SINGLETON MILITARY AREA

PFAS ONGOING MONITORING PLAN

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SINGLETON MILITARY AREA

PFAS ONGOING MONITORING PLAN

April 2025

ACKNOWLEDGEMENT OF COUNTRY

We respectfully acknowledge and pay respects to past, present and emerging Elders of the Traditional Owners of Country and First Nations cultures and countries upon which we live and work in. We extend our respects to our Aboriginal and Torres Strait Islander colleagues who we are working with, engaging with and learning from throughout this program and beyond. We also pay respect to the Aboriginal and Torres Strait Islander men and women who have contributed to the defence of Australia in times of peace and war.

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GLOSSARY

AFFF	Aqueous Film Forming Foam
AHD	Australian Height Datum
ALG	Alternate Landing Ground
AS	Australian Standard
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure, as amended 2013
Base	Singleton Military Area
COC	Chain of Custody
CSM	Conceptual Site Model
DNSDC	Defence National Storage and Distribution Centre
DO	Dissolved Oxygen
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EC	Electrical Conductivity
EPA	Environment Protection Authority (or relevant state/territory jurisdiction)
EPBC	Environmental Protection & Biodiversity Conservation
ERA	Ecological Risk Assessment
FFTA	Former Firefighting Training Area
FSANZ	Food Standards Australia New Zealand
HHERA	Human Health and Ecological Risk Assessment
HHRA	Human Health Risk Assessment
HLG	Helicopter Landing Ground
LOR	Limit of Reporting
NATA	National Association of Testing Authorities
NEMP	National Environmental Protection Measure
Off-site	Off-base (or other Defence property)
OMP	Ongoing Monitoring Plan
OMR	Ongoing Monitoring Report
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

PMAP	PFAS Management Area Plan
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
SER	Sampling Event Report
SFARP	So Far as Reasonably Practicable
SMA	Singleton Military Area
Source	A source can be primary or secondary. Primary sources are generally areas where Aqueous Film Forming Foam (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.
STA	Singleton Training Area
STP	Sewage Treatment Plant
SWL	Standing Water Level
TDI	Tolerable Daily Intake
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
WUS	Water Use Survey

1 INTRODUCTION

1.1 Background

In 2021 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 Singleton Military Area (SMA) 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.

As outlined in the PMAP recommended actions (Action 5), Defence will consult with NSW Government and other stakeholder during the update and implementation of the OMP. The reports developed as part of the implementation will continue to be provided to NSW government for review and feedback.

This Ongoing Monitoring Plan (OMP) replaces the OMP (Defence, 2021a) for Singelton Military Area.

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 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 PMAP (Defence, 2021b) 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 2025 (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 the References section of this document.

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) (AECOM, 2019b)
- DSI Addendum (AECOM, 2021a)
- Human Health and Ecological Risk Assessments (HHERA) (AECOM, 2021b)
- Former Cantonment Fire Station Limited PFAS Soil Investigation (AECOM, 2024e)
- Surface Water Mass Flux Assessment (AECOM, 2025)
- Ongoing Monitoring Program data (2022 – 2025)

- Management of risks documented in the PMAP (Defence, 2021b) (https://www.defence.gov.au/sites/default/files/2024-02/202112SingletonPMAPReport.pdf).

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 results may trigger a review of the OMP.
- The state of knowledge presented within the above documents, including:
  - Historical use of aqueous film forming foam (AFFF)
  - PFAS results (on- and off-base)
  - Conceptual site model (CSM)
  - Community surveys.
- That state of knowledge presented within the PFAS Ongoing Monitoring Report for 2024, including PFAS results on- and off-base.
- Proposed management / remediation options based on current proven technology available at the time of writing this document:
  - Management and remedial technologies summarised in the PFAS NEMP (2025)
  - Additional technologies based on successful trials within and outside of Australia (based on publicly available information)
  - Technologies that are not considered economically viable or feasible for use have been excluded (as recommended in PFAS NEMP [2025]).
- Government issued guidelines, advisories and policies
- Base infrastructure development and access constraints at the time of this report
- Access to off-base private properties will be granted. It is noted that off-base access has not been granted at some key locations.

2 SITE SETTING

2.1 Base description

The SMA is a large and important military base located at Range Road, Singleton, in the Hunter Valley region of New South Wales.

The SMA is comprised of Lone Pine Barracks (the Cantonment) and the Singleton Training Area (STA) and is located approximately 8km south of the township of Singleton. The SMA comprises the barracks houses, the School of Infantry, Joint Logistics Unit East (Hunter Valley), the Australian Army Infantry Museum as well as Estate & Infrastructure Group SMA. Support activities undertaken primarily at the Cantonment include vehicle maintenance, storage and distribution of fuels and equipment wash-down. A fire station was operational at the Cantonment between 1963 and 1994, and associated activities included historical firefighting training with AFFF (primarily 3M Lightwater) and equipment maintenance and testing. 3M Lightwater is no longer stored or used at the SMA.

The STA is an approximately 15,000 hectare firing range located between the Cantonment (to the north), Brokenback Range (south), the Hunter Vineyards (east), and the Mount Thorley Mine area (west). The STA is comprised of a number of former and active ranges for weapons firing, vehicle training and explosives testing.

The monitoring area comprises the SMA and neighbouring properties to the north, northwest and northeast.

2.2 Site setting

There are two distinct areas for PFAS ongoing monitoring, they are:

1. **On-base**: which includes on-base areas where the PFAS sources were identified as follows:
    a. Lone Pine Barracks (the Cantonment):
        i. Former Cantonment Fire Station and surrounding area
        ii. Defence National Storage and Distribution Centre (DNSDC)
        iii. Alternate Landing Ground (ALG) and Associated Former Firefighting Training Area (FFTA)
        iv. Helicopter Landing Ground (HLG)
    b. Singleton Training Area (STA)
        i. Dochra Airfield.
2. **Off-base monitoring area**: which includes private properties to the northwest, north and northeast of the SMA.

The on-base monitoring area is shown on **Figure F1** in **Appendix B**.

Environmental investigations undertaken by Defence have shown that the migration of PFAS from the SMA and the Singleton Sewage Treatment Plant (STP) has and is continuing to impact surface water, and to a lesser extent groundwater, within the off-base monitoring area.

Climate

The climate at the base is characterised as temperate, with cool winters and warm summers. Winter months (May – October) are typically drier than summer months (November – April).

The Bureau of Meteorology (BoM) at Singleton Military Defence Area (station number: 061430) has recorded the climate statistics on base since 2017, presenting a record of approximately 8 years. The following is a historic summary of temperature and rainfall data from this station:

- Mean monthly maximum temperatures have varied between 16.7°C in July 2022 and 36.1°C in January 2019.
- Annual rainfall at the base is ranges between 344 mm and 1026 mm per annum.
- Mean monthly rainfall is highest between October and March, averaging 81.2 mm per month, and lowest from April to September averaging 28.5 mm per month.

The annual rainfall between July 2023 and June 2024 was 446 mm, drier than the previous monitoring period.

Topography

The base and its surrounds are located in the central lowlands along the Hunter River and characterised by undulating to rolling hills and inclines on weak sedimentary rocks. The base is dominated by moderate to gently sloping inclines and hills, with the foothills of the Broken Back Ranges rising steeply at the southern extent of the base.

