendix C.

Table 1. Confirmed Primary Source Areas (CPSA)

Source Areas	CPSA	Description
Primary Source Areas	CPSA A	Former Topside Aviation Fire Training Area (FTA) and current FTA Pad
	CPSA B	Hangar 410 (Building 410) and Former Landfill
	CPSA C	Frogs Hollow Former Fire Training School Location
	CPSA D	Sewage Treatment Plant (STP)
	CPSA E	Historic Containment Pond
	CPSA F	Potential former FTA and Landfill
	CPSA G	Former FTA and Operations Testing Area
	CPSA H	Potential Former FTA and Landfill
	CPSA I	Potential Former FTA and Landfill
	CPSA J	Former FTA and Operations Testing Area
	CPSA L	Potential Former Fire Training and Operations Testing Area

Source Areas	CPSA	Description
	CPSA M	Former Fuel Farm 1 and Triple Interceptor Pit
	CPSA N	Fire Station, FTA training
	CPSA O	Potential location of F1-11 2006 incident
	CPSA P	Potential location of 1978 Skyhawk incident
	CPSA Q	1 Squadron Hangar and 6 Squadron Hangar
	CPSA R	K Store- potential AFFF storage
	CPSA S	AFFF Store / Truck Washdown at Fuel Farm 2/2A
	CPSA T	Potential Location of Aircraft F-4E Incident
	CPSA U	38 Squadron Hangar
	CPSA V	AFFF Wastewater Holding Tank1
	CPSA W	Fire Fighting Training School
	CPSA X	Former Structural and Open Pit FTA
	CPSA Y	Former Secondary FTA
	CPSA Z	Fuel UST with AFFF listing
	CPSA CC	Former Landfill
	CPSA BB	Areas used for irrigation – former grassed runways
	CPSA DD	HS748 Former FTA on Disused Runway
	CPSA FF	Buried PFAS impacted stockpile from CPSA A
Secondary Source Areas	CPSA AA	Triple interceptor pits at engine test cell facilities 1 and 2, which receive wastewaters from a variety of on-Base facilities.
	CPSA EE	Former sports ovals – potentially irrigated with PFAS contaminated wastewater.

The 2020 PMAP summarised PFAS investigation findings in terms of CPSAs and Risk Groups. Risks with the potential to become elevated identified within the Human Health Risk Assessment (HHRA) (EnRiskS, 2019) and Ecological Risk Assessment (ERA) (EnRiskS, 2020) were grouped into six separate risk groups based on potential management options:

- Risk Group 1 – CPSA A and N, located within the RAAF Base Amberley Management Area;
- Risk Group 2 – CPSA A, C, G, W, X, CC located within the RAAF Base Amberley Management Area;
- Risk Group 3 – Risks relevant to Warrill Creek;
- Risk Group 4 – Risks relevant to properties adjacent Warrill Creek;
- Risk Group 5 – Risks relevant to Bremer River; and
- Risk Group 6 – Risks relevant to properties adjacent Bremer River.

The human health and ecological risks associated with each risk group have been summarised in more detail in **Table 3**.

The 2023 mass flux study (Senversa, 2023) has allowed for prioritisation of future investigation and remediation to focus upon three catchment areas (Catchment 3, Catchment 7 and Catchment 8)

which include a number of CPSAs referred to in Risk Group 1 and Risk Group 2. These catchment areas represent approximately 87% of the PFAS which is migrating from the Base into Bremer River and Warrill Creek. Management of contamination from these catchment areas will reduce risks to Risk Groups, 3, 4, 5 and 6.

Table 2. Summary of Mass Flux Assessment

Media	Catchment / Transect	CPSA	Area (m2)	Annual Discharge (kg/year)	Annual Discharge (% of Media Type)	Annual Discharge (% of Total)
Surface Water	Catchment 1	W	4,950,000	0.012	<1%	<1%
	Catchment 2	F, DD	250,000	0.094	<1%	<1%
	Catchment 3	F,J, L, M, N,O, P, Z, BB	2,200,000	12	57%	56%
	Catchment 4	N/A	180,000	0.36	1.8%	1.7%
	Catchment 5	B	180,000	0.004	<1%	<1%
	Catchment 6	B	190,000	0.17	<1%	<1%
	Catchment 7	C, D, EE	2,500,000	1.4	6.7%	6.6%
	Catchment 8	A, R, S, V, X, Y	4,750,000	5.1	25%	24%
	Catchment 9	P, Q, T, U, AA	2,630,000	0.94	4.6%	4.5%
	Catchment 10	G, H, AA, CC, FF	490,000	0.74	3.6%	3.5%
	Catchment 11	N/A	410,000	0.052	<1%	<1%
Groundwater	Total			0.26	100%	1.2%
Total (Annual Average Estimation)				21	NA	100%

3.2 Transport pathways

PFAS can travel from a source to human or environmental receptors via transport pathways, such as surface water, groundwater and stormwater. The transport pathways identified at and surrounding RAAF Base Amberley were summarised in the DSI (CH2M Hill, 2018), and are briefly described below.

Leachate analysis conducted on sediment and soil samples recovered throughout the DSI (CH2M Hill, 2018) and during subsequent investigations (Senversa, 2023b) has demonstrated that the key analytes of interest, namely PFOS and PFHxS, were readily leached from the samples. The results confirm that, without management, impacted soil and sediment at the Base will present an ongoing source of contamination to on-Base stormwater drainage system, groundwater beneath the Base and off-Base surface water of the Bremer River and Warrill Creek.

Stormwater/surface collected from across the Base is discharged off-Base through the stormwater drainage network. The Base drainage network is comprised of a mixture of unlined drains, lined open drains, and underground pipes, within eleven main surface water catchments. A total of approximately 24 discharge points are located west, north and east of the Base along the Bremer River and south along Warrill Creek. As noted previously, the 2023 mass flux study (Senversa, 2023b) identified that off-Base migration of PFAS has been confirmed for all surface water catchments, with catchments 3, 7 and 8 noted to discharge the majority (87%) of PFAS mass from the Base.

PFAS in soil, sediment and stormwater has the potential to migrate vertically into underlying groundwater. PFAS is present in groundwater throughout the Base, with the highest concentrations in groundwater correlating with CPSAs and unlined stormwater drainage lines. Discharge from groundwater to surface water is dependent on gaining or losing stream conditions, with previous studies indicating the Bremer River and Warrill Creek are both gaining and losing streams under different rainfall conditions.

The DSI (CH2M Hill, 2018) has confirmed that PFAS derived from the Base are migrating downstream of the Base in the surface waters of Warrill Creek and the Bremer River to the extent of the PFAS Management Area. On the basis of the 2023 mass flux assessment (Senversa, 2023b), surface water migration is considered to be the most important transport pathway for the movement of PFAS downstream of the Base.

3.3 Receptors, risk and exposure management

A total of 10 elevated or unacceptable risk scenarios were identified based on the DSI, HHRA and ERA process. Table 3 below details each risk scenario and provides a current summary of the status of each risk, noting no change to the risk profile has occurred between 2020 and 2024. Figures showing the spatial distribution of PFAS in groundwater, surface water and sediment are provided in Appendix C.

To address the identified risks, Defence is continuing to implement risk management actions to reduce PFAS migrating from base, as described in Section 4.

Table 3: Risk Listing and Consequence

ID	Risk	Description	Nature of Risk	Relevant Risk Group	Risk Timescale
1	Incidental direct contact with PFAS in soil and sediment	Soils within CPSA A and N contain elevated concentrations of PFAS which presents a risk to Base personnel and contractors who are involved in regular soil disturbance activities Direct contact with soil and sediment on base is mitigated by implementation of safe work practices and the Defence PFAS Construction and Maintenance Framework.	Human health	Risk Group 1 – CPSA A and N, located within the RAAF Base Amberley Management Area	Current
2	Human consumption of fish caught from local waterways	PFAS has been detected in fish and crustaceans collected from Warrill Creek and Bremer River. Current Queensland Health advice is not to consume fish caught in the Management Area due to presence of PFAS. Additional signage providing precautionary health advice for fishing was installed along Bremer River in July 2024.	Human health	Risk Group 3 – Warrill Creek Risk Group 5 – Bremer River	Current (although precautionary advice in place)
3	Consumption of eggs by children	PFAS has been detected in soils on private properties and in water that has historically been used for irrigation. This exposure risk applies to properties where chickens have regular access to PFAS in soil or where water containing PFAS is used for irrigation	Human health	Risk Group 4 – Properties adjacent to Warrill Creek	Current
4	Consumption of home- slaughtered beef meat	PFAS has been detected in soils on private properties and in water that has historically been used for irrigation. This exposure risk applies to properties where cattle have regular access to PFAS in soil / sediment / pasture, or where water containing PFAS is used for irrigation	Human health	Risk Group 4 – Properties adjacent to Warrill Creek	Current
5	Consumption of home- slaughtered	PFAS has been detected in soils on private properties and in water that has historically been used for	Human health	Risk Group 4 – Properties adjacent to Warrill Creek	Current

