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PFAS INVESTIGATION AND MANAGEMENT PROGRAM

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RAAF BASE WILLIAMTOWN

PFAS ONGOING MONITORING PLAN

June 2026

CONTENTS

GLOSSARY

AFFF	Aqueous Film Forming Foam
AHD	Australian Height Datum
AS	Australian Standard
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure, as amended 2013
Base	RAAF Base Williamtown
BMZ	Broader Management Zone
COC	Chain of Custody
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EC	Electrical Conductivity
EPA	Environment Protection Authority
ERA	Ecological Risk Assessment
HHERA	Human Health and Ecological Risk Assessment
HHRA	Human Health Risk Assessment
HWC	Hunter Water Corporation
LOR	Limit of Reporting
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.
NATA	National Association of Testing Authorities
NPSW	National Parks and Wildlife Service
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
PFBS	Perfluorobutane sulfonic acid
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PMAP	PFAS Management Area Plan
PMZ	Primary Management Zone

QA	Quality Assurance
QC	Quality Control
RAP	Remediation Action Plan
Risk management actions	Remediation and management actions to address potential risks to receptors from PFAS contamination
ROA	Remediation Options Assessment
SAQP	Sampling and Analysis Quality Plan
SMZ	Secondary Management Zone
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.
SWL	Standing Water Level
TOC	Total Organic Carbon
TDS	Total Dissolved Solids

1 INTRODUCTION

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.

1.1 Background

In 2019, Defence prepared a PFAS Management Area Plan (PMAP) for managing risks to human health and the environment from per- and poly-fluoroalkyl substances (PFAS) contamination associated with Royal Australian Air Force (RAAF) Base Williamtown (the 'base') and surrounding areas. An important requirement of the PMAP is to undertake ongoing monitoring of PFAS in the environment and to assess for changes in risks to human and ecological receptors from PFAS originating from the base.

The PMAP was subsequently updated in 2023 (2023 PMAP) to reflect the current status of PFAS contamination and risk management actions.

This Ongoing Monitoring Plan (OMP) replaces the November 2023 OMP.

1.2 Purpose

The OMP sets out requirements for collection of adequate data to identify and evaluate:

- spatial, and temporal (including seasonal) variability of PFAS in the environment
- changes to sources, transport pathways and/or receptors, described as a conceptual site model (CSM) for the base
- whether risks to human and ecological receptors require review
- the influence that risk management activities at the base, as outlined in the 2023 PMAP have had on PFAS in the environment, and
- whether the identified changes trigger an action and/or review.

The data collected may be used to inform where new risk management actions may be required, or to support a determination that remediation has been completed so far as reasonably practicable.

1.3 Supporting information

In developing the OMP, reference has been made to the PFAS National Environmental Management Plan (PFAS NEMP), the National Environment Protection (Assessment of Site Contamination) Measure 2013 (ASC NEPM) and Defence estate, environmental and PFAS-specific strategies and guidance, and other information as provided in Section 1.4.

1.4 Constraints and assumptions

This OMP has been prepared based on information available at the time of writing and relies on the findings of the Detailed Site Investigation (DSI), risk assessments, mass flux assessments, remediation activities, ongoing monitoring program data, and management of risks documented in the

2023 PMAP. Defence recognises that there may still be gaps in information, and if required these will be progressively addressed while impacted sites are being managed.

This document has been developed based on the following assumptions:

- The current government issued guidelines, advisories and policies may change, and as a result may trigger a review of the OMP.
- The monitoring locations are based on the data collected to date and may be further refined as proposed management / remediation actions are implemented.
- Access to off-base private properties will be granted, where required. It is noted that previously off-base access has not always been granted in some key locations.

2 SITE SETTING

2.1 Base description

The base is located at Medowie Road, Williamtown, NSW, approximately 15 km north of the Newcastle NSW central business district (CBD) and is located in the Port Stephens local government area (LGA), as shown in Figure F1 in Appendix B.

2.2 Site and management area setting

The base has been an active Defence property since 1941 and serves as the headquarters to both the Air Combat Group and the Surveillance and Response Group. In 2014, it was designated as the home base for Australia's F-35 Joint Strike Fighters. The southern side of the base is leased to Newcastle Airport Pty Limited, which operates the commercial Newcastle Airport.

The surrounding land uses comprise rural and semi-rural, settlements at Fullerton Cove and Salt Ash, small commercial properties and the Salt Ash Primary School. Tilligerry State Conservation area, managed by National Parks and Wildlife Service (NPSW), immediately borders the base to the west, north and east.

Hunter Water Corporation (HWC) pumping stations and groundwater extraction bore fields are located to the west, north and east of the base.

A summary of the environmental setting of the base and Management Area is as follows:

- The area experiences average low temperatures around 6°C in July and maximum average temperatures of around 28°C in January.
- The highest monthly rainfall generally occurs between January and June (averaging >100 mm per month), with the lowest rainfall in July to December (averaging 74 mm per month).
- Low lying area associated with the Lower Hunter River. The region is characterised by low sand dunes, sand sheets and estuarine mud flats.
- Relatively flat topography with ground elevation ranging approximately 10 metres Australian Height Datum (m AHD) to low lying areas between Fullerton Cove and Tilligerry Creek with elevations between 1 and 3 m AHD.
- The geology of the base and Management Area comprises unconsolidated sands (Tomago Sand Beds and Stockton Sand Beds) underlain by estuarine sediments (Tilligerry Mud Member).
- The base is surrounded by an interconnected network of drains, rivers, estuaries, reservoirs and coastal waterbodies within the catchment areas of both the Hunter River and Port Stephens estuary. The major elements of the regional surface water drainage network include:
    - Dawsons Drain, the Fourteen Foot Drain and the Ten Foot Drain, which are located to the south of the base and drain into Fullerton Cove
    - Moors Drain and Tilligerry Creek, which are located to the east and south-east of the base and drain to the north east into the Tilligerry Creek arm of Port Stephens
- The hydrogeology of the area is characterised by two unconfined sand aquifers:
    - Tomago Sand Beds aquifer located northwest of Tilligerry Creek
    - Stockton Sand Beds aquifer located between Tilligerry Creek and the Newcastle Bight.

3 EXTENT OF PFAS CONTAMINATION

This section provides a description of the PFAS sources on the base, the ways in which PFAS has moved in the environment (migration pathways), and the extent of PFAS in the environment outside the base.

It also provides a summary of the potential human and ecological receptors that may be exposed to PFAS. This information is referred to as the Conceptual Site Model (CSM).

3.1 Source areas

Source areas can be primary or secondary. Primary sources are generally areas of PFAS contamination where aqueous foam forming film (AFFF) was used or stored, for example a fire training area. Secondary sources are areas where PFAS accumulates and then continues to feed into the environment.

In the 2019 PMAP, a total of 14 PFAS source areas were prioritised for risk management based on the amount of PFAS they contained. Additional monitoring and investigation has subsequently been undertaken at the base to improve understanding of these source areas to inform the management requirements. The 2023 PMAP provides an update on the current status of source areas.

3.2 Transport pathways

PFAS can be transported from a source to human or environmental receptors by surface water and groundwater. These are referred to as “migration pathways”. The Groundwater Strategy Review (Geosyntec, 2022) categorised the PFAS migration pathways based on the natural catchments across the base and Management Area:

- **Western Region** - characterised by the former Fire Training Area (FFTA) source that is now remediated, and a PFAS groundwater plume extending south away from the source. PFAS in the western plume discharges into Dawsons Drain.
- **Central Region** - characterised by ongoing sources at the Former Fire Training Pad / Current Fire Station (Facility 165) and the Sewage Treatment Plant (Facility 410); with PFAS groundwater plumes extending south across the base boundary. The concentrations of PFAS south of the base and north of Cabbage Tree Rd were likely sourced from Lake Cochran, which was impacted when AFFF foams were still in use at the base. However, Lake Cochran is no longer considered a significant ongoing PFAS source to groundwater. PFAS in the central southern plume discharges into Leary’s Drain.
- **Eastern Region** - characterised by likely sources at the Trade Waste Treatment Plant (Facility 480) and a Former Fuelling Area, with PFAS groundwater plumes extending east across the base boundary, and PFAS impacted surface water discharges to Moors Drain.

3.3 Receptors and risks

More than 50 potential pathways through which humans could be exposed to PFAS from the base were assessed in the off-base Human Health Risk Assessment (HHRA) (AECOM, 2017). These pathways included exposure to elevated PFAS in soil, groundwater, surface water, sediment, land animals and seafood within the Management Area.

The HHRA concluded that unrestricted exposure to PFAS across the Williamtown Management Area may result in an exceedance of the tolerable daily intake (TDI). The TDI is a limit of consumption,

under which no adverse health impacts are likely. The NSW Government subsequently issued precautionary advice in April 2017 (Williamtown-precautionary-advice (nsw.gov.au) on how people within the Williamtown Management Area can reduce their exposure to PFAS. If this advice is followed then individual exposure to PFAS is very unlikely to exceed the TDI.

Potential risks that were identified as elevated or unacceptable in the HHRA are listed in Table 1 with corresponding exposure management advice from the NSW EPA (Williamtown-precautionary-advice (nsw.gov.au). To address these risks Defence is continuing to implement risk management actions to reduce PFAS leaving the base.