Hydrology

The base comprises several drainage lines that ultimately drain north and east towards the Hunter River (located approximately 2 kilometres north of the base boundary). The primary on-base drainage lines include:

- Mudies Creek and Emigrant Creek along the western and eastern boundaries of the Dochra Airfield
- a number of creeks emanating from the southern area of the base. Note that based on non-detection of PFAS and lack of identified source areas, these waterways were not considered further during the Detailed Site Investigation (DSI) (AECOM, 2019b).
- Doughboy Hollow Creek, which traverses the base before discharging off-base towards Whittingham. Doughboy Hollow Creek, and two unnamed tributaries, drain the Cantonment via three sub-catchments described below and presented on **Figure F2** in **Appendix B**:
    - **Sub-Catchment A**: Northern portion of the Cantonment. The primary drainage line is an unnamed tributary of Doughboy Hollow Creek which flows in a northerly direction and discharges off-base at the northern Cantonment boundary. In addition to runoff via the unnamed tributary of Doughboy Hollow Creek, surface water runoff from the Cantonment during heavy rainfall events may occur via overland flow.
    - **Sub-Catchment B**: Central portion of the Cantonment. The primary drainage line is an unnamed tributary of Doughboy Hollow Creek which flows in a north-westerly direction and discharges off-base at the western Cantonment boundary down-gradient of the HLG.
    - **Sub-Catchment C**: Southern portion of the Cantonment. The primary drainage line is the main watercourse of Doughboy Hollow Creek which flows in a north-westerly direction and discharges off-base at the western Cantonment boundary in the vicinity of the landfill and former flame thrower range.

The off-base areas comprise a number of water bodies including private dams and smaller drainage lines located on private properties.

The STP to the north of the base receives wastewater from both the base and wider Singleton township. The wetland east of the STP is understood to have hydraulic connectivity with groundwater present within the Hunter River alluvial floodplain at Whittingham. Therefore, surface water that migrates from Doughboy Hollow Creek to the wetland area east of the STP may provide recharge of groundwater present in the Hunter River alluvial floodplain.

Geology and Hydrogeology

The base and surrounding areas are located within the northern part of the Sydney Basin which is characterised by Permian and Triassic aged sedimentary rock. The lithology underlying the base is Narrabeen Group which is composed of sandstone with some conglomerate, claystone, and shale. Some less prominent rocks present in the area include quartzose sandstone of the Hawkesbury Sandstone, siltstone, and tuff. Coal measures are also extensive consisting of black coal interbedded with sandstone, shale mudstone, conglomerate with minor chert and tuff.

The soils within the low-lying areas of the base consist primarily of alluvial soils, yellow and red podzolic soils. Towards the southern extent of the base where elevation is higher, the soil profiles are thinner and are classified as silty clays and silty loams.

The hydrogeology of the base can be summarised into four notable sub-units.

- The **perched groundwater unit** is an unconfined discontinuous perched zone within the sediments flanking creeks. Groundwater is present within the alluvium/colluvium flanking major water courses across the base. Recharge is mainly from rainfall and the zone periodically dries out following extended periods of low rainfall.
- The **alluvial groundwater unit** presents groundwater in the low-lying part of the base, within the alluvial sediments of the Hunter River floodplain. It is an unconfined aquifer and recharges predominantly from surface water. This zone has suitable yield used for irrigation, agriculture, and farming.
- In the weathered zone of the Permian bedrock lies the **shallow groundwater unit** where its presence is reliant on rainfall. The groundwater is perched above geological zones of low hydraulic conductivity such as clay or shale lenses within the bedrock. Groundwater quality within this unit is generally poor due to the leaching of salts from the Permian bedrock, which has been confirmed by the DSI (AECOM, 2019b) and sampling under the OMP.
- The **deep groundwater unit** forms the regional aquifer underlying the base. Rock porosity and the interconnection of void space highly dictates the flow of groundwater through this aquifer, followed by structural features in the rock.

The previous investigations and monitoring have indicated groundwater flows in a general northerly direction towards the Hunter River.

Flora and Fauna

The species or species habitat which are known to occur at the base and are listed as threatened species (under Environmental Protection and Biodiversity Conservation (EPBC) Protected Matters Search Tool as reported in the OMP) are as follows:

- Birds: the regent honeyeater and swift parrot are critically endangered
- Mammals: the spot-tailed quoll is endangered
- Plants: *Euphrasia arguta* (annual herb) and *Prasophyllum sp. Wybong* (terrestrial orchid) are critically endangered
- Reptiles: the broad-headed snake is vulnerable.

An ecological survey of terrestrial habitats completed as part of the HHERA (AECOM, 2021b), identified one threatened species: the River Red Gum, whose Hunter population is listed as endangered under the EPBC Act. No threatened fauna species were observed, and a habitat assessment noted that threatened amphibian species are considered unlikely to occur within the surveyed areas.

The ecological survey of aquatic habitats identified a range of aquatic invertebrates at surveyed locations, including lower trophic level species (e.g. gastropods) and higher trophic level species (e.g. yabbies).

Current and Potential Future Land Uses

The current uses of land surrounding the SMA are summarised in **Table 1**. It is anticipated that the land uses surrounding SMA will remain reasonably similar for the foreseeable future. However, any new information pertaining to changes in land use could trigger a review and/or update of the HHERA (AECOM, 2021b). Additionally, it is noted that there is the potential that off-property activities and/or businesses may have used or generated wastes containing PFAS for various purposes.

Table 1: Land Uses Surrounding Singleton Military Area

Direction	Description
North	Grazing land and the floodplain areas of Whittingham and Glenridding, as well as the STP owned by Singleton Council. The Whittingham Fire Station and Airstrip are located 1 kilometre and 1.3 kilometres northeast, respectively
South	The Pokolbin State Forest and the Broken Back Range are located to the south of the base. Hunter Valley vineyards are located further southeast of the base.
East	A mix of rural and semirural land holdings including sparsely wooded open land and pastureland is to the east. The Hunter River lies to the northeast, irrigating the croplands on the floodplains.
West	Grazing land and irrigated cropland within the floodplains of the Hunter River are located immediately west of the base.

3 EXTENT OF PFAS CONTAMINATION

3.1 Source areas

PFAS source areas can be primary or secondary. Primary sources are generally areas of PFAS contamination where 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. PFAS can generally travel from a source to human or environmental receptors by surface water and groundwater. These are referred to as “migration pathways”.

The PMAP (Defence, 2021b) provided a list of primary and secondary PFAS source areas that were identified in the DSI (AECOM, 2019b), as summarised below:

- On-base PFAS Source Areas:
  - Former Cantonment Fire Station and Fire Training Pits (CSR ID 000213) (PFAS in soil, surface water, groundwater and concrete)
  - Defence National Storage and Distribution Centre Compound (CSR ID 000800) (PFAS in soil, groundwater, surface water and sediment)
  - Alternate Landing Ground (PFAS in soil, surface water and sediment) (CSR ID 001048)
  - Dochra Airfield (CSR ID 000774) (PFAS in soil, groundwater, surface water and sediment)
  - Helicopter Landing Ground (PFAS in soil, groundwater, surface water and sediment) (CSR ID 001049)
- There is the potential that off-base activities and/or businesses may have used or generated wastes containing PFAS.

The PFAS source areas are presented on **Figure F3** in **Appendix B**.

Defence completed a targeted investigation of surface soils at the Former Cantonment Fire Station in February 2024 in accordance with PMAP, (2021). The purpose of the investigation was to evaluate whether the PFAS in surface soils are likely to be a significant contributor to PFAS concentrations identified in surface water at the northern base boundary.