ID	Risk	Description	Nature of Risk	Relevant Risk Group	Risk Timescale
	beef offal (liver and / or kidney)	irrigation. This exposure risk applies to properties where cattle have regular access to PFAS in soil / sediment / pasture, or where water containing PFAS is used for irrigation			
6	Multiple exposure pathways	Multiple exposure pathways that relate to the cumulative risks associated with the consumption of fish, eggs and beef products as identified in Risk ID 3 - 6 above and the incidental direct contact with water and swimming in the Bremer River and Warrill Creek.	Human health	Risk Group 3 – Warrill Creek Risk Group 4 – Properties adjacent to Warrill Creek Risk Group 5 – Bremer River Risk Group 6 – Properties adjacent to Bremer River	Current
7	Direct toxicity to terrestrial ecosystems	Concentrations of PFOS in soils, sediments and some grass samples on-Base exceeded investigation criteria for ecological direct exposure (HEPA, 2020). As such, adverse effects on ecological receptors cannot be excluded.	Ecological risk	Risk Group 2 – CPSA A, C, G, W, X, DD, located within RAAF Base Amberley Management Area	Current
8	Bioaccumulation and effects on higher order consumers within terrestrial ecosystems	Concentrations of PFOS in soils, sediments and some grass samples on- and off-Base exceeded investigation criteria for ecological direct exposure (95% species protection) (HEPA, 2020). As such, adverse effects on ecological receptors cannot be excluded.	Ecological risk	Risk Group 2 – CPSA A, C, G, W, X, DD, located within RAAF Base Amberley Management Area	Current
9	Direct toxicity to aquatic ecosystems	Concentrations of PFOS in surface water exceeded investigation criteria for ecological direct exposure (HEPA, 2020). As such, adverse effects on ecological receptors cannot be excluded.	Ecological risk	Risk Group 3 – Warrill Creek Risk Group 5 – Bremer River	Current
10	Bioaccumulation and effects on higher order consumers within aquatic ecosystems	Concentrations of PFOS in surface water exceeded investigation criteria for ecological direct exposure (HEPA, 2020). As such, adverse effects on ecological receptors cannot be excluded.	Ecological risk	Risk Group 3 – Warrill Creek Risk Group 5 – Bremer River	Current

4 RISK MANAGEMENT ACTIONS

This section outlines the actions that Defence will take to manage the risks associated with PFAS that are described in Section 3.

4.1 Background

In developing actions to address potential risks to receptors from PFAS contamination, Defence considers:

- whether an action is proportional to risks
- the sustainability and longevity of an action (environmental, economic and social) in achieving an appropriate balance between benefits and effects
- views of the jurisdictional regulator and other stakeholders
- availability of best-practice management systems, treatments and technologies
- site specific issues (including transformation, cross-contamination, and remobilisation)
- logistical and operational constraints
- effectiveness and validation status of technology
- success measures for the treatment or remediation outcomes
- the need for ongoing operations, management, maintenance or monitoring
- the net environmental benefit.

Defence prioritises source management and pathway management as preferable to receptor management, but these components may also be progressed concurrently.

4.2 Implementation

Defence takes a risk-based approach to implementing actions under this PMAP and considers value for money in the use of public resources. Defence engages consultants to implement the PMAP.

A summary of key factors for progressing and prioritising PMAP actions have been presented in Table 4.

Table 4: Key Factors for Progressing and Prioritizing PMAP Action

Factor	Detail
Mitigating PFAS migration and protecting human health	Implementation of practicable solutions to prevent or minimise the migration of PFAS beyond the Defence property boundary, and measures to protect the community from exposure to PFAS.
Higher risks	The relative level of risk being addressed, including changes in land use.
Outcomes of completed works	Outcomes from further studies, technology trials or validated remedial works may change the profile or priority of source areas or works.
Linked actions	Whether the implementation of one response action is dependent on the implementation of another response action.
Use of public resources	Application of the Commonwealth Procurement Rules (issued under the <i>Public Governance, Performance and Accountability Act 2013</i>)

Factor	Detail
	<p>including the Defence Infrastructure Panel – Environment, Heritage and Estate Engineering Services 2020-2025, to achieve value for money in procurement; and to use public money in an efficient, effective, economical and ethical manner. Cost-effectiveness may be facilitated through:</p> <ul style="list-style-type: none"> • grouping the implementation of similar risk management actions within one or more Management Areas • aligning Defence infrastructure and maintenance plans with a PFAS response action.
Mandatory approvals	Timeframes for mandatory approvals and notification processes.
New legislation or policy	Development of relevant legislation, policy, guidelines and whole-of-government positioning.
Science and technology	The availability of new relevant science and technology.
Stakeholder input	Information from stakeholders that may impact a risk profile.

4.3 Completed and ongoing risk management actions

A screening assessment of options to manage the risks presented in Section 3 was undertaken as part of the 2020 PMAP. Based on this assessment, the strategy adopted was to focus upon additional investigations, development of remediation plans and remediation works for a number of CPSAs. The status of the 2020 PMAP risk management actions have been presented in Table 5 below, with re-defined actions presented in Table 6.

Table 5: Status of 2020 PMAP Actions

Action	Description	Status	Reason / timeframe
Action 1	Restrict surface runoff and infiltration of PFAS to the stormwater networks on-Base and limit direct discharge to the Bremer River and / or Warrill Creek.		
Action 1a	Completion of additional investigation to better understand the extent of the stormwater networks at the Base. This should include a survey of the condition of stormwater pipes and pits in the vicinity of source areas CPSA A, CPSA B, CPSA C, CPSA D, CPSA N, CPSA U, CPSA W and CPSA DD in order to identify potential PFAS infiltration points.	Complete	A mass flux study was conducted to confirm which areas of the Base should be focused upon for remediation. The mass flux study was completed in 2023 and identified that the 2020 PMAP actions correlated with the surface water catchments representing the majority of PFAS migration from the Base.
Action 1b	Completion of an assessment of stormwater drainage points that discharge to the Warrill Creek and Bremer River. The purpose of this assessment should be to determine PFAS mass discharge (flux) from the different stormwater drainage points into the Bremer River or Warrill Creek. The mass of PFAS being discharged from each drainage point under different flow conditions can be calculated and will provide a means by which drainage improvement works at the Base can be prioritised. This assessment should also include consideration of PFAS concentrations in sediments within the drainage channels in order to inform specific management options / requirements.	Complete	As above.
Action 1c	Development of a RAP that identifies options for drainage improvement works	Redefined	See Table 6 (stormwater remediation to be addressed as part of Catchment 3, 7 and 8 RAPs).
Action 2	Restriction of infiltration of PFAS to the sewer network on-Base as well as further assessment of the vertical and lateral extent of PFAS at CPSA D (the STP) and the adjacent Frogs Hollow Gully.		
Action 2a	Completion of additional investigation to better understand the extent and integrity of the sewer network at the Base, particularly in the immediate vicinity of identified source areas. This should include a survey of the condition of sewer pipes, pits and other related	Redefined	See Table 6 (PFAS treatment capability added to new STP).

Action	Description	Status	Reason / timeframe
	infrastructure in the vicinity of CPSA B, CPSA N, CPSA U, and CPSA W in order to identify potential PFAS infiltration points.		
Action 2b	The completion of item (a) above should aim to identify which sections of the sewer system that interface with the identified source areas are impacted by PFAS and to what extent. This information should guide the prioritisation of subsequent management actions specific to the sewerage system and inform the design of a PFAS mass flux assessment. PFAS impact should be assessed in the context of a Base-wide sewer network PFAS mass flux.	Redefined	See Table 6 (PFAS treatment capability added to new STP).
Action 2c	Additional review of the preliminary STP factual soil investigation report (CH2M, 2020). Based on data gaps identified, completion of additional soil investigations at the STP compound and Frogs Hollow Gully in order to determine the vertical and lateral extent of PFAS impact in soils. / sediments as well as leachability potential.	Redefined	See Table 6 (additional investigations to be completed to inform development of Catchment 7 RAP).
Action 2d	Development of a RAP (or multiple RAPs) that can be implemented in order to reduce PFAS discharges from the Base through the sewerage system, including the STP. The development of the RAP(s) should be undertaken in consideration of information relating to the replacement of the STP. Factors that may influence management requirements may include timelines for construction and details regarding any associated sewer upgrade works and network analyses that may be planned.	Redefined	See Table 6 (PFAS treatment capability added to new STP, RAPs to be developed for catchments 3, 7 and 8).
Action 3	Reduction of PFAS mass flux through vertical / lateral migration from CPSA A (Former Topside Aviation Fire Training Area and current Fire Training Area Pad)		
Action 3a	Completion of additional investigations to better understand the vertical and lateral distribution of PFAS across this source area. This should include a detailed survey of infrastructure, including a review of infrastructure associated with the existing temporary stockpiling facility completed as part of the BFA.	In progress / redefined	Initial phase of targeted investigation complete. Final pre-RAP investigations to be completed (see Table 6, Catchment 8).
Action 3b	Development of a RAP for the implementation of source management actions. This RAP should include remediation design components. At this stage a capping solution is proposed, therefore the remediation design should include the selection of capping materials and specification.	Redefined	See Table 6 (a RAP is to be prepared for Catchment 8, inclusive of CPSA A).