Table 1 Potential Human Health Risks

Process	NSW Government Precautionary Advice
R01 – Ingesting Groundwater Drinking groundwater with PFAS concentrations above drinking water guidelines (or use in cooking). Applies to NSW EPA Williamtown Management Area.	**NSW Government**: • Precautionary advice to minimise exposure by not using groundwater for drinking or cooking, • Avoid swallowing groundwater when bathing, showering, swimming and paddling in the NSW EPA Williamtown Secondary and Broader Management Zones. • Groundwater and bore water should not be used for any purpose in the NSW EPA Williamtown Primary Management Zone.
R02 – Ingesting Groundwater Incidental ingestion of shallow groundwater (where PFAS concentrations are above drinking water guidelines) from indoor use, including showering, bathing, food preparation using extracted groundwater. Applies to NSW EPA Williamtown Primary Management Zone.	**NSW Government**: • Precautionary advice to minimise exposure by not using groundwater and bore water for any purpose in the NSW EPA Williamtown Primary Management Zone.
R03 – Ingesting Groundwater Incidental ingestion of shallow groundwater where PFAS concentrations are above drinking water guidelines, as a result of outdoor use (including swimming pools, sprinkler play, domestic irrigation). Applies to NSW EPA Williamtown Primary Management and Secondary Management Zones	**NSW Government**: • Precautionary advice to minimise exposure by not using groundwater for any purpose in the NSW EPA Williamtown Primary Management Zone.

Process	NSW Government Precautionary Advice
R04 – Eating Home Produced Eggs Eating eggs from home grown backyard poultry that are exposed to groundwater or surface water as their primary drinking water supply and/or consumed soil or plants that have accumulated PFAS from irrigation water. Applies to the NSW EPA Williamtown Management Area.	**NSW Government**: • Precautionary advice to minimise exposure by not consuming home-grown foods produced, including eggs in the NSW EPA Williamtown Primary Management Zone, • Avoid eating eggs from the NSW EPA Williamtown Secondary and Broader Management Zones.
R05 – Eating Home-grown Vegetables Eating vegetables that have been irrigated with surface water or groundwater containing detectable PFAS concentrations and/or have been grown in soil that has been irrigated or flooded with water containing detectable PFAS concentrations. Applies to the NSW EPA Williamtown Management Area.	**NSW Government**: • Precautionary advice to minimise exposure by not consuming home-grown foods produced in the NSW EPA Williamtown Primary Management Zone, • Avoid eating vegetables produced in the NSW EPA Williamtown Secondary and Broader Management Zones.
R06- Ingesting Groundwater Incidentally ingesting surface water through swimming/ outdoor recreational use (drains/creeks). Applies to the NSW EPA Williamtown Management Area.	**NSW Government** • Surface water should not be used for any purpose in the NSW EPA Williamtown Primary Management Zone. • Avoid swallowing groundwater or surface water when bathing, showering, swimming and paddling (including in creeks and drains) in the Secondary and Broader Management Zones. • Groundwater should not be used for swimming or paddling pools in the Secondary and Broader Management Zones.
R07 – Eating Locally Sourced Cattle Eating locally grown cattle, which are exposed to surface water or groundwater as their primary drinking water supply and/or have consumed soil or plants that have accumulated PFAS from irrigation water. Applies to the NSW EPA Williamtown Management Area.	**NSW Government**: • Precautionary advice to minimise exposure by not consuming home-grown foods produced, including home-slaughtered meat in the NSW EPA Williamtown Primary Management Zone. • Avoid eating home-slaughtered meat in the NSW EPA Williamtown Secondary and Broader Management Zones.
R08 – Drinking Locally Sourced Milk Drinking milk from locally grown cattle, which are exposed to surface or groundwater as their primary source of drinking water and/or consumed soil or	**NSW Government**: • Precautionary advice to minimise exposure by not consuming home-grown foods produced, including milk in the NSW EPA Williamtown Primary Management Zone.

Process	NSW Government Precautionary Advice
plants that have accumulated PFAS from irrigation water. Applies to the NSW EPA Williamtown Management Area.	• Avoid drinking milk produced in the NSW EPA Williamtown Secondary and Broader Management Zones.
R09 – Eating Locally Caught Fish Eating high quantities of locally sourced finfish from the marine environment. Applies to Hunter River Estuary, Fullerton Cove and Tilligerry Creek.	**NSW Government**: • People who personally source and eat fish and seafood from the Hunter River Estuary, Fullerton Cove and Tilligerry Creek should limit the number of servings of individual species. • Sourcing seafood from a variety of locations including the ocean and waterways outside these areas will assist in minimising exposure. • The NSW government also provide the recommended maximum intake based on eating a single species caught from the Hunter River Estuary, Fullerton Cove and Tilligerry Creek.

3.3.1 Ecological Risks

Potential risks to ecological receptors that were identified as elevated or unacceptable in the Ecological Risk Assessment (ERA) (AECOM, 2018) are listed in Table 2**.** To minimise these risks Defence continues to implement risk management actions to reduce PFAS leaving the base.

Table 2 Elevated Ecological Risks

Risk ID	Description
R10	Toxicity to terrestrial and aquatic organisms from direct exposure to PFAS in soil, sediment or surface water. Applies to drains in Management Area, including Dawsons Drain and Moors Drain.
R11	Consumption of organisms that have been exposed to PFAS where bioaccumulation is occurring.

4 ONGOING MONITORING PLAN

This section sets out the data quality objectives, monitoring scope and assessment requirements. Changes made to the 2023 OMP are summarised in the following sections, and supporting rationale is provided in Appendix D.

4.1 Sampling and Analysis Quality Plan

A Sampling and Analysis Quality Plan (SAQP) will be developed prior to implementation of the updated OMP. The SAQP provides information on data quality assurance procedures and measures including data quality indicators (DQI), sampling methodologies and analytical methods. The SAQP will be updated as required.

4.2 Data Quality Objectives

The Data Quality Objective (DQO) process is an iterative planning approach used to define the type, quantity and quality of data that is needed to inform decisions relating to the environmental condition of a site. The seven-step DQO process:

- clarifies the study objective
- defines the most appropriate collection of data as relevant to the study objective
- determines the conditions from which to collect data
- specifies tolerable limits on decision errors, which will be used as the basis for establishing the quantity and quality of data, needed to support the decision.

The DQOs for monitoring are presented in Table 3. They have been prepared in line with the DQO process outlined in the ASC NEPM (Schedule B2).

Table 3. Data Quality Objectives

Process	Description
Step 1: State the problem	The historical use of AFFF containing PFAS at the base for operational and training purposes has resulted in widespread contamination in groundwater, surface water, sediment, soil and biota both on- and off-base. Defence and State agencies require up-to-date data to enable informed risk management decisions to protect human health and the environment, given that elevated concentrations of PFAS have been identified in environmental media. Defence requires an understanding of the holistic effect of PFAS management response activities that have and will be implemented. The data collected by implementing this OMP will provide a detailed dataset that can be used to assist with assessment of temporal changes in PFAS concentrations in groundwater, surface water and sediment on- and off-base, and biota (sentinel species) in Fullerton Cove. This will facilitate refinement of the CSM, allow update of the human health and ecological risk assessment and inform management decisions by Defence and NSW EPA, and possibly other government agencies, if required.

Process	Description
	Additionally, the temporal monitoring of PFAS concentrations in selected biota aims to provide data necessary to support and/or update the ongoing advice relating to minimising exposure (e.g. consumption of seafood)
Step 2: Identify the decision/goal of the study	The goal of the study is to establish a systematic routine groundwater, surface water, sediment and biota sampling and analysis program to: • refine current understanding of the distribution of PFAS in groundwater and surface water/sediment associated with the base • monitor changes in PFAS concentrations in selected aquatic biota sentinel species to identify potential changes to the risk profile for consumers • monitor changes to PFAS distribution and variability due to management actions and seasonal variations. This will allow decisions to be made regarding the assessment of risks to human and ecological receptors into the future (for example, updating the conceptual site model), and whether the OMP needs to be amended to reflect these updates.
Step 3: Identify the information inputs	The information and inputs needed to support the decisions include: • PFAS results for groundwater, surface water, sediment and biota from previous environmental investigations and monitoring events • data collected during PFAS remediation management activities • meteorological data including rainfall • advances in laboratory analytical approaches and changes in regulatory requirements.
Step 4: Define the boundaries of the study	The spatial and temporal boundaries that apply for data collection are detailed below (and aim to influence the decision-making process for ongoing monitoring): • the spatial boundary for data collection is the base and Management Area • the media targeted will be limited to groundwater, surface water, sediment and biota, at the frequencies defined in Section 4.3. • the monitoring will be long term (beyond 3 years) and ongoing. The OMP will continue after the remediation / management actions have ended in consultation with NSW Government.
Step 5: Develop the analytical approach/decision rules	The analytical approach has been designed to collect environmental monitoring data of sufficient quality and quantity in order to identify potential changes in the known extent of PFAS in the environment, and any potential changes to the conceptual site model and associated risk profile. The decision rules for the study are as follows: i. is the study approach scientifically suitable and defensible? Decision Rule: The study approach is considered scientifically suitable and defensible if data are collected in accordance with