The investigation comprised 29 samples collected from the former fire station footprint (demolished in 2022) and surrounding areas. The findings of this investigation indicated that the PFAS in surface soils at the Former Cantonment Fire Station present a low risk to human and/or ecological receptors and are unlikely to be a significant contributor to PFAS concentrations identified in surface water at the northern base boundary. On this basis no further investigation at the Former Cantonment Fire Station was considered warranted.

3.2 Transport pathways

Sampling of surface water and sediment in the creeks that drain the SMA identified that PFAS is migrating from on-base source areas via surface water. These off-base surface water discharges occur via:

- Mudies Creek, Emigrant Creek discharging from the STA and ultimately towards the Hunter River
- Doughboy Hollow Creek, which exits the base at the western boundary of the Cantonment (Sub-Catchment C), flowing to the west of the Cantonment in a north-westerly direction, before winding northeast towards Army Camp Road and entering into the off-base monitoring area. Two unnamed tributaries of Doughboy Hollow Creek exit the Cantonment at the western Cantonment boundary (via Sub-Catchment B) and the northern Cantonment boundary (via Sub-Catchment A)

- Down gradient of the STP it is likely that Doughboy Hollow Creek soaks through the alluvial soils, providing recharge to groundwater. This groundwater may then be used for irrigation (north, northeast and east of the wetland, and particularly east of New England Highway), redistributing PFAS impacts across a broader area, which will ultimately migrate back to groundwater
- The sewer which connects the SMA to the STP. It is understood that the sewer network transfers sewage and stormwater from the SMA to the pumping station of the STP
- Overland flow to the east of Sub-Catchment A down gradient of the DNSDC
- Drainage line down gradient of the Alternate Landing Ground (within Sub-Catchment A) which discharges off-base under Range Road.

Residual PFAS within the soil and sediment profiles can leach to surface water and groundwater, and there is evidence that surface water also infiltrates vertically to groundwater. Following heavy rainfall, surface water is noted to accumulate in the Doughboy Hollow floodplain, located downgradient and to the northwest of the Cantonment. Surface water flows that accumulate here may allow contaminants to seep into the shallow groundwater present within the alluvial soils of the Hunter River floodplain.

Defence completed a targeted surface water mass flux study in 2024 to establish a baseline estimate of PFAS mass flux in surface water at the northern Cantonment boundary (AECOM, 2025) in accordance with PMAP Action 3. The study found that an average of 35 g of PFAS is discharged annually at the Site boundary with median flow rate of around 790 L/s during the mass flux monitoring events.

Groundwater flow direction from the SMA is in northerly direction towards the Hunter River.

The spatial distribution of PFAS detections in groundwater is limited and, in some cases isolated, and it is considered unlikely that groundwater migration is a significant transport mechanism off-base.

Based on the data, the principal PFAS migration pathway is via surface water, including areas of overland flow. Catchment drainage regimes at the SMA are characterised by rapid overland flow and little ponding in the upper catchments, and more defined flows with greater potential for ponding in the lower catchments.

3.3 Receptors and risks

Receptors

The receptors associated with the SMA and surroundings include:

- residents (including adults, children and infants)
- recreational users of waterways on private property
- outdoor workers, either on private property (e.g. agriculture, grounds maintenance) or on public land (e.g. utilities maintenance)
- aquatic and terrestrial ecosystems in Doughboy Hollow Creek and users of surface water in those water bodies.
- aquatic and terrestrial ecosystems within dams located adjacent Army Camp Road and the ephemeral portion of Doughboy Hollow Creek and users of surface water in those water bodies.
- aquatic and terrestrial ecosystems in Doughboy Hollow Creek and users of surface water to the north and northeast of the SMA.

- aquatic and terrestrial ecosystems in Muddies Creek, Emigrants Creek and the Hunter River and users of surface water to the north and northeast of the SMA.
- terrestrial fauna (including invertebrates, reptiles, mammals and birds) and flora with exposure to PFAS in soil

Identified Risks

Potential unacceptable risks identified by the HHERA (AECOM, 2021b) are as follows:

- Ingestion of home-grown red meat from sheep or cattle that have consumed water containing detectable PFAS or have grazed in areas irrigated or flooded with water containing detectable PFAS.
- Ingestion of home-grown milk from cows that have consumed water containing detectable PFAS or have grazed in areas irrigated or flooded with water containing detectable PFAS.
- Cumulative ingestion of home-grown red meat, of home-grown milk from cows from sheep or cattle and of eggs from home-grown backyard poultry that have consumed water containing detectable PFAS or have grazed / roamed in areas irrigated or flooded with water containing detectable PFAS.

Drinking groundwater may present a future risk to off-base users of groundwater (it is not known to currently occur), should the land and water use change including groundwater extraction as a drinking water source occur near the SMA.

Groundwater is not currently known to be used as a drinking water supply within the off-base area monitored by Defence (refer to the study area defined in the HHERA [AECOM, 2021b]).

The ecological risk assessment (HHERA as presented in AECOM [2021b]) concluded that there is low to minimal potential for direct or indirect risks to ecological (aquatic and terrestrial) receptors from exposure to PFAS in the Study/Investigation Area. Thus, no site management measures are considered necessary to abate PFAS exposure to ecological receptors.

4 ONGOING MONITORING PLAN

This section sets out the data quality objectives, monitoring scope and assessment requirements. Changes made to the previous OMP (Defence, 2021a) are summarised in the following sections, and supporting rationale is provided in **Appendix D**.

4.1 Sampling and Analysis Quality Plan

A Sampling, Analysis and Quality Plan (SAQP) will be developed prior to implementation of this OMP. The SAQP is required to include information on data quality assurance procedures and measures including data quality indicators (DQI), sampling methodologies and analytical methods. The SAQP will continue to 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 1**. They have been prepared in line with the DQO process outlined in the ASC NEPM (Schedule B2).

Table 1. Data Quality Objectives

Process	Description
Step 1: State the problem	PFAS source areas at the SMA are contributing to the presence of PFAS in surface water and to a limited extent groundwater off-property. Defence and State regulatory agencies require up-to-date data to assess the ongoing nature and extent of PFAS associated with SMA, assess the performance of implemented management actions and enable informed risk management decisions to protect human health and the environment. The data collected by implementing this OMP will provide ongoing periodic / longitudinal dataset that can be used to assist with assessment of temporal changes in PFAS concentrations in groundwater and surface water / sediment on- and off-base. The OMP will be reviewed annually. The need for ongoing monitoring following each annual review period will be assessed with advice from NSW Government.
Step 2: Identify the decision/goal of the study	The goal of the study is to continue systematic routine groundwater and surface water / sediment sampling and analysis program to: • Refine current understanding of the distribution of PFAS in groundwater and surface water/sediment associated with SMA.