Action	Description	Status	Reason / timeframe
Action 4	Further assessment of the infrastructure associated with CPSA V (AFFF Wastewater Holding Tank).		
Action 4a	Additional investigation of CPSA V (the AFFF Wastewater Holding Tank) in order to better understand how this infrastructure operates and assess the extent to which this feature may be contributing towards PFAS concentrations observed in groundwater at the Base	Redefined	See Table 6 (a RAP is to be prepared for Catchment 8, inclusive of CPSA V).
Action 5	Reduction of PFAS mass flux through vertical / lateral migration from CPSA N (Former Fire Station).		
Action 5a	Review of documentation relating to the recently completed upgrade works in order to establish the extent of source area removal already completed, noting that such information is not currently available.	Redefined	See Table 6 (investigation to be completed across catchment 3 inclusive of CPSA N).
Action 5b	Completion of additional investigations to better understand the vertical and lateral distribution of PFAS across this source area. This should include a detailed survey of infrastructure.	Redefined	See Table 6 (investigation to be completed across catchment 3 inclusive of CPSA N).
Action 5c	Development of a RAP for the implementation of source management actions. This RAP should include remediation design components. At this stage a capping solution is proposed, therefore the remediation design should include the selection of capping materials and specification.	Redefined	See Table 6 (a RAP is to be prepared for Catchment 3, inclusive of CPSA V).

Table 6. Re-defined PMAP actions

Action	Description	Status	Reason / timeframe
1. Catchment 7 (including CPSA D and Frogs Hollow Gully)	Additional investigations	In progress	Targeted investigations to be conducted during 2025 to prepare a remediation plan.
	Remediation plan	Planned works	A remediation plan is to be prepared following final pre remediation investigations aimed to refine the conceptual site model for the purpose of assessing remedial options. The remediation plan will be finalised early 2026.
	Remediation work	In progress	Defence has commissioned works to replace the existing STP within Catchment 7, with design work completed in

Action	Description	Status	Reason / timeframe
			2022 and construction work commencing in 2023. The new STP has been designed to have PFAS treatment capability and is to be commissioned during 2025-2026, following which time the existing STP will be decommissioned. Additional remediation work outlined within the remediation plan will be completed in 2026-2027.
2. Catchment 8 (including CPSA A, CPSA V)	Additional investigations	Complete	Targeted investigations completed during early 2025 to facilitate preparation of remediation plan.
	Remediation plan	Planned works	A remediation plan is to be prepared following final pre remediation investigations aimed to refine the conceptual site model for the purpose of assessing remedial options. The remediation plan will be finalised early 2025.
	Remediation work	In progress	Defence has commissioned works to replace the STP within Catchment 7, which is planned to receive wastewater from Catchment 8. Additionally, PFAS treatment plants were designed and commissioned in 2022 (Current Fire Training Area) and 2023 (Fire Training School). The purpose of the plants is to treat PFAS contaminated wastewater generated from fire training activities as a result of low level PFAS impacts in the hardstand across the fire training area. Additional remediation work outlined within the remediation plan will be completed in 2025-2026.
3. Catchment 3 (including CPSA N)	Additional investigations	In progress	Mass flux study complete, with targeted investigations to be conducted during 2025 to prepare remediation plan.
	Remediation plan	Planned works	A remediation plan is to be prepared following final pre remediation investigations aimed to refine the conceptual site model for the purpose of assessing remedial options. The remediation plan will be finalised late 2025.
	Remediation work	In progress	Remediation works first commenced in Catchment 3 and Catchment 9 during 2017 and have been ongoing since this

Action	Description	Status	Reason / timeframe
			time. These remediation works have been completed as part of construction works associated with Battlefield Airlifter (BFA) and Growler related infrastructure project to the Base. Significant quantities of PFAS contaminated soils have been removed as part of these works, with some materials disposed of offsite to landfill and materials containing relatively higher PFAS levels retained onsite beneath a cap in the TSF within Catchment 8 pending future remediation work. Additional remediation work outlined within the remediation plan will be completed in 2026-2027.
4. Catchment 3, 7 and 8.	Post remediation mass flux assessment	Planned works	A post remediation mass flux assessment is to be completed to assess the effectiveness of the remediation works.

4.4 Additional risk management actions

Additional management actions have been identified and implemented since publication of the 2020 PMAP. A description and the status of these actions are set out in **Table 7** below.

Table 7. Status of additional risk management actions

Action	Description	Status	Reason / timeframe
Groundwater well installation and maintenance program	Decommissioning of five destroyed wells and installation of replacement monitoring wells. Repair of wells casing, standpipes and well covers. Survey of 15 wells where standpipes have changed.	Completed	Groundwater well installation and maintenance program carried out to ensure an adequate and fit-for-purpose monitoring well network is maintained for the purpose of assessing potential PFAS risks.
Installation of signage	Installation of additional signage providing precautionary health advice along Bremer River.	Completed	Additional signage was installed along the Bremer River to communicate precaution health advice in relation to fishing along the Bremer River. The signage was installed in July 2024.
Spoil Management Plan	Base-specific spoil management plan	In progress	To provide a framework for management of excavated soils generated from construction activities across RAAF Base Amberley (to be finalised in 2025).

4.5 Completed remediation

At the time of this PMAP Revision, no remediation works are considered to be complete with respect to closing out 2020 PMAP risk management actions. However, it is important that significant earthworks and construction have been completed across the Base since 2016. The most significant works with respect to the PMAP can be summarised as follows:

- Catchment 3 (CPSAs F, J, L, M, N, O, P, Z, BB) and Catchment 9 (CPSAs P, Q, T, U, AA): Significant quantities of PFAS contaminated soil have been excavated during the Battlefield Airlifter and Growler projects, with the excavated areas subsequently covered with 1m of concrete (approximately 12ha in area). Category 1 and 2 material from Catchment 3 was transferred to Catchment 8 (see below). Soil was categorised in accordance with the Defence PFAS Construction and Maintenance Framework (Defence, 2021). The Framework support decision-makers in managing risks from PFAS contaminated soil, water and demolition waste in the context of construction and maintenance works on the Defence estate;
- Catchment 8 (CPSAs A, R, S, V, X, Y):
 - Significant quantities of PFAS contaminated soil have been excavated during the 17th Construction Squadron project (located across and surrounding CPSA X and CPSA Y), with the excavated areas subsequently covered with 1m of concrete (approximately 7.5ha area);

- Approximately 38,000m³ of Category 1 and 2 soil has been transferred from Catchment 3 to a Temporary Stockpile Facility within CPSA A and then covered with a temporary capping layer.

4.6 Ongoing monitoring and trigger levels

Defence continues to monitor PFAS concentrations in the environment at the base through an ongoing monitoring program. This allows for the timely identification and management of emerging risks and informs Defence's approach to the management of PFAS. Monitoring requirements are outlined in an Ongoing Monitoring Plan (OMP). The OMP is reviewed annually and, if required, amended to ensure it continues to provide the data needed to monitor important changes in PFAS concentrations and distribution.

The results from the ongoing monitoring program are shared with DETSI and are provided in an Ongoing Monitoring Interpretive Report, available on the Defence website. The Ongoing Monitoring Interpretive Report provides the PFAS data, and an analysis of what important changes in concentrations may mean to the profile of PFAS contamination set out in the CSM, or potential changes to risks to humans or the environment.

Based on the data collected to date, and 2021-2023 Ongoing Monitoring Interpretive Report, changes to the CSM for RAAF Base Amberley were identified, as outlined in Section 3.

The OMP outlines triggers and actions that Defence will undertake if certain results or trends are reported from the ongoing monitoring program sampling. This includes actions to confirm the accuracy of results, notification to DETSI and other agencies upon new PFAS detections or increasing trends, and implementing additional investigations and risk management actions if the monitoring data indicates changes to the current risk profile.

5 NEXT STEPS

Defence will carry out the risk management actions set out in this PMAP and continue to reassess its actions based on a range of factors, such as the outcomes of remediation, monitoring results, changes to government policy settings, site conditions and scientific methodologies and technologies.

Defence will review, and if required revise the PMAP at regular intervals to ensure the PMAP remains current, relevant and prioritises actions to protect human health and the environment. Defence will continue to engage with the community, the Council, DETSI and other stakeholders to ensure information is available in an easily accessible form.

It is not possible to remove all PFAS from the environment. Remediation at RAAF Base Amberley will be undertaken so far as reasonably practicable, and unacceptable risks that may remain will be identified through monitoring, and appropriately managed.