Process	Description
	the applicable guidelines and legislation (outlined in Section 1.3), and the approach outlined in this OMP. ii. are the collected datasets adequate to assess changes: a. in the known nature and extent of PFAS in groundwater, surface water, sediment and biota. b. to the current CSM. c. to the current risk profile for on and off-base human health and ecological receptors. Decision Rule: If the datasets described in Step 3 are collected and assessed as being appropriate quality (including completeness), that is adequate.
Step 6: Specify performance or acceptance criteria	Specific limits for the works included in the OMP are in accordance with the appropriate guidance made or endorsed by state and national regulations, appropriate indicators of data quality, and standard procedures for field sampling and handling. This step also examines the certainty of conclusive statements based on the available new data collected. This should include the following points to quantify tolerable limits: • a decision can be made based on a certainty assumption of 95% confidence in any given data set. A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative. • a decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area. • sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the base. To address this, the OMP outlines minimum numbers of samples proposed to be collected from each media. • as such, there may be limitations in the data if aspects of the OMP cannot be implemented. Some examples of this scenario include but are not limited to: - proposed surface water sample locations may be dry at the time of sampling - proposed groundwater well locations are damaged or destroyed and therefore cannot be sampled - proposed samples are not collected due to access being restricted to a given location. • limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. An example of this scenario includes: - some of the data are proposed to be collected from landholder bores, which are not purpose-built for groundwater monitoring. In some cases, there is limited information on the bore construction, and the likely presence of dedicated pumps may prevent groundwater depths being

Process	Description
	accurately recorded while also preventing groundwater being sampled using Hydrasleeves™ . • measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: - collection of sufficient sample mass to facilitate analysis reported to standard laboratory detections limits. Collection of insufficient sample mass may result in raised detection limits. - field staff to follow a standard procedure when collecting samples, including decontamination of tools, and use of appropriate sample containers and preservation methods. - laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the OMP.
Step 7: Develop the plan for obtaining data	The methodology presented in this OMP is designed to meet the purpose described in Section 1.2 to achieve the nominated DQOs. Optimisation of the data collection process will be achieved by: • working closely with the analytical laboratories and sampling equipment suppliers to ensure that appropriate procedures and processes are developed and implemented prior to and during the fieldwork, to ensure that sample handling, and transport to and processing by the analytical laboratories is appropriate • conducting sampling according to Australian Standards for the type of sampling being conducted (i.e. groundwater monitoring well sampling versus landholder bore water sampling). This standard is: Standards Australia (AS/NZS5667.11–1998) *Water Quality – Sampling, part 11: Guidance on sampling of groundwater.* • basing the sampling upon a CSM developed using the information available at the implementation of the OMP. Updating the CSM as new data becomes available in the course of the implementation of the OMP, as required. If the objectives of the OMP are not being met, the sampling design and approach will be reviewed and amended, as required.

4.3 Proposed monitoring intervals

The key element of the OMP is six monthly groundwater, surface water and sediment sampling on and off-base, and biota sampling biennially. This includes:

- an **autumn** comprehensive sampling and analysis event for the first of the biannual groundwater, surface water and sediment sampling events timed to occur in March / April.
- a **spring** targeted sampling and analysis event for the second of the biannual groundwater, surface water and sediment sampling events timed to occur in September / October to target key monitoring wells.
- biota sampling for sentinel species in Fullerton Cove to occur every second year in Autumn.

The rationale for these elements are summarised below:

- the six-monthly monitoring to occur:
    - **Autumn** (March / April), during high average rainfall period (127 mm for March and 111 mm for April) based on Bureau of Meteorology (BoM) Williamtown RAAF weather station (number 061078); and
    - **Spring** (September / October), during low average rainfall period (60 mm for September and 75 mm for October) based on BoM.
- the monitoring event targeting low average rainfall period will increase the understanding of groundwater changes at discrete locations considered to be of importance for understanding trends (for example bores close to source areas, base boundaries and creek systems), or locations with higher sensitivity (groundwater sample locations with concentrations close to screening criteria, areas with fewer monitoring locations).

The key changes in monitoring intervals of sampling locations since the 2023 OMP are summarised as follows:

- sampling frequency increased from annual to biannual at one location (MW318D) due to increasing trends for PFAS concentrations
- sampling frequency decreased from biannual to annual at two locations (MW247S and MW252S) due to decreasing trends for PFAS concentrations.

4.4 Monitoring locations

4.4.1 Rationale for groundwater gauging locations

Groundwater monitoring will be undertaken on selected monitoring wells, Hunter Water bores and residential bores. The ongoing monitoring program will continue to monitor water quality in the shallow and deep portions of the Tomago Sand Beds aquifer. The current understanding of the conceptual site model is that PFAS concentrations in the intermediate groundwater (approximate depth of 12 m bgs) are similar to that of the deeper portions (approximate depth of 20 m bgs) of the aquifer and hence will not be targeted, with the exception of MW132I and MW134I which have been included due to the lack of alternative shallow sampling locations.

The rationale for monitoring well selection for each area is summarised in Table 4 below.

The groundwater monitoring well sampling methodology will be presented in the SAQP. The locations to be monitored on a six-monthly basis ('Autumn' comprehensive and 'Spring' targeted) are provided in **Appendix C** and shown on **Figure F2-A** to **Figure F2-C** in **Appendix B**.

Table 4. Rationale for groundwater monitoring

Area	Rationale
On-Base	• monitor spatial and temporal variations in PFAS concentrations in groundwater concentrations up, down and cross-gradient of source areas • assess if PFAS concentrations in groundwater within and downgradient of the source areas change in response to management measures over time • monitoring of HWC assets that are in close proximity to the PFAS plume to inform risk to a potential drinking water supply • monitoring of sentinel wells for Pump Station 7 located on-base • monitor PFAS concentrations in groundwater within the on-base Moors Drain Catchment to target elevated PFAS concentrations detected during PFAS characterisation studies and support the Moors Drain Catchment data gap

Area	Rationale
	assessment and improve understanding of the interaction between groundwater and surface water • continue to monitor groundwater wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations • monitor groundwater on transects parallel and perpendicular to plume, and at shallow and deep portions of the aquifer to assist with understanding concentrations changes in the nominated transect alignments.
East of Base	• monitor spatial and temporal variation in PFAS concentration in groundwater up and down hydraulic gradient of HWC asset Pumping Station 9 • continue to monitor groundwater wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations • monitor potential changes in PFAS concentrations at the plume margins to refine model predictions and provide an indication of additional management of PFAS to groundwater users outside the current plume • monitor groundwater adjacent to Moors Drain to assess PFAS migrating from the drain to groundwater • monitor groundwater on transects parallel and perpendicular to the plume, and at shallow and deep portions of the aquifer to assist with understanding concentration changes in the nominated transect alignments.
West of Base	• monitor the western edge of the plume in relation to HWC asset Pumping Station 5 at sentinel locations • monitor the movement of PFAS from the FFTA towards southern boundary (where groundwater is currently being extracted for treatment). • monitor groundwater wells on transects parallel and perpendicular to plume, and at shallow and deep portions of the aquifer to assist with understanding concentrations changes in the nominated transect alignments.
Southern Area	• monitor potential changes in PFAS concentrations at the plume margins in the Primary Management Zone to refine model predictions • continue to monitor groundwater wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations • monitor groundwater on transects parallel and perpendicular to plume, and at shallow and deep portions of the aquifer to assist with understanding concentrations changes in the nominated transect alignments.
Cabbage Tree Road	• monitor potential changes in PFAS concentrations to refine model predictions and provide an indication of additional management of PFAS to groundwater users outside the current plume • monitor the isolated detections of PFAS in groundwater that have been considered to be associated with unconfirmed mechanisms. This may include transport of PFAS via surface water, flooding or an unidentified source • continue to monitor wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations • monitor groundwater on transects parallel and perpendicular to plume, and at shallow and deep portions of the aquifer to assist with understanding concentrations changes in the nominated transect alignments.

Area	Rationale
Lavis Lane	• monitor the plume to the south east of the base and in the Lavis Lane area • monitor groundwater adjacent to Fourteen Foot Drain • monitor potential changes in PFAS concentrations at the plume margins to refine model predictions and provide an indication of additional management of PFAS to groundwater users outside the current plume • continue to monitor wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations. • monitor groundwater on transects parallel and perpendicular to plume, and at shallow and deep portions of the aquifer to assist with understanding concentrations changes in the nominated transect alignments.
Salt Ash	• monitor the isolated detections of PFAS in groundwater in Salt Ash that have been considered to be associated with unconfirmed mechanisms. This may include transport of PFAS via surface water, flooding or an unidentified source • monitor potential changes in PFAS concentrations at the plume margins to refine model predictions and provide an indication of additional management of PFAS to groundwater users outside the current plume • continue to monitor wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations • monitor groundwater on transects perpendicular to the plume, and at shallow and deep portions of the aquifer to assist with understanding concentration changes in the nominated transect alignments.
Fullerton Cove	• monitor the isolated detections of PFAS in groundwater that have been considered to be associated with unconfirmed mechanisms. This may include transport of PFAS via surface water, flooding or an unidentified source • monitor potential changes in PFAS concentrations to refine model predictions • continue to monitor wells with existing temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations.

Off-base monitoring locations requiring access to private properties will require the agreement of the landowners prior to access.

In addition to the measurement of depth to groundwater in each monitoring well prior to collection of groundwater samples, a targeted gauging round at selected groundwater locations shall be undertaken prior to a sampling event, given that it is not necessary to gauge all monitoring well locations to determine regional groundwater flow directions.