Process	Description
	• 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 CSM), and whether the OMP needs to be amended to reflect these updates.
Step 3: Identify the information inputs	To allow assessment of the data against the study goal listed in Step 2 above, the following inputs will be considered: • PFAS results from previous environmental investigations including the DSI (AECOM, 2019b), DSI Addendum (AECOM, 2021a) and HHERA (AECOM, 2021b) and data collected as part of the OMP. • Groundwater and surface water flow regimes identified from the above investigations and monitoring. • The Surface Water Mass Flux Study (AECOM, 2025). • 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 will influence the decision-making process for ongoing monitoring: • The spatial boundary for data collection and decision making is limited to on-base and the off-base monitoring area. • The sampling completed as part of this OMP will be limited to groundwater, surface water and sediment, at the frequencies defined. • The monitoring will be reviewed annually based the data and refinement of the OMP, as appropriate.
Step 5: Develop the analytical approach/decision rules	The decision rules can be defined as: **Analytical**: • Analytical selection: all samples will be analysed for the PFAS full suite (31 analytes). • Analytical method selection for PFAS is based on achieving appropriate laboratory Limit of Reporting (LOR) in the various media to be analysed. • If the sample / laboratory quality assurance / quality control data are within the acceptable ranges, the data will be considered suitable for use. **Project**: • Sample locations have been selected with the objective of monitoring PFAS trends, providing early warning of changes in the migration of PFAS on an off-base, in surface water and groundwater, and to assist with refinement of the monitoring program, as required.

Process	Description
	• If PFAS concentrations are reported at concentrations that are an OMP Trigger (refer to **Table 10**), then further review/assessment and or action is required. • If the PFAS is reported at a concentration that is inside a trigger value or acceptable range, then it will be considered whether monitoring is continued or reduced, this assessment will be undertaken annually based on historical data.
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: o Proposed surface water or groundwater sample locations may be dry at the time of sampling. o Proposed groundwater well locations are damaged or destroyed and therefore cannot be sampled. o 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. Some examples of this scenario include: o 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 accurately recorded while also preventing groundwater being sampled using low flow techniques. • Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed:

Process	Description
	o 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. o Field staff to follow a standard procedure when collecting samples, including decontamination of tools, and use of appropriate sample containers and preservation methods. o Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. o 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** and 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 in accordance with the PFAS NEMP (2025), with specific reference to Section 18.5 - Considerations for Specific Environmental Media. • 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

Groundwater, surface water and sediment sampling on and off-base will be performed on an annual basis during Winter (June / July).

The proposed monitoring interval is based on the following:

- The temporal data set captured since OMP monitoring commenced in 2021 indicates that there are significant reportable differences in PFAS concentrations between the previous Summer and Winter monitoring events, with Winter events generally reporting higher PFAS concentrations.
- Surface water sampling at the SMA during the DSI (AECOM, 2019b), HHERA (AECOM, 2021b) and OMP (since 2021) indicated surface water bodies and drainage lines are typically ephemeral and therefore may be unavailable for routine sampling events. However, given that PFAS migration via surface water is considered to be the most critical migration pathway, surface water monitoring events will be undertaken, where possible following rainfall when surface water is most available. Groundwater at the base demonstrates limited variability in response to rainfall.
- The monitoring data suggests that the Winter period provides the most stable temporal conditions (i.e. lower rainfall) and considered most appropriate for understanding groundwater trends (for locations close to source areas, base boundary and or creek systems) or locations with higher

sensitivity (i.e. groundwater sampling locations with concentrations close to the screening criteria or areas with fewer monitoring locations).

As concentrations of PFAS in surface water and groundwater are stable or decreasing, the data gap in relation to eggs, plants and livestock samples are considered low priority. However, specific triggers in relation to future biota considerations have been made in **Section 7** below.

The proposed monitoring intervals compared to the existing monitoring intervals under the 2021 OMP and associated rationale are outlined in **Table 2** below.

Table 2. Summary of Existing and Proposed Monitoring Intervals and Associated Rationale

Sample Media	Existing Monitoring Interval	Proposed Monitoring Interval Under this OMP	Rational for Change
Groundwater (*selected monitoring wells and residential bores*)	Bi-annual and biennial monitoring	Annual monitoring of all existing and accessible OMP locations.	Concentrations of PFAS in groundwater, surface water and sediment at the base demonstrates limited variability in response to rainfall since monitoring commenced under the OMP. Monitoring of all media during Winter is deemed appropriate based on the historical data, the CSM and the risk profile remains unchanged.
Surface Water (including wastewater sampling)	Bi-annual monitoring		
Sediment	Bi-annual monitoring		

4.4 Monitoring locations

4.4.1 Rationale for Groundwater Sampling Locations

Groundwater monitoring will continue at the selected monitoring wells and private bores. The rationale for monitoring well / bore selection for each area is summarised in **Table 3** below. The monitoring locations are presented on **Figure F4** in **Appendix B**.

Table 3. Rationale for Groundwater Monitoring

Area	Rationale
On-base (Cantonment)	• Continue to monitor groundwater wells to develop temporal datasets to assist with better understanding of temporal patterns in PFAS concentrations. • Assess if PFAS concentrations in groundwater within and downgradient of the Cantonment source areas (former Cantonment Fire Station, ALG, DNSDC, and HLG) change in response to management measures, or other base activities, over time. • Provide early warning of PFAS concentrations migrating from the Cantonment to the off-base monitoring area. • Assess if background conditions change over time.
On-base (STA)	• Continue to monitor groundwater wells to assist with understanding of temporal trends in PFAS concentrations.

	• Assess if PFAS concentrations in groundwater within and downgradient of Dochra Airfield change in response to management measures, or other base activities, over time. • Provide early warning of PFAS concentrations migrating from the STA to off-base areas to the north.
Northern boundary of SMA, and off-base to the north	• Continue to monitor groundwater wells to understand potential changes in PFAS concentrations at the base boundary and at off-base locations to the north within the off-base monitoring area (pastureland towards the STP). • Sentinel wells along northern Cantonment boundary will provide early warning of PFAS concentrations migrating from the SMA boundary into the off-base monitoring area.
West and northwest of the Cantonment (off-base)	• Continue to monitor groundwater wells to assist with understanding of temporal trends in PFAS concentrations. • Provide early warning of PFAS concentrations migrating from the Cantonment boundary to the west and northwest portions of the off-base monitoring area (towards Glenridding).
East and northeast of the Cantonment (off-base)	• Continue to monitor groundwater wells to assist with understanding of temporal trends in PFAS concentrations. • Monitor groundwater wells on transects parallel and perpendicular to the Cantonment and off-base plume (Whittingham), to confirm that the Cantonment is not contributing to off-base PFAS impacts at Whittingham, or migration via groundwater.

Off-base monitoring locations will require the agreement of the landholder/leaseholder. A stakeholder engagement plan will be prepared to manage this process.

The groundwater sample locations are presented in **Table 4** below.

Table 4. Groundwater Sample Locations

Area	Description	Sampling Locations	Number of Wells/Bores	Total
On-base	Northern Cantonment Boundary	MW102, MW109, MW110, MW114, MW115, MW118	6	17 locations
	DNSDC Compound	MW048, MW049, MW050 MW052	4	
	Former Fire Station	MW008, MW011, MW167	3	
	HLG	MW059	1	
	Dochra Airfield	MW063, MW071, MW073	3	
Off-base	North of base	MW121, MW126*, MW187S, MW187D, MW188S, MW188D	6	10 locations
	Northwest of base	MW128*	1	
	Northeast of base	MW056*, MW124, MW139*	3	

Note: * Location on private property

All off-base groundwater monitoring wells / bores are located on private property (including Singleton Council property) and will require the agreement of the landholder/leaseholder. A stakeholder engagement plan will be prepared to manage this process. Where access to these locations

encounters challenges, or changes in concentrations trends are observed, alternate locations may be considered appropriate to meet the objective of the OMP.

Further information for the groundwater sampling locations is presented in **Appendix C**.