In determining what is reasonably practicable, a range of aspects will be considered, including the:

- level of risk from PFAS to human and ecological receptors
- environmental site setting
- nature and extent of PFAS contamination
- availability of proven technologies suitable for the characteristics of the site
- logistical and operational constraints of the site, and
- financial and sustainability aspects of each technology.

At completion of remediation, an independent professional, accredited as a site auditor in Queensland and engaged by Defence will assess whether remediation has been conducted so far as reasonably practicable. The PMAP will then be updated to reflect a transition to ongoing monitoring, and long-term management of remaining risks.

APPENDIX A REFERENCES

Key documents

- Aurecon. (2013). *Amberley Base Engineering Assessment Program Stage 2 Final Report, Rev2*.
- CH2M Hill. (2018). *RAAF Base Amberley PFAS Investigation—Detailed Site Investigation (No. 2)*. CH2M Australia Pty Ltd.
- CH2M Hill. (2019). *RAAF Base Amberley PFAS Investigation – Terrestrial Ecology Technical Report, Revision 2*.
- CH2M Hill. (2020a). *RAAF Base Amberley PFAS Investigation—Factual Report for Additional Sewage Treatment Plant (STP) Investigation, Revision 2*.
- CH2M Hill. (2020b). *RAAF Base Amberley, Human Health Risk Assessment for Leichhardt Residential Area, Revision 3*.
- CH2M Hill. (2020c). *RAAF Base Amberley Seasonal Monitoring Event, Post Dry Season 2019—Addendum Report, Revision 2*.
- CH2M Hill. (2020d). *RAAF Base Amberley Seasonal Monitoring Event Report, Revision 4*.
- EnRiskS. (2019). *Human Health Risk Assessment for the RAAF Base Amberley PFAS Investigation. Prepared for: CH2M Hill Australia Pty Ltd and the Australian Government Department of Defence. Environmental Risk Sciences Pty Ltd*.
- EnRiskS. (2020). *Screening Level Ecological Risk Assessment for the RAAF Base Amberley Investigation, Revision F (CH2M/18/AMBR002)*.
- AECOM. (2020). *Annual Interpretive Report, 2020, PFAS OMP – RAAF Base Amberley*.
- AECOM. (2021). *Annual Interpretive Report, 2021, PFAS OMP – RAAF Base Amberley*.
- Senversa. (2022a). *SP2 – Temporary Stockpile Storage Facility Investigation Factual Report, RAAF Base Amberley, August 2022, Revision C*.
- Senversa. (2022b). *SP2 – Topography, Sewer, Surface Water and Sediment Investigation Factual Report, Revision B*.
- Senversa. (2023a). *SP2 – Washdown and Lysimetry Investigation Factual Report, Revision D*.
- Senversa. (2023b). *SP3 – PFAS Mass Flux Interpretive Report, RAAF Base Amberley, Revision D*.
- Aurecon. (2023). *Regional Contamination Investigation Program, Phase 2 North Region 2021-2024, RAAF Base Amberley (0861) Stage 2 Detailed Site Investigation: Report, Revision 0*.
- AECOM. (2024). *Ongoing Monitoring Report (March 2021 to May 2023), PFAS OMP – RAAF Base Amberley, Revision 7*.

Other References

- Australian and New Zealand Guidelines*. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*

Defence. (2021). Defence PFAS Construction and Maintenance Framework - Guidance for managing the risks of PFAS contamination for works on the Defence Estate. Department of Defence. Version 3.0, August 2021

Heads of EPAs Australia and New Zealand (HEPA). (2020). PFAS National Environmental Management Plan. Version 2.0, January 2020.

National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended in 2013. (ASC NEPM)

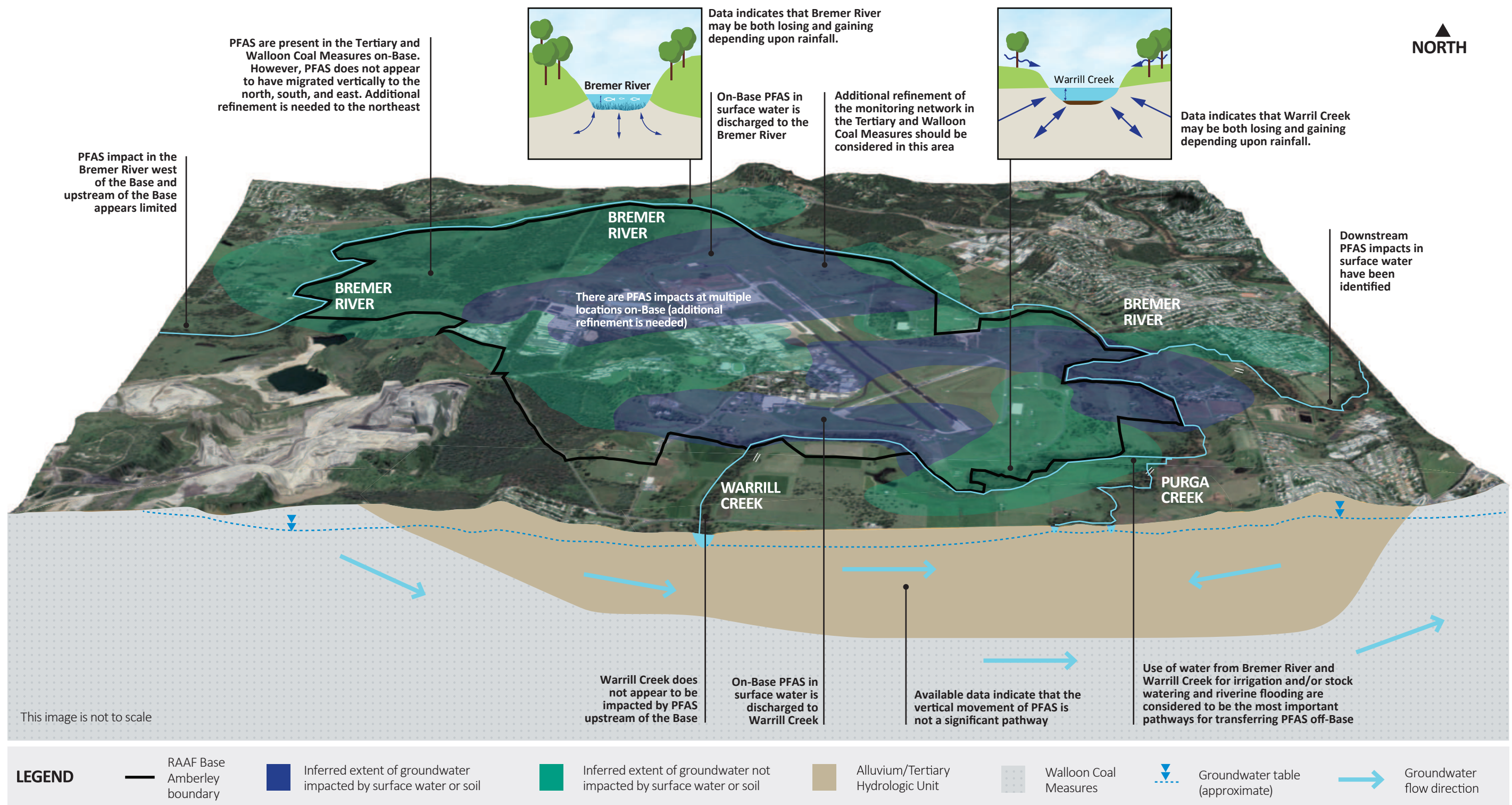
APPENDIX B CONCEPTUAL SITE MODEL

This Appendix provides visualisations of the source – pathway – receptor relationships in the form of a Conceptual Site Model.