The selected locations for the targeted gauging event are as follows:

- Shallow wells: MW106S, MW122, MW123, MW124, MW125S, MW126S, MW146S, MW158S, MW162S, MW188S, MW202S, MW232S, MW247S, MW256S, MW257S, MW260S, MW268S and MW897S.
- Deep monitoring wells: MW106D, MW125D, MW126D, MW146AD, MW158D, MW162D, MW202D, MW232D, MW247D, MW256D, MW257D, MW260D, MW268D and MW897D.

The key changes in the proposed groundwater monitoring locations since the 2023 OMP are summarised as follows:

- groundwater locations MW084D, MW084S, MW104D and MW104S have been removed as they are noted to have been destroyed and are unable to be sampled
- groundwater locations MW177, MW185S and MW220S were added as alternative sampling locations to MW084D, MW084S, MW104D and MW104S
- groundwater location MW137 was added to monitor the western extent of the plume
- groundwater locations MW139, POT107, POT046, POT144 and POT236 were added at the request of private property owners wishing to opt into the OMP
- groundwater locations MW142D, MW142S, MW144, MW266D. MW266S and MW538 were added to provide additional coverage between the base and Fullerton Cove
- groundwater location MW262D and MW262S were added to monitor the eastern extent of the plume outside of the Broader Management Zone (BMZ)
- groundwater locations MW268D and MW268S were added to monitor the southern extent of the plume near Fullerton Cove.

It is noted that the sampling under the OMP will also cover the quarterly monitoring in October 2026 of the following wells as part of the performance monitoring of the Western Region wellfield under the Groundwater Monitoring Plan (GMP) (AECOM, 2025):

- MW340S / MW340D,
- MW354S / MW342D
- MW344S / MW344D
- MW108S / MW108D

Additionally, the OMP will also consider the revised monitoring program under any future updates to the GMP, and off-base monitoring wells for the Central Region, once the wellfield is commissioned.

4.4.2 Rationale for surface water sample locations

The surface water monitoring locations have been selected to maintain consistency with the monitoring completed under the DSI and 2023 OMP and address the requirements of the NSW Government.

The locations have been sampled many times, and continued monitoring will provide additional data to assess temporal variability.

Six monthly surface water monitoring will be undertaken at the selected locations.

Off-base monitoring locations requiring access to private properties will require the agreement of the landowners prior to access.

There are no changes to proposed surface water sampling locations since the 2023 OMP.

4.4.3 Rationale for sediment sample locations

The sediment monitoring locations have been selected to maintain consistency with the monitoring completed under the DSI and 2023 OMP and address the requirements of the NSW Government.

The locations have been sampled many times, and continued monitoring will provide additional data to assess temporal variability.

The existing sediment sampling locations have been complimented by two additional locations which have been included due to the following:

- Gain access to off-base drains that were not able to be sampled as access to private property could not be achieved.
- Improve understanding of the concentrations along Dawsons Drain to the south of the base, which will aim to monitor the area where the groundwater model has predicted that groundwater from the base (originating from the FFTA) upwells.

Six monthly sediment monitoring will be undertaken at the selected locations.

Off-base monitoring locations requiring access to private properties will require the agreement of the landowners prior to access.

The key changes in the proposed sediment monitoring locations since the 2023 OMP are summarised as follows:

- sediment locations SD019, SD023, SD047, SD048, SD062, SD081, SD254 and SD255 were removed given that adequate data for the purposes of establishing site conditions has been collected.

4.4.4 Rationale for biota sample locations

The aquatic biota monitoring locations have been selected to maintain consistency with the monitoring completed under the 2023 OMP and address the requirements of the NSW Government.

Biota sampling will be undertaken in publicly accessible areas under applicable licences and ethics approvals. NSW Government had previously requested that temporal variation of PFAS concentrations in selected sentinel species need to be monitored through the collection of additional samples.

As per the 2023 OMP, the locations will be focused in Fullerton Cove only, refer to **Figure F3** (in **Appendix B**).

Sampling will target sentinel species that has been identified by the former Risk Assessment Working Group (RAWG) (previously appointed by NSW Government) that appear to accumulate elevated concentrations of PFAS relative to other species, namely:

- Dusky Flathead (*Platycephalus fuscus*)
- Luderick (*Girella tricuspidata*)
- School Prawn (*Metapenaeus macleayi*).

A description of these species is provided in Table 5.

Table 5. Aquatic Biota Description

Species	Description
Finfish	
Dusky Flathead (Platycephalus fuscus)	• Dusky Flathead PFAS levels in the Hunter River were considered to be elevated relative to other species, variable and did not follow spatial patterns evident in the other species • Dusky Flathead is a target recreational and commercial species.
Luderick (Girella tricuspidata)	• Found primarily in estuaries and around nearshore rocky reefs. • Spawning occurs in surf zones near estuary entrances during winter, the larvae then enter estuaries and small juveniles live in sheltered shallow water habitats. Adults are mainly found in association with weedy habitats such as seagrass and rocky reefs. Adults migrate to near-coastal waters prior to spawning and may then return to estuaries • Mainly herbivorous, feeding on seagrass and green algae, and sometimes small invertebrates • Mature around 25 cm. Minimum legal length is 27 cm • Important recreational species, minor commercial species.
Crustacea	

Species	Description
School Prawn (Metapenaeus macleayi)	• Inhabit estuaries and inshore ocean waters • Spawn in near shore ocean waters between December and May. Post-larval prawns enter estuaries and move upstream. Following spring the adolescent prawns return down-stream and migrate to sea to mature and spawn • Prefer soft muddy substrates and areas of seagrass • Eat a variety of small invertebrates and detritus • Maximum length 16 cm • Important domestic market.

It is noted that not all species above may be present at Fullerton Cove during the sampling events.

There are no changes to proposed biota sampling locations since the 2023 OMP.

4.5 Sample analysis

Samples will be analysed by a NATA accredited laboratory for a suite of PFAS as outlined in Appendix E, using NATA accredited methods.

Laboratory levels of reporting (LORs) must be selected to achieve the OMP objectives (Section1.2) and the DQO's. Selected off-base groundwater samples (refer to Appendix C) are to be analyzed at a low level limit of reporting (LOR) to enable comparison to the adopted human health (drinking water) screening criteria outlined in Section 6. All other samples are to be analysed at the standard laboratory LOR.

Quality control and quality assurance measures will be outlined within the SAQP.

In addition to PFAS, field measurement of water quality parameters such as pH, electrical conductivity, redox potential, dissolved oxygen and temperature will be undertaken on all surface and groundwater samples.

5 OTHER ASPECTS

To achieve the OMP objectives (Section1.2), inform the CSM and allow assessment of the site risk profile, a review of other aspects will also be undertaken, including (but not limited to) water use surveys, registered bore searches, change in land zoning, changes in land use on/off base, development works, remediation works, etc.

The aspects review requirements are included in Table 6.

Table 6. Other aspects review

Aspect	Review requirements
Information sources	The OMP will consider other sources of information, such as - data obtained from works associated with PMAP implementation, namely remediation actions and further characterisation of source areas or areas of interest (i.e. catchments). - changes that may result from the specific or cumulative impact of remediation or containment actions, existing transportation trends, changes to hydrogeology. - investigations associated with estate planning or works. - other remediation works (non-PFAS) which may also result in changes to existing transportation trends, changes to hydrogeology.
Development works or changes in on-base land use	The OMP will consider development works and/or changes in on-base land use that may have the potential to impact the nature and/or extent of PFAS including: - capture projects planned for the next 12-month monitoring period, particularly where works relate to source areas. - a significant change of land use in source area may require review of OMP, and whether additional monitoring will be required (actions may include installing new monitoring wells or adding new surface water / sediment locations).
Development works or changes in off-base land use	The OMP will consider development works and/or changes in off-base land use that may have the potential to impact the nature and/or extent of PFAS contamination including: - a significant change of land use within Management Area or adjoining land may require review of OMP, and whether additional monitoring will be required (actions may include installing new monitoring wells or adding new surface water / sediment locations).
Significant weather events	The significant weather events could include prolonged wet weather or long dry periods, where rainfall is significantly greater or lower than the monthly averages for the area. Review of these aspects will include: - potential for variability on PFAS concentrations. - potential for surface water or groundwater interaction with source areas could become a significant contributor.

Aspect	Review requirements
Water use surveys	The OMP will consider data collected through the completion of water use surveys to identify any changes in water use or land use activities which may impact the respective risk profiles.
Changes in NSW Government Precautionary Advice and/or geographical extent of current Management Zones	The OMP will consider any changes made by the NSW Government to the geographical extents of the existing management zones and/or associated Precautionary Advice.
Changes in nationally endorsed PFAS Screening Criteria	The OMP will consider any changes to the current human health and ecological screening criteria for PFAS as presented in the Heads of EPA (HEPA) PFAS National Environmental Management Plan 3.1 (PFAS NEMP, 2025) and the Australian Drinking Water Guidelines (NHMRC, 2025).

6 PFAS SCREENING CRITERIA

The adopted screening criteria references the PFAS NEMP 3.1 (HEPA, 2025) and the Australian Drinking Water Guidelines (NHMRC, 2025), Defence estate and environmental strategies, and Defence PFAS-specific strategies and guidance. At the time of preparing this OMP, a number of guidance documents were available in Australia and referred to including:

- PFAS National Environmental Management Plan (NEMP) Version 3.1, Heads of EPA (HEPA) Australia and New Zealand. March 2025 (HEPA, 2025)
- National Health and Medical Research Council (NHMRC), 2019. Guidance on PFAS in Recreational Water. August 2019 (NHMRC, 2019)
- NHMRC, 2025. Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy (NHMRC, 2025).
- FSANZ, 2017. Perfluorinated chemicals in food. Food Standards Australia New Zealand.