4.4.2 Rationale for Surface Water Sampling Locations

The surface water monitoring locations have been selected to build on and maintain consistency with the monitoring completed during the DSI (AECOM, 2019b) and the OMP (Defence, 2021a). Surface water is the main migration pathway and as such is a key focus for the OMP. The sampling locations nominated in this OMP are located at source areas, within key catchments draining the source areas, at the Cantonment and STA. The majority of the locations were established during the DSI and previous OMPs and therefore have historical datasets available for assessment.

Continued monitoring will provide additional data to assess temporal variability. The locations and rationale are as follows:

- Doughboy Hollow Creek catchment will continue to be monitored at several on-base and off-base locations. These include:
    - SW003, SW032, SW026, and SW034 targeting an unnamed tributary of Doughboy Hollow Creek that runs through the central portion of the Cantonment (sub-catchment A).These locations are positioned downstream of the identified Cantonment source areas comprising the Former Cantonment Fire Station, DNSDC, and ALG..
    - SW002 and SW115 targeting an undefined drainage line that drains from the northern portion of the DNSDC to the northern Cantonment boundary and Doughboy Hollow beyond.
    - SW040, SW028 and SW035 at Doughboy Hollow Creek at boundary to assess PFAS migrating off-base to Doughboy Hollow Creek in surface water via sub-catchments B and C. SW028 is located downstream of the HLG, a previously identified source area. SW040 and SW035 are located upstream and downstream of SW028, respectively.
    - SW555, at the southeastern Cantonment boundary, west of Range Road, where an unnamed tributary of Doughboy Hollow Creek enters sub-catchment B and flows onto the base. The location is proposed to monitor potential on-base migration of PFAS that were detected on private properties east of the base during the HHERA.
- SW116, targeting an unnamed drainage line that runs from the northeastern portion of the ALG off-base underneath Range Road. The location is proposed to monitor potential off-base migration of PFAS from the ALG.
- Northeast portion of the STA, at SW004 (Emigrant Creek) and SW005 (Mudies Creek) to assess runoff from the Dochra Airfield. These locations adequately represent the concentration of PFAS entering the off-base environment from the STA.
- at off-base locations (pending landowner consent) SW035 and SW036 to continue to monitor PFAS concentrations in surface water downstream of the SMA. It is noted the water at these locations is thought to soak away to the alluvial sediments of Doughboy Hollow, upstream of the Hunter River flood plain (Whittingham).
- off-base locations in the vicinity of the STP and within the Hunter River floodplains at Whittingham at locations SW553, SW563, SW065, SW064 and SW039. Monitoring at these locations provide an understanding of off-base PFAS contributions, from the STP, to surface water courses in Doughboy Hollow, and eventually the Hunter River and monitor for any

temporal changes. OTH006, located at the STP pumping station is additionally proposed to be monitored as this pumping station is understood to transfer sewage and stormwater collecting via the SMA sewer network into the STP.

The surface water locations to be monitored on an annual basis are presented on **Figure F5** in **Appendix B**.

Table 5 provides the surface water sampling locations

Table 5. Surface Water Sample Locations

Area	Description	Sampling Locations	Number of Locations	Total
On-base	Northern Cantonment (Sub catchment A)	SW003, SW026, SW032, SW034	5	13 Locations
	Northern Cantonment boundary	SW002, SW115	2	
	Northeastern Cantonment boundary	SW116	1	
	Central Cantonment (Sub catchment B)	SW028, SW555	2	
	Southern Cantonment (Sub catchment C)	SW040	1	
	Dochra Airfield	SW004, SW005	2	
Off-base	West of base (Doughboy Hollow Creek)	SW035*	1	8 Locations
	North of base (Doughboy Hollow Creek Catchment)	SW036*, SW064*, SW065*, SW553, SW563, OTH006**	6	
	East of base (Doughboy Hollow Creek Catchment)	SW039*	1	

Note: * Location on private property.
** Wastewater sampling location.

Some of the off-base surface water locations are located on private property (including Singleton Council property) and require the agreement of the landholder/leaseholder. A stakeholder engagement plan will be prepared to manage this process. Where access to these locations encounters challenges, alternate locations may be considered appropriate to meet the objective of the OMP.

Further information for the surface water sampling locations is presented in **Appendix C**.

4.4.3 Rationale for Sediment Sampling

The sediment sample locations have been selected to be co-located with surface water sample locations and to maintain consistency with the monitoring completed during the DSI (AECOM, 2019b) and the OMP (Defence, 2021a). Continued monitoring of the sediment locations will provide additional to assess temporal changes to meet the OMP objectives.

The sediment locations to be monitored on an annual basis are presented on **Figure F6** in **Appendix A**.

The sediment sampling locations are presented in **Table 6** below.

Table 6. Sediment Sample Locations

Area	Description	Sampling Locations	Number of Locations	Total
On-base	Northern Cantonment (Sub catchment A)	SD003, SD053, SD032, SD065	5	13 Locations
	Northern Cantonment boundary	SD002, SD115	2	
	Northeastern Cantonment boundary	SD116	1	
	Central Cantonment (Sub catchment B)	SD055, SD555	2	
	Southern Cantonment (Sub catchment C)	SD040	1	
	Dochra Airfield	SD004, SD005	2	
Off-base	West of base (Doughboy Hollow Creek)	SD052*	1	7 Locations
	North of base (Doughboy Hollow Creek Catchment)	SD080, SD539, SD047, SD046, SD563	5	
	East of base (Doughboy Hollow Creek Catchment)	SD039*	1	

Note: * Location on private property

Some of the off-base sediment sampling locations are located on private property (including Singleton Council property) and require the agreement of the landholder/leaseholder. A stakeholder engagement plan will be prepared to manage this process. Where access to these locations encounters challenges, alternate locations may be considered appropriate to meet the objective of the OMP.

Further information for the sediment sampling locations is presented in **Appendix C**.

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 LORs must be selected to achieve the OMP objectives (**Section 1.2**) and the DQOs. The rationale for selecting LORs below the standard LOR must be provided and outlined in the SAQP.

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, temperature, total dissolved solids, salinity, and turbidity (where feasible) will be undertaken on all surface and groundwater samples.

5 OTHER ASPECTS

To achieve the OMP objectives (**Section 1.2**), inform the CSM and allow assessment of the site risk profile, a review of other aspects will also be undertaken, including water use surveys, registered bore searches, change in land zoning, changes in land use on- and off-base, development works and remediation works.

The aspects review requirements are included in **Table 7**.

Table 7. Other aspects review

Aspect	Review requirements
Information sources	The OMP will consider other sources of information, such as: • Data obtained from PMAP actions, namely the surface water mass flux study (AECOM, 2025), and further PFAS soil investigation at the Former Cantonment Fire Station (AECOM, 2024e). • Other remediation works (non-PFAS) which may also result in changes to existing transportation trends, or 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 PFAS source areas. • A significant change of land use in source areas 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 including: • A significant change of land use within the off-base monitoring 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.
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.

Aspect	Review requirements
Changes in NSW Government Precautionary Advice	The OMP will consider any changes made by the NSW Government to the precautionary advice to residential properties associated with the off-base monitoring area.
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 PFAS NEMP (2025). The National Health and Medical Research Council (NHMRC) has released Draft guidelines for PFAS in drinking water. Once finalised and released, the criteria in the OMP may be updated.