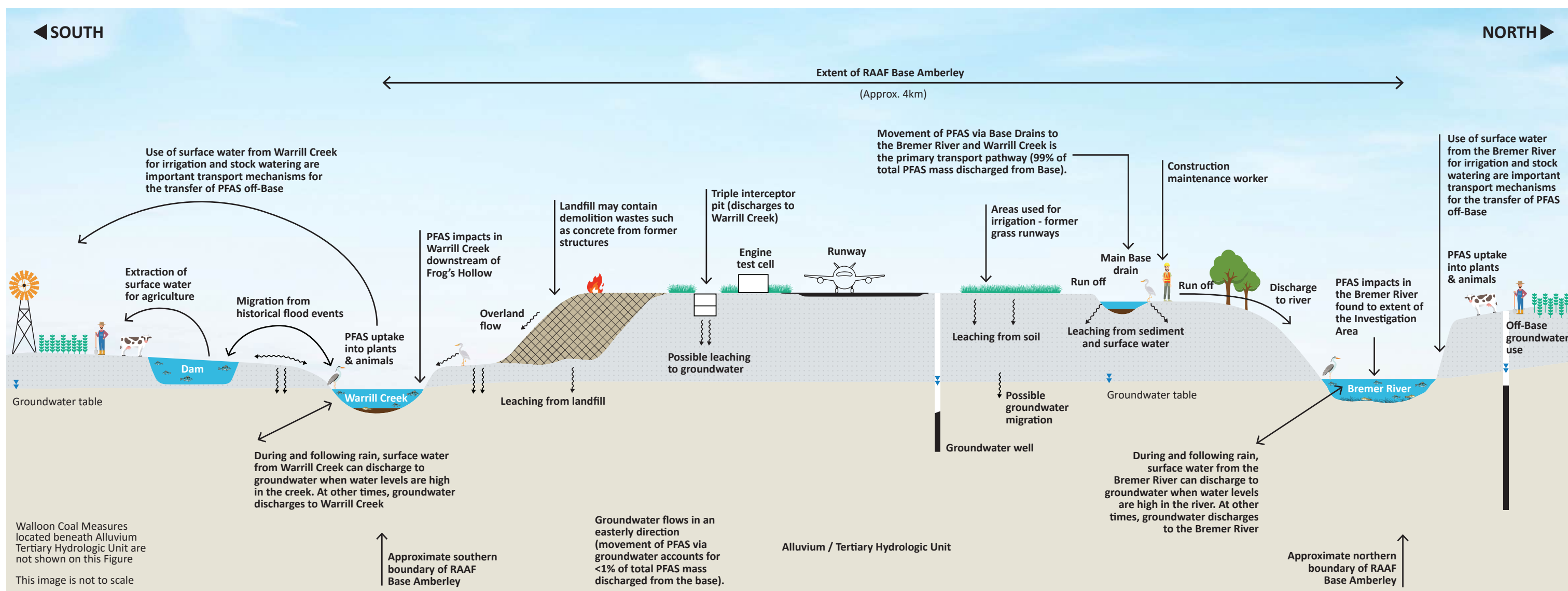
RAAF Base Amberley Conceptual Site Model showing topography and geology

PFAS Investigation and Management Program



RAAF Base Amberley and surrounds Conceptual Site Model

PFAS Investigation and Management Program



PFAS SOURCES

- Primary Sources on Base are located within Catchments 3, 7 and 8
- Potential off-Base primary sources include landfill, fire stations and extractive industries
- On and off-Base areas where PFAS has been transferred from a primary source area to another through transport pathways

PFAS TRANSPORT PATHWAYS

- Surface water runoff and infiltration
- Groundwater migration
- Flooding
- Sediment migration
- Bioaccumulation
- Use of PFAS contaminated water for irrigation and stock watering

COMPLETE EXPOSURE PATHWAYS

- Direct contact with contaminated soil, sediment and surface water
- Direct contact with extracted groundwater or surface water
- Consumption of organisms including edible fish
- Recreational activities in Bremer River and Warill Creek
- Drinking contaminated water by domestic and native animals

POTENTIALLY COMPLETE EXPOSURE PATHWAYS

- Consumption of home grown produce and livestock



APPENDIX C FIGURES

List of Figures

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Figure 2: Confirmed Primary Source Areas and Surface Water Catchments

Figure 3A: Sum PFHxS + PFOS Concentrations - Alluvium / Tertiary Formation (April 2024)

Figure 3B: PFOA Concentrations - Alluvium / Tertiary Formation (April 2024)

Figure 4A: Sum PFHxS + PFOS Concentrations Walloon Coal Measures (April 2024)

Figure 4B: PFOA Concentrations - Walloon Coal Measures (April 2024)

Figure 5A: Sum PFHxS + PFOS Concentrations - Surface Water (April 2024)

Figure 5B: PFOA Concentrations - Surface Water (April 2024)

Figure 6A: Sum PFHxS + PFOS Concentrations – Sediment (April 2024)

Figure 6B: PFOA Concentration – Sediment (April 2024)



- Legend**
- Watercourse
 - - - PFAS Management Area Plan Boundary
 - RAAF Amberley Approximate Site Boundary



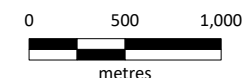
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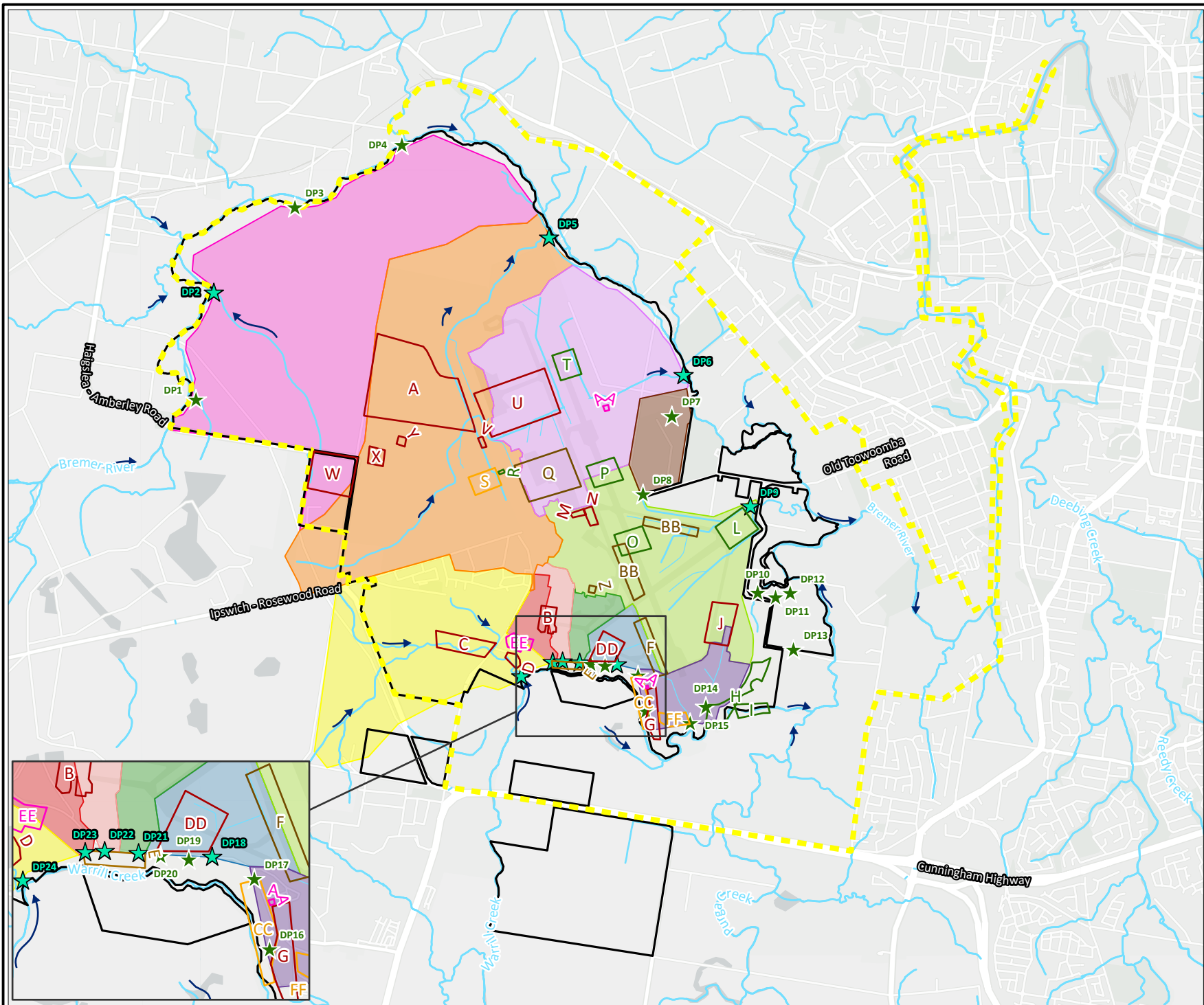


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**RAAF Base Amberley,
Queensland**