The adopted PFAS screening criteria to assess the data collected as part of the monitoring are presented in Table 7, Table 8, and Table 9.

It is noted that at the time this OMP was prepared no HEPA (2025) endorsed criteria was available for PFAS in sediments. Additionally, Defence has focussed on PFOA, PFOS, PFOS+PFHxS and PFBS (groundwater only), which are the PFAS present in AFFF historically used at the base and/or with screening criteria available in Australia.

Table 7 PFAS Adopted Screening Criteria – Human Receptors

Media	Pathway	Compound	Criteria	Comment/Reference
Water – Groundwater	Drinking water	PFOS	0.008 µg/L	The values are from the PFAS NEMP 3.1 (HEPA, 2025) which are based on the NHMRC (2025) values. *All off-base groundwater results will be compared to these criteria.*
		PFHxS	0.03 µg/L	
		PFOA	0.2 µg/L	
		PFBS	1 µg/L	
Water – Surface Water and Groundwater	Recreational use	PFOS + PFHxS	2 µg/L	The values presented in the PFAS NEMP 3.1 (HEPA, 2025) are based on the NHMRC (2019) values. Note: given that groundwater at the base is extracted for irrigation purposes (post treatment), the recreational guidelines have been adopted to be protective of this water use activity. *All surface water and all on- and off-base groundwater results will be compared to these criteria.*

Table 8 PFAS Adopted Screening Criteria - Ecological Receptors

Media	Pathway	Compound	Criteria	Comment/Reference
Water – Groundwater and Surface Water	Freshwater	PFOS	0.02 µg/L	The values are from the PFAS NEMP 3.1 (HEPA, 2025) which are based on the ANZG (2026) values. ANZG (2018) recommends a conservative approach when applying default guideline values (DGVs) for bioaccumulative toxicants. As such the 99% species protection DGV has been selected for application to the slightly-to moderately-disturbed freshwater ecosystem. *All surface water and groundwater results will be compared to these criteria.*
		PFOA	19 µg/L	

Table 9 PFAS Screening Criteria - Aquatic Biota

Media	Compound	Criteria	Comment
Crustaceans, 2 – 6 years (all species)	PFOS	0.065 mg/kg	FSANZ (2017) *Perfluorinated chemicals in food.* Food Standards Australia New Zealand.
	PFHxS	0.065 mg/kg	
	PFOA	0.520 mg/kg	
Finfish, 2 – 6 years (all)	PFOS	0.0052 mg/kg	FSANZ (2017) *Perfluorinated chemicals in food.* Food Standards Australia New Zealand.
	PFHxS	0.0052 mg/kg	
	PFOA	0.0410 mg/kg	

7 TRIGGERS FOR ACTION AND REVIEW

A critical step in establishing an effective monitoring program is to identify performance measures against which the environmental impact of PFAS can be assessed. Once these have been established, an action plan is necessary to describe the measures taken if pre-defined compliance levels are exceeded.

Performance measures designed to monitor the environmental impacts to groundwater and surface water have been assigned on the basis of the following definitions:

- Screening criterion: a water quality standard that is identified as being appropriate to a contaminant in a water body in order to assess the overall impact on water quality.
- Trigger level: a specific assessment criterion applied to a contaminant to assess whether there have been possible adverse trends in environmental monitoring data. A trigger level is used as a tool to alert stakeholders and Regulators of these changes. The trigger levels and responses are described in Table 10.

Table 10. Trigger levels and responses

OMP Trigger	Response Actions
Spatial and Temporal Variability	
First time detect of PFAS at a monitoring location not associated with a known on-base PFAS source area that may suggest that an off-base source unrelated to Defence activities is present. *To be considered potentially significant if above relevant screening criteria and repeat detections occur over two subsequent monitoring events.*	• Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling frequency. • NSW EPA to be notified via Sampling Event Reports and Ongoing Monitoring Reports.
First time detect of PFAS at a monitoring location down gradient of the PFAS plume that suggests PFAS migration is occurring. *To be considered potentially significant if above relevant screening criteria and repeat detections occur over two subsequent monitoring events.*	• Review the CSM and risk profile, and update where required. • If consistent with CSM (i.e. result is expected based on modelling) – no further action required. • If inconsistent with CSM (i.e. result is unexpected) – consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling frequency. • NSW EPA to be notified via Sampling Event Reports and Ongoing Monitoring Reports.

OMP Trigger	Response Actions
New maximum at a monitoring location (a concentration that is considered to be "significant" within the context of the CSM) *Note that new maximum concentrations reported within a known PFAS source area is likely to be less "significant" to the CSM than a new maximum reported outside (upgradient or downgradient) of a known PFAS source area.* *Consider laboratory variability of 30%.* **Significant is considered to be one order of magnitude higher or greater than historical ranges.*	• Assess whether the new maximum concentration is influenced by other factors (e.g. rainfall, remediation and/or other estate works). • Review the CSM and risk profile, and update where required. • Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling. • NSW EPA to be notified via Sampling Event Reports and Ongoing Monitoring Reports.
Increasing trend in groundwater concentrations at base boundary or off-base monitoring locations *Trends are to be determined using a statistical tool (i.e. Mann-Kendall) with a minimum of four (4) data points with concentrations greater than the laboratory LOR.*	• Assess whether trend is influenced by other factors (e.g. rainfall, remediation and/or other estate works). • Review the CSM and risk profile, and update where required. • If consistent with CSM (i.e. result is expected based on modelling) – no further action required. • If inconsistent with CSM (i.e. result is unexpected) – consider whether further assessment is required. • At sensitive locations, e.g. sentinel wells, consider further characterisation of PFAS (e.g. installation of additional monitoring wells) at areas upgradient and downgradient of the monitoring location. • NSW EPA to be notified via Sampling Event Reports and Ongoing Monitoring Reports. • Review OMP to ensure monitoring remains current.
Decreasing trend in groundwater concentrations at a monitoring location or within a specified area *Trends are to be determined using a statistical tool (i.e. Mann-Kendall) with a minimum of four (4) data points with concentrations greater than the laboratory LOR.* *Monitoring locations may be considered to be removed from the OMP if no longer required to assess the CSM and risk profile.*	• Assess whether trend is influenced by other factors (e.g. rainfall, remediation and/or other estate works). • Review the CSM and risk profile, and update where required. • Review OMP to ensure monitoring remains current.
Changes to the CSM	

OMP Trigger	Response Actions
New human health or ecological receptor or exposure path identified associated with a known on-base source area. *New information regarding exposure pathways or receptors may be identified via an updated water use survey, change in land use, new monitoring location, or field observations.*	• Review CSM and risk profile, and update where required. • Review OMP to ensure monitoring remains current.
Drinking water pathway identified in off-base property directly associated with a known on-base source area. *New information regarding exposure pathways or receptors may be identified via an updated water use survey, change in land use, new monitoring location, or field observations.*	• Review CSM and risk profile, and update where required. • Re-iterate NSW Government precautionary advice for the relevant Management Zone to off-base property occupants in the results letter. • Review OMP to ensure monitoring remains current.
Recreational water pathway identified in off-base property directly associated with a known on-base source area. *New information regarding exposure pathways or receptors may be identified via an updated water use survey, change in land use, new monitoring location, or field observations.*	• Review CSM and risk profile, and update where required. • Re-iterate NSW Government precautionary advice for the relevant Management Zone to off-base property occupants in the result letter. • Review OMP to ensure monitoring remains current.
Human Health and Ecological Receptors	

New exceedance of published screening criteria of an off-base or base boundary monitoring location down gradient of an identified PFAS source area, that suggests PFAS migration from a known PFAS source area.
 	
Review to be undertaken following all first-time exceedances of published screening criteria
	• Review the potential water uses at (or nearby) the sampling location and what control measures are in place (including NSW Government Precautionary Advice).
	• If consistent with risk profile – no action.
	• If inconsistent with risk profile:
	  o Notify relevant stakeholders, including property occupants and NSW Government (if required)
	  o Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling frequency.
	  o Review management measures

OMP Trigger	Response Actions
First time exceedance in groundwater of the groundwater exposure point concentration (EPC) used in the 2017 HHRA for the relevant Risk Zone: **Risk Zone A** PFOS+PFHxS: 190.3 µg/L **Risk Zone B** PFOS+PFHxS: 5.67 µg/L **Risk Zone C & D** PFOS+PFHxS: 0.05 µg/L	• Review the potential water uses at (or nearby) the sampling location and what control measures are in place (including NSW Government Precautionary Advice). • If consistent with risk profile – no action. • If inconsistent with risk profile: o Notify relevant stakeholders, including property occupants and NSW Government (if required) o Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling frequency. o Review management measures
First time exceedance in surface water of the surface water EPC used in the 2017 HHRA: **Marine Water** PFOS: 1.78 µg/L, PFHxS: 1.48 µg/L **Region 1** PFOS: 5.035 µg/L, PFHxS: 1.666 µg/L **Region 2** PFOS: 1.47 µg/L, PFHxS: 1.009 µg/L **Region 3** PFOS: 7.743 µg/L, PFHxS: 6.773 µg/L	• Review the potential water uses at (or nearby) the sampling location and what control measures are in place (including NSW Government Precautionary Advice). • If consistent with risk profile – no action. • If inconsistent with risk profile: o Notify relevant stakeholders, including property occupants and NSW Government (if required) o Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling frequency. o Review management measures
Other Considerations	
Changes to Precautionary Advice by NSW Government *The OMP will consider any changes made by the NSW Government to precautionary advice.*	• Review OMP to ensure monitoring remains current.
Changes to endorsed screening criteria in Australia	• Revision of the OMP SAQP to include the most up to date screening criteria • Revise the OMP to ensure monitoring remains current.