6 PFAS SCREENING CRITERIA

Table 8. Screening Criteria for Surface Water and Groundwater (µg/L)

Pathway	Compound	Criteria	Comment/Reference
Drinking water	PFOS + PFHxS	0.07 µg/L	The values presented in the NEMP (2025) are from the Department of Health (DoH) (2017), which published final health-based guidance values for PFAS for use in site investigations in Australia. DoH utilised the Tolerable Daily Intake (TDI) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) from Food Standards Australia New Zealand (FSANZ) [2017] and the methodology described in Chapter 6.3.3 of the NHMRC's Australian Drinking Water Guidelines (ADWG, 2016) to determine drinking water values. As a precaution, the DoH has advised that the PFOS TDI should also apply to Perfluorohexanesulfonic Acid (PFHxS), meaning the level of PFHxS exposure should be added to the level of PFOS exposure and the combined level should then be compared to the TDI for PFOS. All groundwater and surface water results will be compared to these criteria. It is noted that direct consumption of groundwater and surface water are not currently considered complete exposure pathways within the off-base monitoring area. However, the HHERA (AECOM, 2021b) did note several properties within the off-base monitoring area abstract groundwater and surface water for non-potable supply; as source of irrigation water; as a source for livestock and poultry drinking water; and irrigation of homegrown produce. The drinking water criteria are considered suitably protective of these indirect exposure pathways.
	PFOA	0.56 µg/L	
Recreational use – surface water	PFOS + PFHxS	2 µg/L	In August 2019, NHMRC released guidance on the assessment of PFAS in surface water (NHMRC, 2019). Rather than adopting an ingestion rate of 0.2 L of water per day (as per the ADWG formula), NHMRC adjusted this rate with consideration of an event frequency (150 events/year) to calculate an annual ingestion rate of 30 L per year. These values were adopted by the PFAS NEMP (2025). All groundwater and surface water results will be compared to these criteria given: • A number of ephemeral creeks and drainage lines, including Doughboy Hollow Creek, Mudies Creek and Emigrant Creek, enter the
	PFOA	10 µg/L	

			off-base monitoring area from identified on-Base source areas at the Cantonment and STA. off-base surface water bodies are understood to be subject to overland flow or flooding during periods of heavy rainfall, potentially resulting in transport of PFAS from on-base sources to these waterbodies. • The HHERA (AECOM, 2021b) identified surface water bodies (e.g. creeks, drainage lines and dams) on a number of properties are used by residents for outdoor recreational purposes such as swimming and watering of lawns and gardens. The recreational criteria are considered suitably protective of potential outdoor workers, such as Council or utility / service provider workers, that may incidentally encounter surface or groundwater during occupational activities (e.g. maintenance of drainage channels, or work within service pits that extend below the groundwater table).

Table 9. PFAS Criteria Summary – Ecological

Media	Pathway	Chemical	Criteria	Comment/Reference
Water Surface water and Groundwater (Freshwater)	Uptake (flora) and direct ingestion (fauna) of surface water and groundwater	PFOS	0.00023 µg/L	The values are from the PFAS NEMP (2025) which endorsed the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. The 99% species protection level, for high value conservation systems, has been applied. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Aquatic and terrestrial plants have the potential to uptake and bioaccumulate PFAS, which can result in direct phytotoxicity and/or can be ingested by aquatic and terrestrial biota. Aquatic (including avian species) and terrestrial fauna can use surface water bodies as a source of drinking-water. It is proposed that the laboratory LOR is adopted for the purposes of preliminary screening of analytical water results, rather than sole use of the criteria value.
		PFOA	19 µg/L	

7 TRIGGERS FOR ACTION AND REVIEW

The OMP Triggers and associated actions are outlined in **Table 10** below.

Note: it is assumed that data to be reviewed against the OMP triggers have been subjected to standard data quality validation (Quality Assurance/Quality Control) processes and are considered adequate for interpretive purposes (refer to **Section 4.2**, Step 6). This includes reanalysis and/or resampling of locations where potentially anomalous data have been reported.

Table 10. OMP Triggers and Response Actions

OMP Trigger	Notes	Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)	Response Actions
Spatial and Temporal Variability			
First time detect at a monitoring location not associated with a known on-base PFAS source area.	To be considered potentially significant if repeat detections occur over three subsequent monitoring events. Groundwater: Monitoring locations cross gradient or up-gradient of identified PFAS source areas (i.e. MW073). Surface water: Monitoring locations cross gradient or upstream of identified PFAS source areas (i.e. SW040)..	SER	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 at a monitoring location, outside an identified PFAS source area, that suggests PFAS migration is occurring from a known PFAS source area.	To be considered potentially significant if repeat detections occur over three subsequent monitoring events. • Monitoring wells down gradient of known PFAS source areas (i.e. MW050, MW110, MW114, MW115, and MW118) • Surface water / sediment monitoring locations downstream of known PFAS source areas (i.e. SW004).	SER	Consider additional sampling outside of OMP schedule (where re-sampling within the routine sampling event has confirmed the initial detection) If consistent with CSM (i.e. result is expected) – no further action. 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.
New maximum at monitoring location (a concentration that is	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	SER	

OMP Trigger	Notes	Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)	Response Actions
considered to be "significant" within the context of the CSM)	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.		Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling. Review the CSM and risk profile, and update where required. NSW EPA to be notified via Sampling Event Reports and Ongoing Monitoring Reports.
Increasing trend at a monitoring location or within a specified area	Applicable to the base boundary and key off-base monitoring locations that are related the Defence sources only, which includes: • MW102, MW109, MW110, MW114, MW115, MW118 (base boundary locations). • MW126, MW128, MW187SD, MW188S/D (off-base monitoring locations). Assess whether trend is influenced by other factors (e.g. rainfall, remediation and/or other estate works).	OMR	Review the CSM and risk profile, and update where required. Review OMP to ensure monitoring remains current. Changes to monitoring program to be notified to NSW EPA updates to OMP. 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.
Decreasing trend at a monitoring location or within a specified area	Monitoring locations may be considered to be removed from the OMP if no longer required to assess the CSM and risk profile. Needs to assess if trend is influenced by other factors (e.g. rainfall, remediation and/or other estate works).	OMR	Review the CSM and risk profile, and update where required. Review OMP to ensure monitoring remains current. Changes to monitoring program to be notified to NSW EPA updates to OMP.
Changes to the CSM			

OMP Trigger	Notes	Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)	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.	SER/OMR	Review CSM and risk profile, and update where required. Review OMP to ensure monitoring remains current. Changes to monitoring program to be notified to NSW EPA updates to OMP.
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. Based on information reported in the HHERA (AECOM, 2021b) which was collected via water use surveys and interviews with residents as part of the field sampling program, groundwater within the off-base monitoring locations is not used as a drinking water source.	SER/OMR	Review CSM and risk profile, and update where required. Review OMP to ensure monitoring remains current. Changes to monitoring program to be notified to NSW EPA, updates to OMP.
Risk to Human and Ecological Receptors			
New exceedance of published screening criteria of a monitoring location outside an identified PFAS source area, that suggests PFAS migration from a known PFAS source area	Typically, applicable to base boundary and off-base monitoring locations only. To be considered potentially significant if repeat detections occur over three subsequent monitoring events. Review the potential S-P-R linkages at the sampling location and what control measures are in place. New exceedances may not be unanticipated based on the understanding of surface	SER	If consistent with risk profile – no action. If inconsistent with risk profile: • Notify relevant stakeholders (if required) • Consider whether further assessment is required, which may include revision of the OMP SAQP to increase sampling frequency. • Review management measures