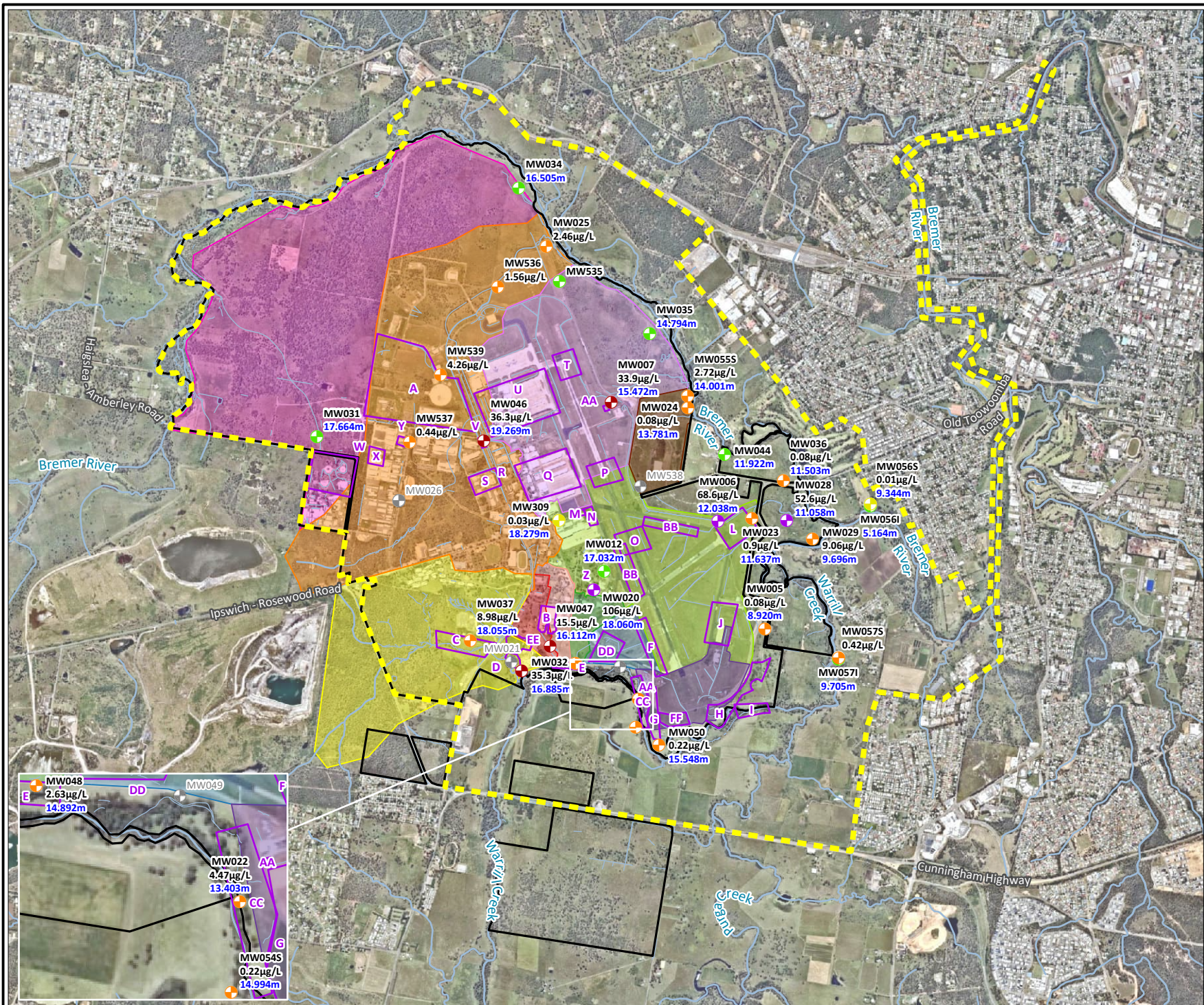
**SITE LOCATION AND
MANAGEMENT AREA**

FIGURE 1



Legend
Discharge Point
★ Major Discharge Point
★ Minor Discharge Point
➡ Stream Flow Direction
— Watercourse
— PFAS Management Area Plan Boundary
— RAAF Amberley Approximate Site Boundary
Confirmed Primary Source Area Type
Major
Moderate
Minor
Secondary Impact Area
Insignificant

Job No: 66133
Client: Department of Defence
Version: v3 Date: 04-Dec-2024
Scale: 1:48,000
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RAAF Base Amberley, Queensland
CONFIRMED PRIMARY SOURCE AREAS AND SURFACE WATER CATCHMENTS
FIGURE 2



Legend

- Watercourse
- PFAS Management Area Plan Boundary
- Confirmed Primary Source Area
- RAAF Amberley Approximate Site Boundary
- Groundwater Monitoring Location (RWL shown in mAHD)**
- Concentration Sum PFHxS & PFOS**
 - >50 µg/L
 - 10 - 50 µg/L
 - 0.07 - 10 µg/L
 - <0.07 µg/L
 - Non-detect
 - Not sampled
- Catchment Areas**
 - Catchment 1
 - Catchment 2
 - Catchment 3
 - Catchment 4
 - Catchment 5
 - Catchment 6
 - Catchment 7
 - Catchment 8
 - Catchment 9
 - Catchment 10
 - Catchment 11

Job No: 66133

Client: Department of Defence

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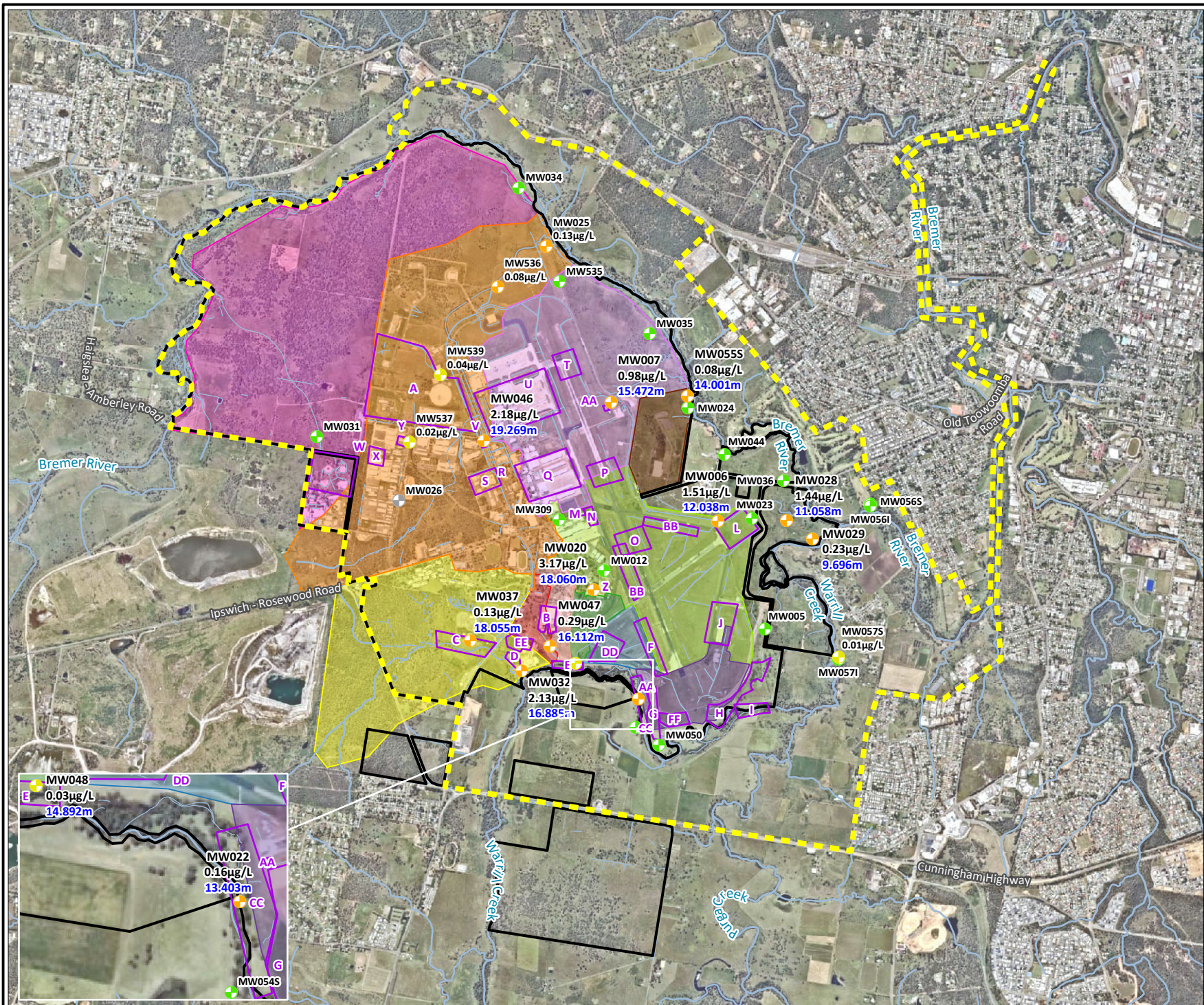
metres

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**RAAF Base Amberley,
Queensland**

**SUM OF PFHxS + PFOS GROUNDWATER
CONCENTRATIONS, ALLUVIUM /
TERTIARY FORMATION (APRIL, 2024)**

FIGURE 3A



Legend

- Watercourse
- PFAS Management Area Plan Boundary
- Confirmed Primary Source Area
- RAAF Amberley Approximate Site Boundary

Concentration PFOA

- 0.07 - 10 µg/L
- <0.07 µg/L
- Non-detect
- Not Sampled

Catchment Areas

- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5
- Catchment 6
- Catchment 7
- Catchment 8
- Catchment 9
- Catchment 10
- Catchment 11