8 REPORTING REQUIREMENTS

8.1 Reporting

After each monitoring event, information, field and laboratory data will be documented in a Sampling Event Report.

At the end of a specified monitoring period (typically 12 months but may vary) the whole data set (including the current and historic data) will be reviewed, and an Ongoing Monitoring Report prepared.

The Ongoing Monitoring Report will report on the objectives of the OMP, which are to identify and evaluate:

- spatial, and temporal (including seasonal) variability of PFAS in the environment
- changes to sources, transport pathways or receptors, described as a conceptual site model (CSM) for the base
- changes in risks to human and environmental receptors
- the influence that risk management activities at the base, as outlined in the 2023 PMAP have had on PFAS in the environment, and
- whether the identified changes trigger a prescribed action and/or review (Section 7).

8.2 Stakeholder engagement

Engagement with a range of stakeholders, such as NSW Government, Councils, other agencies, and the community will be undertaken. A stakeholder engagement plan will be prepared and/or updated to manage the engagement process.

Where off-base monitoring is undertaken on a private property a separate letter will be provided to the stakeholder presenting the results of the monitoring event.

The OMP will be published on the Defence website, along with the current PMAP and Ongoing Monitoring Report.

APPENDIX A REFERENCES

AECOM, 2017. Off-Site Human Health Risk Assessment – December 2017– RAAF Base Williamtown Stage 2B Environmental Investigation. 1 December 2017.

AECOM, 2018. Ecological Risk Assessment – September 2018 - RAAF Base Williamtown Stage 2B Environmental Investigation. 7 December 2018.

AECOM, 2025 Sampling and Analysis Quality Plan – PFAS OMP, RAAF Base Williamtown (Revision D), 25 September 2025.

AECOM, 2025. Ongoing Monitoring Report, 2024. PFAS OMP, RAAF Base Williamtown, 18 July 2025.

AECOM, 2025. Groundwater Monitoring Plan, Western Region Wellfield, RAAF Base Williamtown. 7 August 2025.

Defence, 2019. PFAS Management Area Plan. RAAF Base Williamtown. Revision 1, 27 May 2019.

Defence, 2023a. PFAS Management Area Plan. RAAF Base Williamtown. Revision 1 , September 2023.

Defence, 2023b. PFAS Ongoing Monitoring Plan – RAAF Base Williamtown, November 2023

Defence, 2024. PFAS Ongoing Monitoring Program Reporting Guidance. Directorate of PFAS Remediation Infrastructure Division, Version 0, dated 29 February 2024.

Geosyntec, 2022. Remedial Options Assessment, Royal Australian Airforce Base Williamtown. 16 September 2022.

APPENDIX B FIGURES

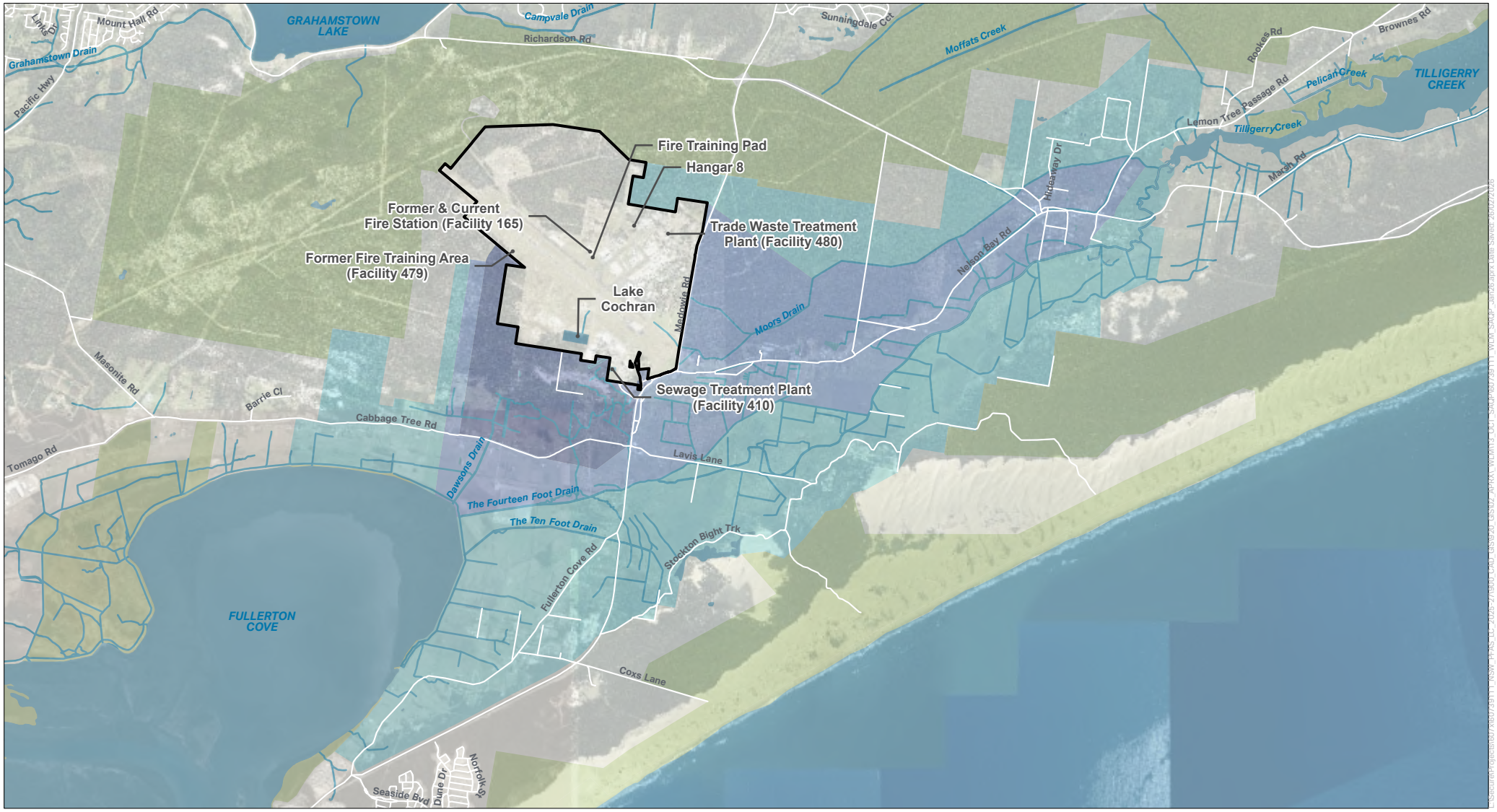
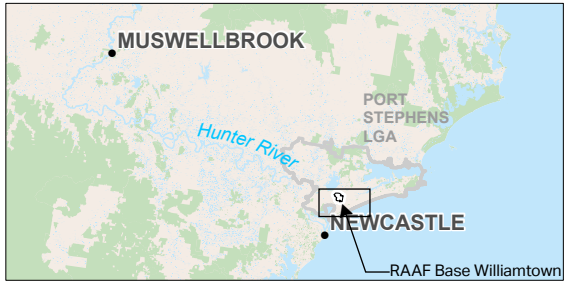


FIGURE F1: SITE LOCATION AND MANAGEMENT AREA

Legend

- RAAF Base Williamtown - Active Base Boundary
- Primary Management Zone
- Secondary Management Zone
- Broader Management Zone



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PROJECT
PFAS OMP
RAAF BASE WILLIAMTOWN