OMP Trigger	Notes	Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)	Response Actions
	water/groundwater plume dynamics and the CSM. For example, a surface water monitoring location downstream of a PFAS source area, or a groundwater location down gradient of a known PFAS source area, where results have been previously reported below LOR. This result may be unanticipated if reported at a location outside where the PFAS is predicted to migrate based on the CSM. This may include: • Sentinel wells (i.e. off-base wells located between the northern Cantonment boundary and the STP including MW187S/D) • Monitoring wells within an aquifer previously unaffected by PFAS source areas (i.e. deeper aquifer including MW187D) • Monitoring wells located on-base boundary and off-base monitoring locations (i.e., MW110, MW114, MW115, MW118, MW128, MW129, and MW132).		
Exceedance of human health exposure point concentrations (EPC) (off-base monitoring locations)	Applicable to off-base monitoring locations and property specific locations. To be considered significant if repeat detections occur over three subsequent monitoring events. EPCs applicable to human health receptors in the off-base monitoring area were defined by the HHERA (AECOM, 2021b). EPCs relevant to	SER/OMR	Additionally, if an exceedance of an EPC is observed at a property within the off-base monitoring area then the risk profile will be reviewed, which would include an update of WUS at the off-base property. If risk profile is found to have changed then data gaps in relation to consumption of biota (eggs, plants and livestock) will be considered a higher priority to address with further sampling of biota at the off-base property.

<table>
<tr><th>OMP Trigger</th><th>Notes</th><th>Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)</th><th>Response Actions</th></tr>
<tr><td></td><td>media proposed for monitoring under this OMP are as follows:

<table><tr><th>Media</th><th>PFOS</th><th>PFOA</th><th>PFHxS</th></tr><tr><td>Groundwater[1] (µg/L)</td><td>0.040</td><td>0.020</td><td>0.080</td></tr><tr><td>Surface Water (µg/L)[2]</td><td>0.470</td><td>0.050</td><td>0.280</td></tr><tr><td>Sediment (mg/kg)</td><td>0.0128</td><td>0.0009</td><td>0.0017</td></tr></table></td><td></td><td>NSW EPA to be notified via Sampling Event Reports and Ongoing Monitoring Reports.</td></tr>
</table>

[1] Based on the scenario of non-potable domestic use of groundwater (i.e. irrigation or watering of fruit/vegetable gardens)

[2] Based on the scenario of main stock drinking water source. May be applicable to groundwater where being used for this purpose

<table>
<tr><th>OMP Trigger</th><th>Notes</th><th>Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)</th><th>Response Actions</th></tr>
<tr><td></td><td>The data sets may be different between the risk assessment and OMP scope, therefore the results may not be directly comparable.

Note that the property where monitoring well MW056 (with concentrations above the adopted screening criteria) is located has one active bore that abstracts approximately 10,000 litres of water a year based on the water use survey (WUS) completed by the property owner. This bore is reportedly not connected to the residence but used for livestock drinking.</td><td></td><td></td></tr>
<tr><td>Exceedance of ecological EPC</td><td>Not applicable to PFAS source areas.

EPCs applicable to ecological receptors within the Off-Base monitoring area were defined by the HHERA (AECOM, 2021b). EPCs relevant to media proposed for monitoring under this OMP are as follows:
<table>
<tr><th>Media</th><th>PFOS</th><th>PFOA</th></tr>
<tr><td colspan="3">Doughboy Hollow Creek Catchment</td></tr>
<tr><td>Surface Water (mg/L)</td><td>0.00126</td><td>0.0001</td></tr>
<tr><td>Sediment (mg/kg)</td><td>0.0613</td><td>0.0003</td></tr>
<tr><td colspan="3">Mudies/Emigrant Creek Catchment</td></tr>
</table></td><td>SER/OMR</td><td>Review CSM and risk profile, and update where required.

Review OMP to ensure monitoring remains current.</td></tr>
</table>

OMP Trigger	Notes	Sampling Event Report (SER) / Ongoing Monitoring Report (OMR)	Response Actions
	<table><tr><td>Surface Water (mg/L)</td><td>0.00004</td><td>0.00005</td></tr><tr><td>Sediment (mg/kg)</td><td>0.0028</td><td>0.0002</td></tr></table> The data sets may be different between the risk assessments and OMP scope, therefore the results may not be directly comparable.		
Other Considerations			
Changes to Precautionary Advice by NSW Government	The OMP will consider any changes made by the NSW Government to precautionary advice.	SER/OMR	Review OMP to ensure monitoring remains current.
Defence Reputation – Dissatisfied community or government stakeholders	Ensure regular updates are provided to community and government stakeholders.	SER/OMR	Considered and proactive communication. Regular updates provided to community and key stakeholders. Engage local and state government (as required).

8 REPORTING REQUIREMENTS

8.1 Reporting

After each monitoring event, information, field and laboratory data will be documented in a factual 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 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 PMAP (Defence, 2021) 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 Environment Protection Authority, Councils, other agencies, and the community will be undertaken.

Where off-base monitoring is undertaken 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 Ongoing Monitoring Report.

APPENDIX A REFERENCES

AECOM, 2018, Stakeholder and Community Engagement Plan - Singleton Military Area Environmental Investigation, 04 September 2018.

AECOM, 2019a, Preliminary Site Investigation – Singleton Military Area – PFAS Investigation, 04 February 2019

AECOM, 2019b, Detailed Site Investigation – Singleton Military Area – PFAS Investigation, 28 November 2019.

AECOM, 2021a, Detailed Site Investigation Addendum - Singleton Military Area – PFAS Investigation, 15 March 2021.

AECOM, 2021b, Human Health and Ecological Risk Assessment – Singleton Military Area – PFAS Investigation, 23 March 2021

AECOM, 2022. Sampling Event Factual Report, July 2022 – PFAS OMP - Singleton Lone Pine Barracks (Site ID 0356). 6 December 2022.

AECOM, 2023. Sampling Event Factual Report, January 2023 – PFAS OMP - Singleton Lone Pine Barracks (Site ID 0356). 19 April 2023.

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AECOM, 2024b. Sampling and Analysis Quality Plan – PFAS OMP - Singleton Military Area (Site ID 0356). Revision 6. 23 January 2024.