Job No: 66133

Client: Department of Defence

Version: v7	Date: 04-Dec-2024
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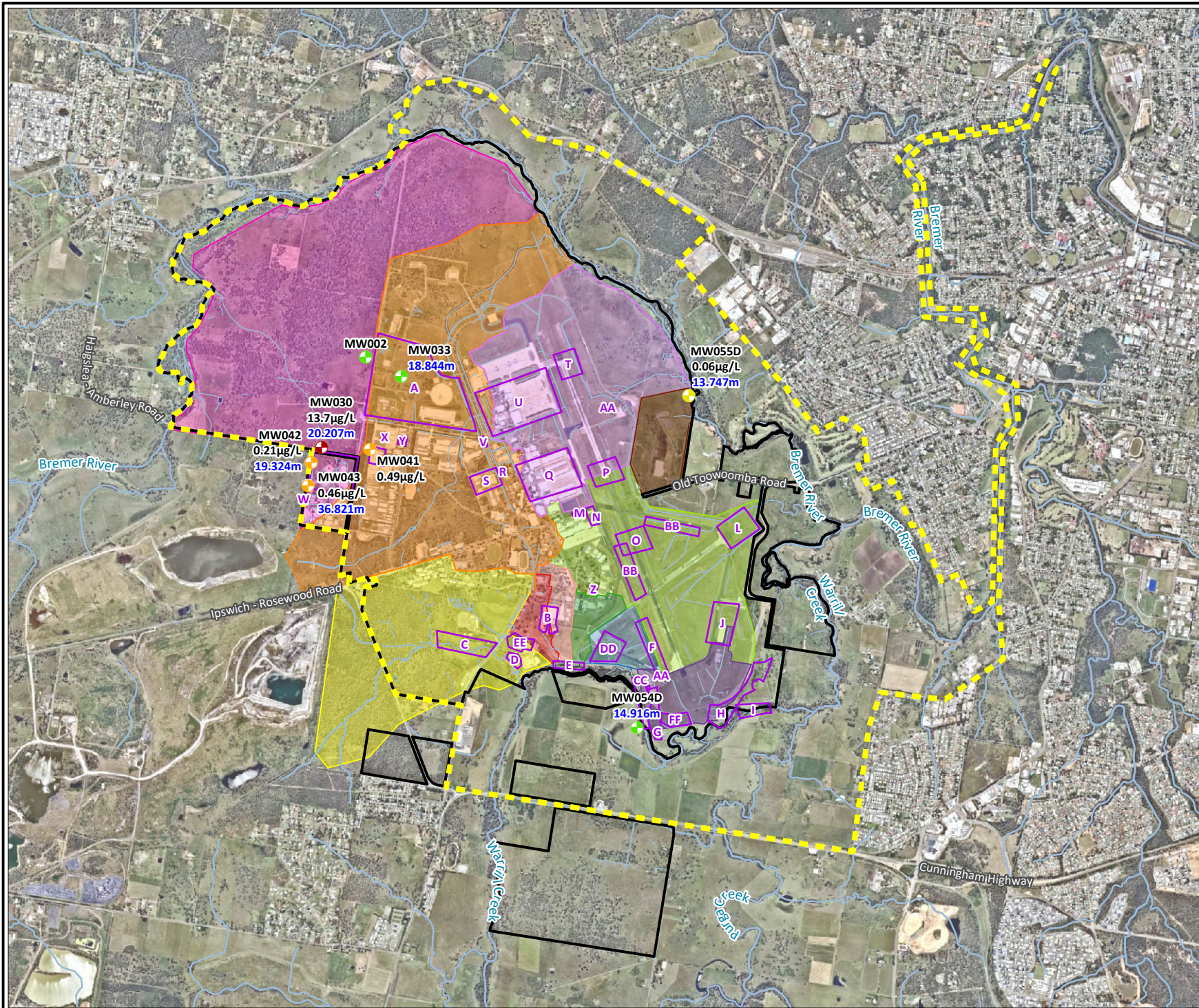
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**RAAF Base Amberley,
Queensland**

**PFOA GROUNDWATER CONCENTRATIONS,
ALLUVIUM / TERTIARY FORMATION
(APRIL, 2024)**

FIGURE 3B



Legend

- Watercourse
- PFAS Management Area Plan Boundary
- Confirmed Primary Source Area
- RAAF Amberley Approximate Site Boundary
- Groundwater Monitoring Location (RWL shown in mAHD)**
- Concentration Sum PFHxS & PFOS**
 - 10 - 50 µg/L
 - 0.07 - 10 µg/L
 - <0.07 µg/L
- Catchment Areas**
 - Catchment 1
 - Catchment 2
 - Catchment 3
 - Catchment 4
 - Catchment 5
 - Catchment 6
 - Catchment 7
 - Catchment 8
 - Catchment 9
 - Catchment 10
 - Catchment 11



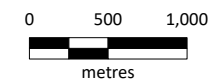
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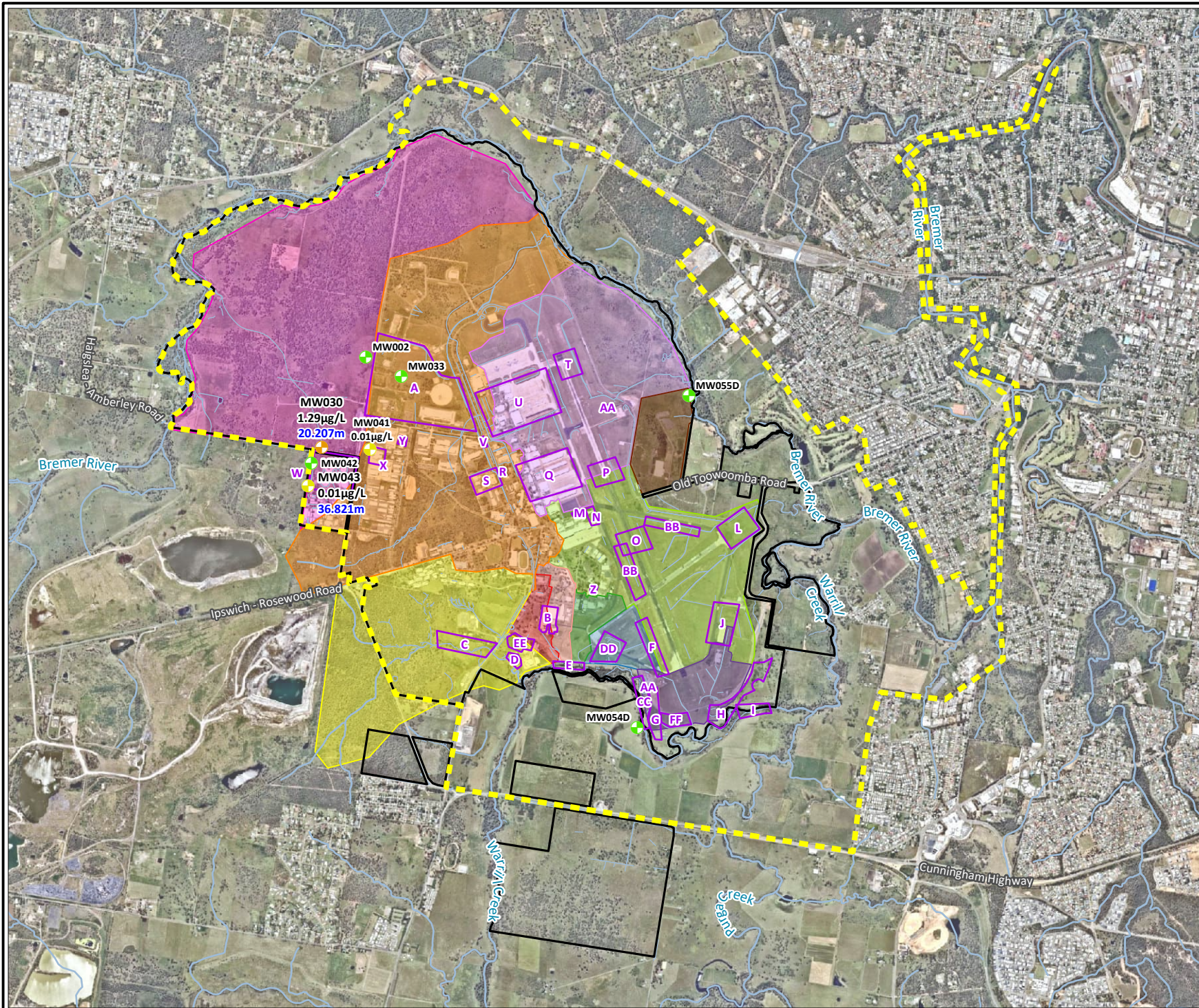


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**RAAF Base Amberley,
Queensland**

**SUM OF PFHxS + PFOS GROUNDWATER
CONCENTRATIONS, WALLOON COAL
MEASURES (APRIL, 2024)**

FIGURE 4A



Legend

- Watercourse
- PFAS Management Area Plan Boundary
- Confirmed Primary Source Area
- RAAF Amberley Approximate Site Boundary