CLIENT
DEPARTMENT OF DEFENCE

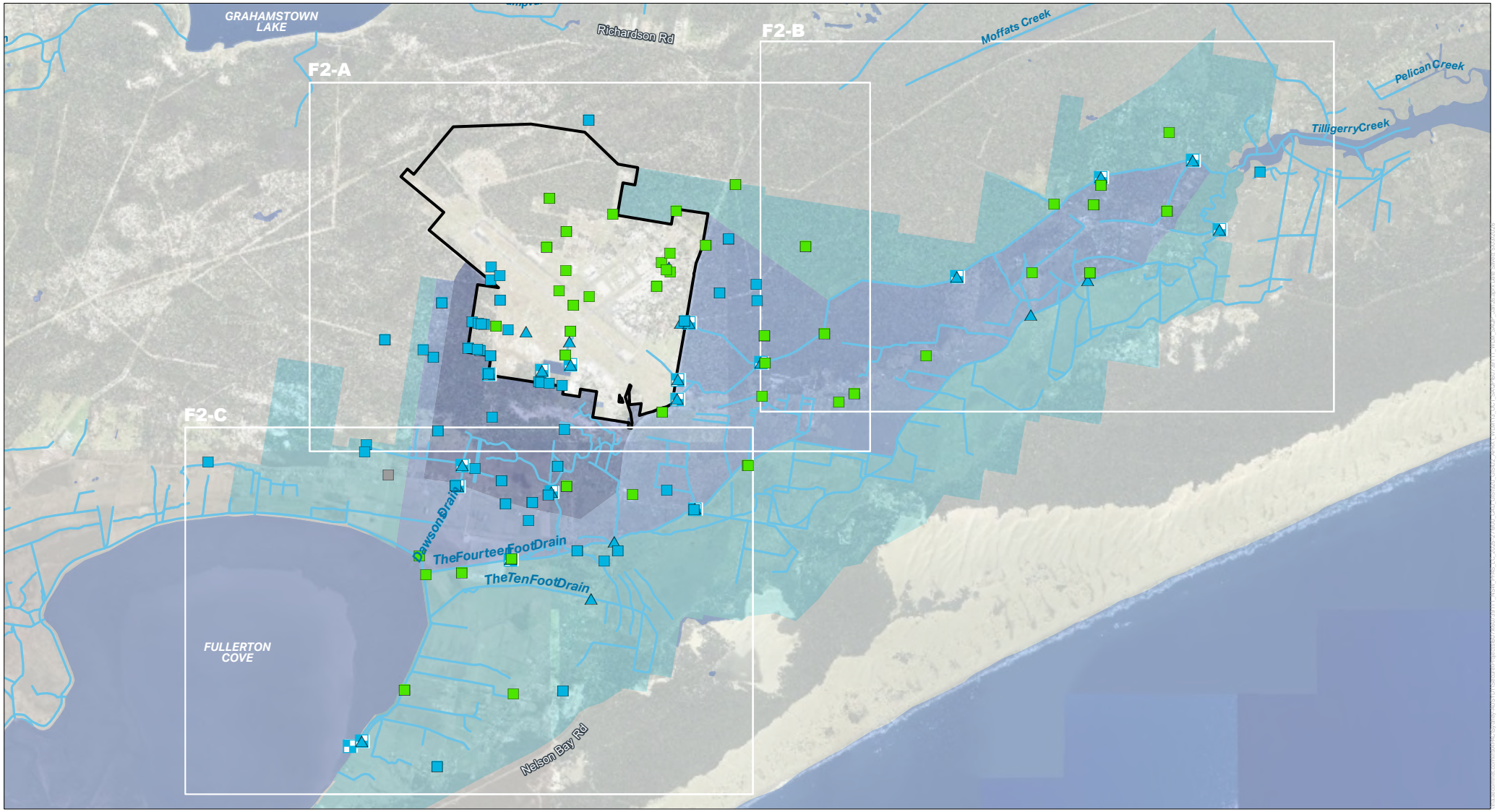

FIGURE F2-0: OMP LOCATIONS - OVERVIEW

Legend

- RAAF Base Williamtown - Active Base Boundary
- Watercourse
- Primary Management Zone
- Secondary Management Zone
- Broader Management Zone
- Sediment
- Groundwater
- Surface Water
- Annual Sampling
- Biannual Sampling
- Gauge Only

N

0 0.5 1 km

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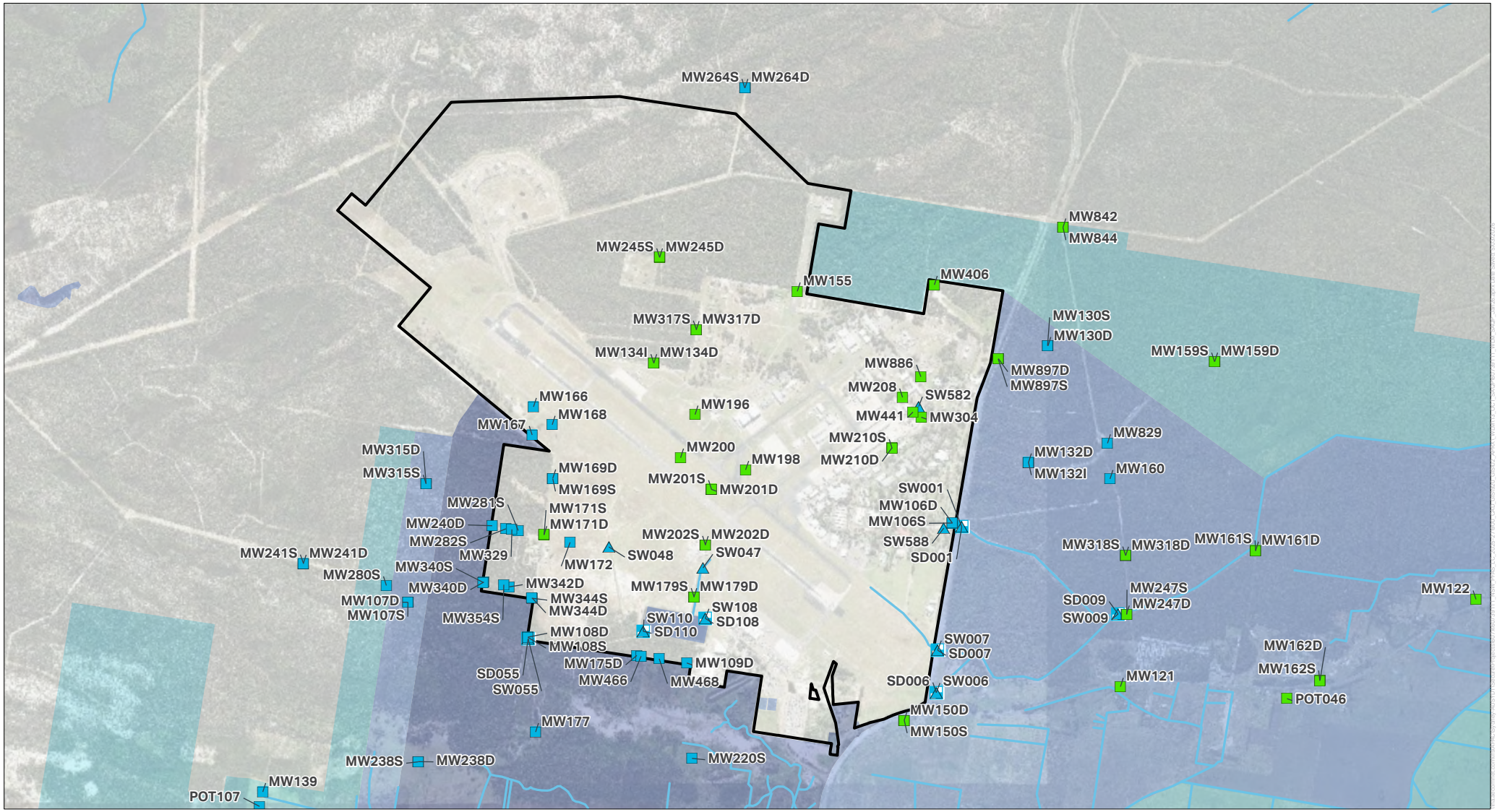

FIGURE F2-A: OMP LOCATIONS – BASE AND WEST

Legend

- RAAF Base Williamtown - Active Base Boundary
- Watercourse
- Primary Management Zone
- Secondary Management Zone
- Broader Management Zone
- Sediment
- Groundwater
- Surface Water
- Annual Sampling
- Biannual Sampling
- Gauge Only

N

0 0.5 1 km

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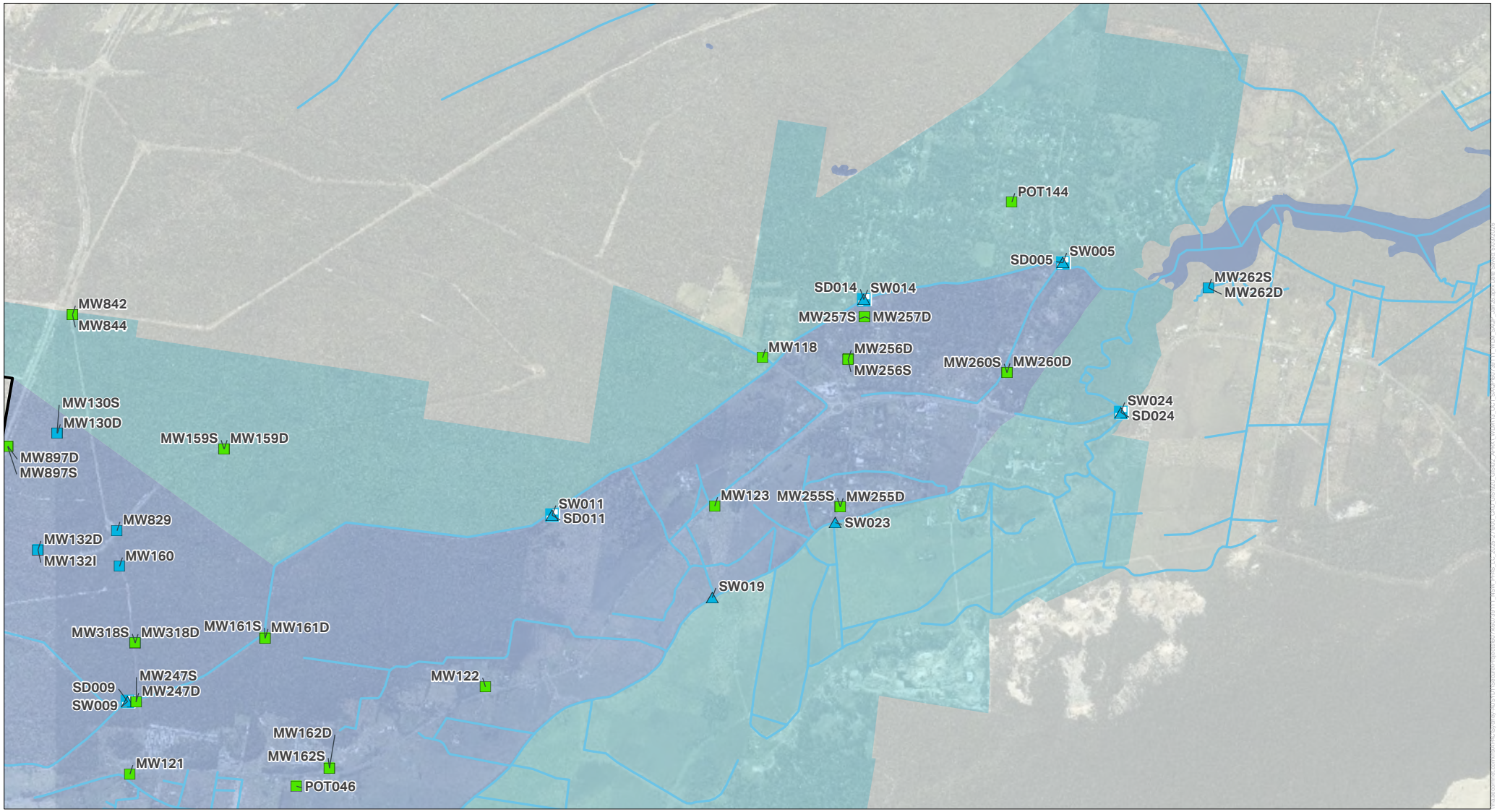

FIGURE F2-B: OMP LOCATIONS – EAST

Legend

- RAAF Base Williamtown - Active Base Boundary
- Watercourse
- Primary Management Zone
- Secondary Management Zone
- Broader Management Zone
- Sediment
- Groundwater
- Surface Water
- Annual Sampling
- Biannual Sampling
- Gauge Only

N

0 0.5 1 km

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FIGURE F2-C: OMP LOCATIONS – SOUTH

Legend

- RAAF Base Williamtown - Active Base Boundary
- Watercourse
- Primary Management Zone
- Secondary Management Zone
- Broader Management Zone
- Sediment
- Groundwater
- Surface Water
- Annual Sampling
- Biannual Sampling
- Gauge Only

N

0 0.5 1 km

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FIGURE F3: BIOTA SAMPLING AREA

Legend

- RAAF Base Williamtown - Active Base Boundary
- Biota Sampling Area
- State Conservation Area
- Watercourse

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0 1 2 km

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RAAF BASE WILLIAMTOWN

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APPENDIX C SAMPLE LOCATION INFORMATION

APPENDIX D OMP REVIEW

Table 11 OMP monitoring location and frequency review

Location	Does the location inform the nature of PFAS at the site	Does the location inform the extent of PFAS at the site	Does the location inform the risk profile at the site	Does the sampling frequency inform the risk profile	OMP Review Outcome	Reason
Groundwater Monitoring Locations						
MW104D	-	-	-	-	*Remove from OMP*	*These wells have been destroyed and are no longer able to be sampled*
MW104S	-	-	-	-		
MW132I	-	-	-	-	*Location ID Updated*	*This well was previously identified as MW132S*
MW137	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on biannual frequency ongoing*	*New location to monitor the western extent of the plume*
MW139	*No*	*Yes*	*No*	*No*	*Add to OMP on biannual frequency*	*Defence approved stakeholder request to add this location to the OMP in 2024*
POT107	*No*	*Yes*	*No*	*No*		
MW142D	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on annual frequency*	*New locations to monitor concentrations in groundwater between the base and Fullerton Cove*
MW142S	*No*	*Yes*	*Yes*	*Yes*		
MW144	*No*	*Yes*	*Yes*	*Yes*		
MW177	*No*	*Yes*	*No*	*Yes*	*Add to OMP on biannual frequency*	*Alternative sampling location to MW184S and MW184D*

Location	Does the location inform the nature of PFAS at the site	Does the location inform the extent of PFAS at the site	Does the location inform the risk profile at the site	Does the sampling frequency inform the risk profile	OMP Review Outcome	Reason
MW184D	*-*	*-*	*-*	*-*	*Remove from OMP*	*These wells have been destroyed and are no longer able to be sampled*
MW184S	*-*	*-*	*-*	*-*		
MW185S	*No*	*Yes*	*No*	*Yes*	*Add to OMP on biannual frequency*	*Alternative sampling location to MW104S and MW104D*
MW220S	*No*	*Yes*	*No*	*Yes*		
MW247S	*No*	*Yes*	*Yes*	*No*	*Decrease sampling frequency to annual*	*Due to decreasing trends for PFOA, PFOS, PFHxS and PFBS concentrations*
MW252S	*No*	*Yes*	*Yes*	*No*	*Decrease sampling frequency to annual*	*Due to decreasing trends for PFOA, PFOS, PFHxS and PFBS concentrations*
MW262S	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on biannual frequency*	*New locations outside the BMZ to monitor the eastern extent of the plume near Salt Ash*
MW262D	*No*	*Yes*	*Yes*	*Yes*		
MW266S	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on annual frequency*	*New locations to monitoring the southern extent of the plume near Fullerton Cove*
MW266D	*No*	*Yes*	*Yes*	*Yes*		
MW268S	*No*	*Yes*	*No*	*No*	*Add to OMP on biannual frequency*	*New sentinel locations to monitor the southern extent of the plume near Fullerton Cove*
MW268D	*No*	*Yes*	*No*	*No*		

Location	Does the location inform the nature of PFAS at the site	Does the location inform the extent of PFAS at the site	Does the location inform the risk profile at the site	Does the sampling frequency inform the risk profile	OMP Review Outcome	Reason
MW318D	*No*	*Yes*	*Yes*	*Yes*	*Increase sampling frequency to biannual*	*Due to an increasing trends for PFOA, PFOS and PFHxS concentrations*
MW354S	*-*	*-*	*-*	*-*	*Location ID Updated*	*This well was previously identified as MW354*
MW538	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on annual frequency*	*New location to monitor concentrations in groundwater between the base and Fullerton Cove.*
POT046	*No*	*No*	*Yes*	*Yes*	*Add to OMP on annual frequency*	*Defence approved stakeholder request to add this location to the OMP in 2024*
POT236	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on annual frequency*	*Defence approved stakeholder request to add this location to the OMP in 2024*
POT144	*No*	*Yes*	*Yes*	*Yes*	*Add to OMP on annual frequency*	*Defence approved stakeholder request to add this location to the OMP in 2024*
Sediment Monitoring Locations						
SD047	*No*	*No*	*No*	*No*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions. Downstream sediment monitoring locations in OMP.*
SD048	*No*	*No*	*No*	*No*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions.*

Location	Does the location inform the nature of PFAS at the site	Does the location inform the extent of PFAS at the site	Does the location inform the risk profile at the site	Does the sampling frequency inform the risk profile	OMP Review Outcome	Reason
						Downstream sediment monitoring locations in OMP.
SD062	*No*	*Yes*	*Yes*	*Yes*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions*
SD081	*No*	*Yes*	*Yes*	*Yes*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions*
SD254	*No*	*Yes*	*Yes*	*Yes*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions*
SD255	*No*	*Yes*	*Yes*	*Yes*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions*
SD019	*No*	*Yes*	*Yes*	*Yes*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions*
SD023	*No*	*Yes*	*Yes*	*Yes*	*Remove from OMP*	*Adequate data for the purposes of establishing site conditions*

APPENDIX E PFAS ANALYTICAL SUITE

Target analytes	
Perfluoroalkane sulfonic acids	
PFBS	Perfluorobutane sulfonic acid
PFPeS	Perfluoropentane sulfonic acid
PFHxS	Perfluorohexane sulfonic acid
PFHpS	Perfluoroheptane sulfonic acid
PFOS	Perfluorooctane sulfonic acid
PFDS	Perfluorodecane sulfonic acid
Perfluoroalkyl carboxylic acids	
PFBA	Perfluorobutanoic acid
PFPeA	Perfluoropentanoic acid
PFHxA	Perfluorohexanoic acid
PFHpA	Perfluoroheptanoic acid
PFOA	Perfluorooctanoic acid
PFNA	Perfluorononanoic acid
PFDA	Perfluorodecanoic acid
PFUnDA	Perfluoroundecanoic acid
PFDoDA	Perfluorododecanoic acid
PFTrDA	Perfluorotridecanoic acid
PFTeDA	Perfluorotetradecanoic acid
Perfluoroalkyl sulfonamides	
FOSA	Perfluorooctane sulfonamide
MeFOSA	N-Methyl perfluorooctane sulfonamide
EtFOSA	N-Ethyl perfluorooctane sulfonamide
MeFOSE	N-Methyl perfluorooctane sulfonamidoethanol
EtFOSE	N-Ethyl perfluorooctane sulfonamidoethanol
MeFOSAA	N-Methyl perfluorooctane sulfonamidoacetic acid
EtFOSAA	N-Ethyl perfluorooctane sulfonamidoacetic acid
(n:2) Fluorotelomer sulfonic acids	
4:2 FTS	4:2 Fluorotelomer sulfonic acid
6:2 FTS	6:2 Fluorotelomer sulfonic acid
8:2 FTS	8:2 Fluorotelomer sulfonic acid
10:2 FTS	10:2 Fluorotelomer sulfonic acid