Groundwater Monitoring Location (RWL shown in mAHD)

Concentration PFQA

- 0.07 - 10 µg/L
- <0.07 µg/L
- Non-detect

Catchment Areas

- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5
- Catchment 6
- Catchment 7
- Catchment 8
- Catchment 9
- Catchment 10
- Catchment 11



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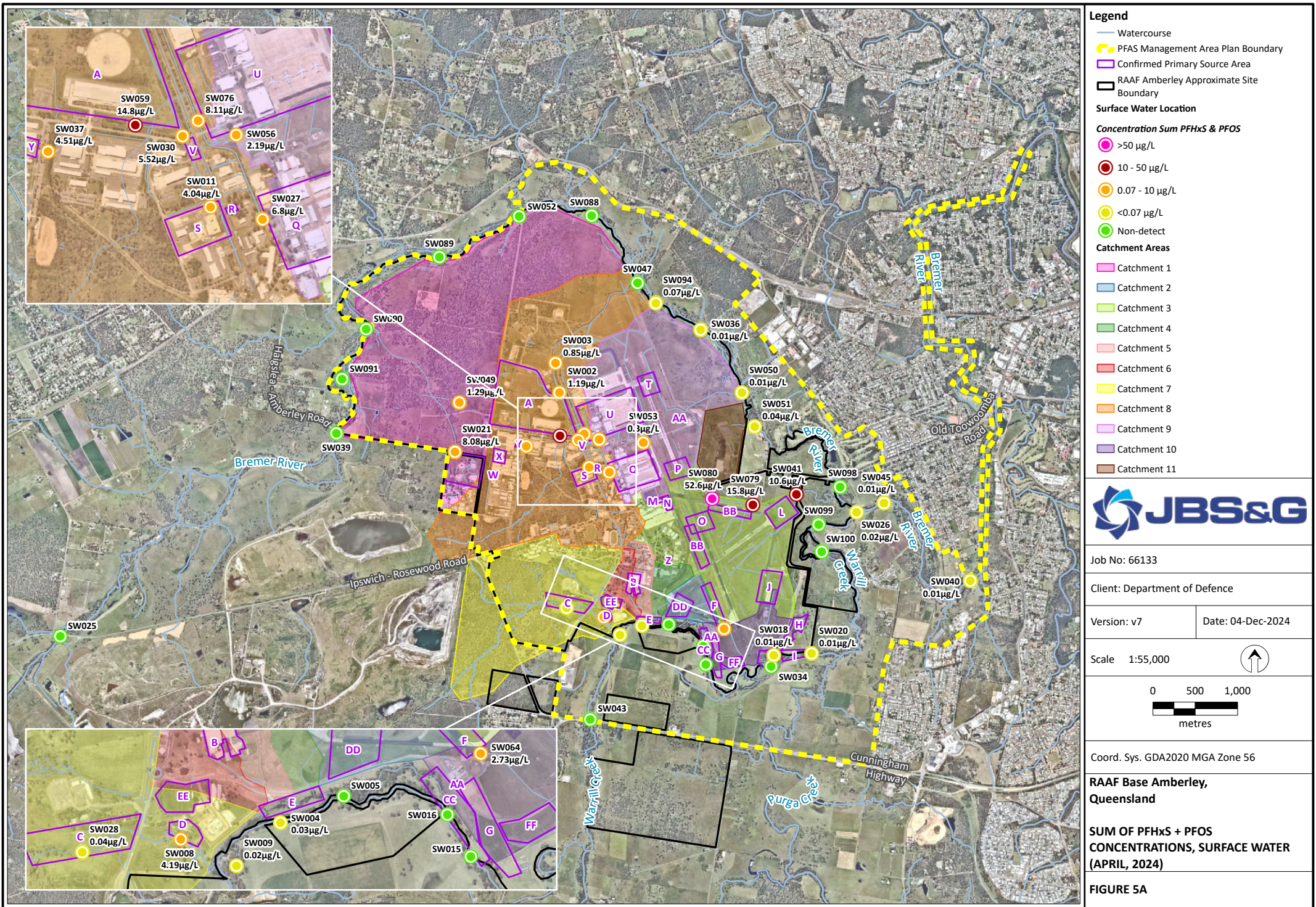
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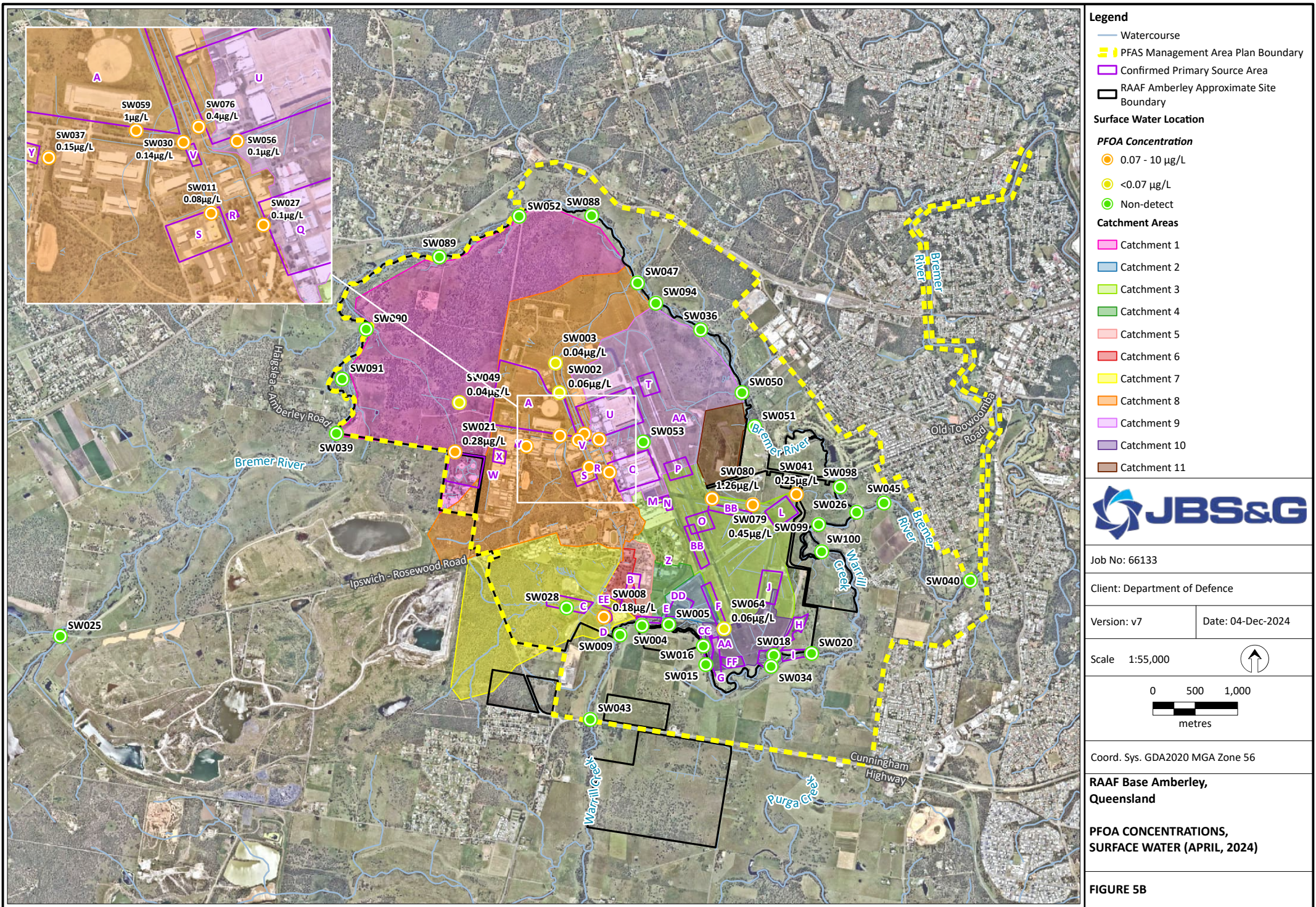
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RAAF Base Amberley, Queensland

PFOA GROUNDWATER CONCENTRATIONS, WALLOON COAL MEASURES (APRIL, 2024)

FIGURE 4B





Legend

- Watercourse
- PFAS Management Area Plan Boundary
- Confirmed Primary Source Area
- RAAF Amberley Approximate Site Boundary

Surface Water Location

PFOA Concentration

- 0.07 - 10 µg/L
- <0.07 µg/L
- Non-detect

Catchment Areas

- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5
- Catchment 6
- Catchment 7
- Catchment 8
- Catchment 9
- Catchment 10
- Catchment 11

Job No: 66133

Client: Department of Defence

Version: v7	Date: 04-Dec-2024
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Scale 1:55,000

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RAAF Base Amberley, Queensland

PFOA CONCENTRATIONS, SURFACE WATER (APRIL, 2024)

FIGURE 5B