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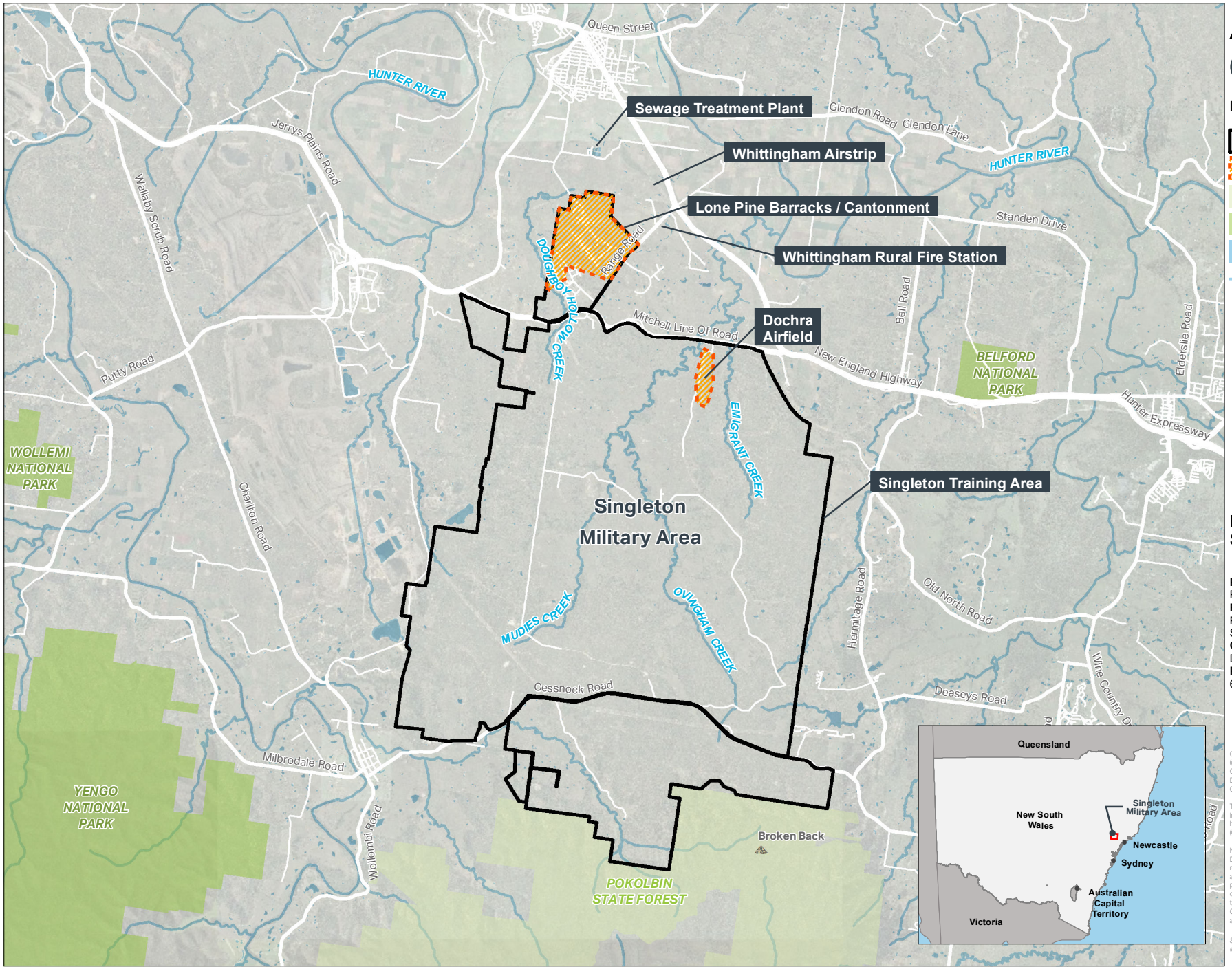
APPENDIX B FIGURES



AECOM

N

0 1.5 3 km

Legend

- Site Boundary
- On-site Monitoring Area
- State Forest
- NPWS Reserve
- Waterbody
- Watercourse

FIGURE F1:
SITE LOCATION

PROJECT NAME:
PFAS OMP
REPORT NAME:
PFAS OMP
Singleton Military Area (0356)
CLIENT NAME:
Department of Defence
PROJECT NUMBER:
60569462

Source:
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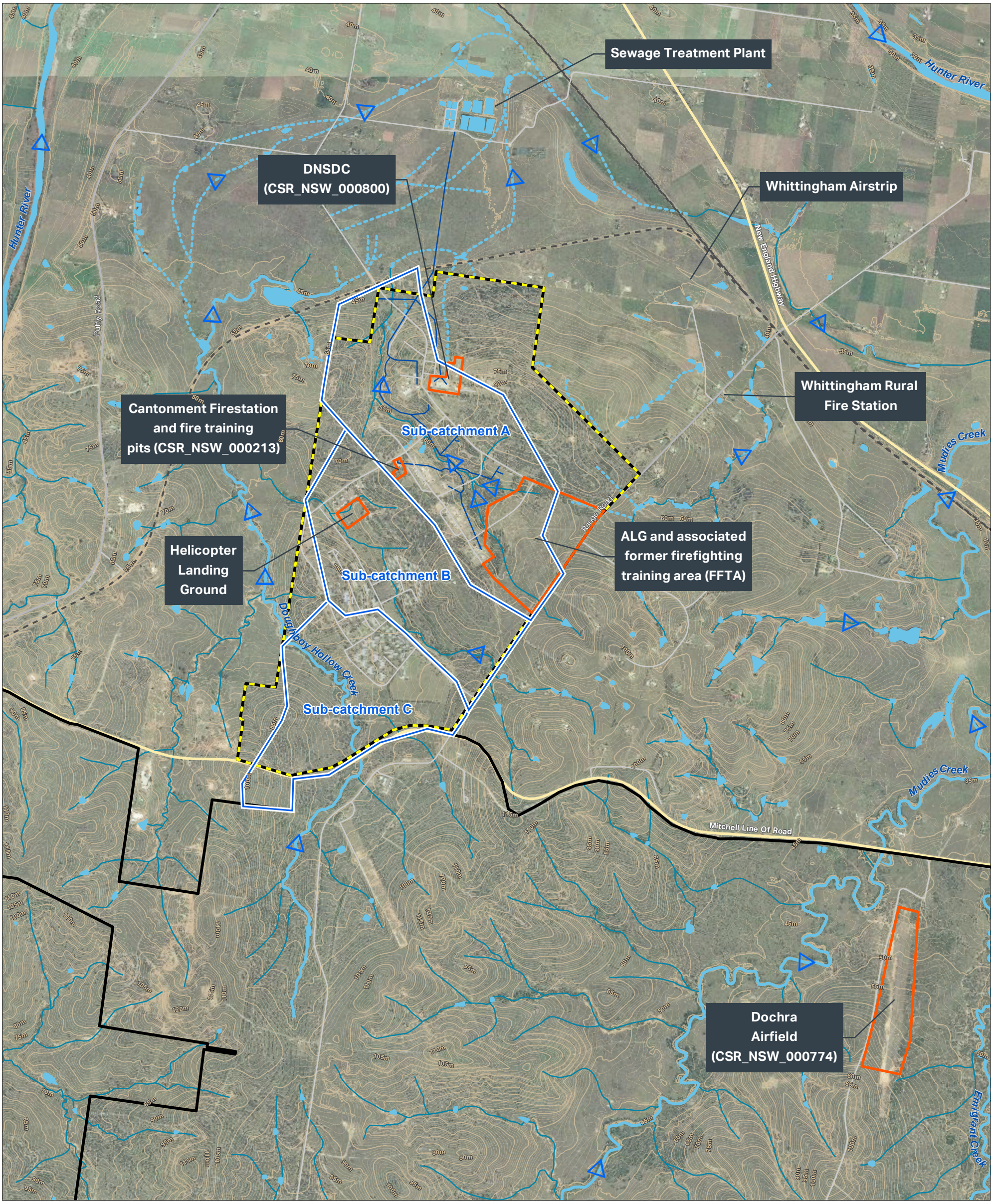

FIGURE F2: CANTONMENT CATCHMENTS

- Cantonment Boundary
- Property Boundary
- CSR boundaries
- State Forest
- Contours (1m)
- Watercourse Flow Direction
- Waterbody
- Drainage line
- Watercourses
- Sewer
- Undefined Drainage Lines
- Catchment Boundaries
- Railway
- Highways
- Main Roads
- Local Roads

AECOM

N

0 0.45 0.9 km

PROJECT NAME:
PFAS OMP
REPORT NAME:
PFAS OMP
Singleton Military Area (0356)
CLIENT NAME:
Department of Defence
PROJECT NUMBER:
60612562

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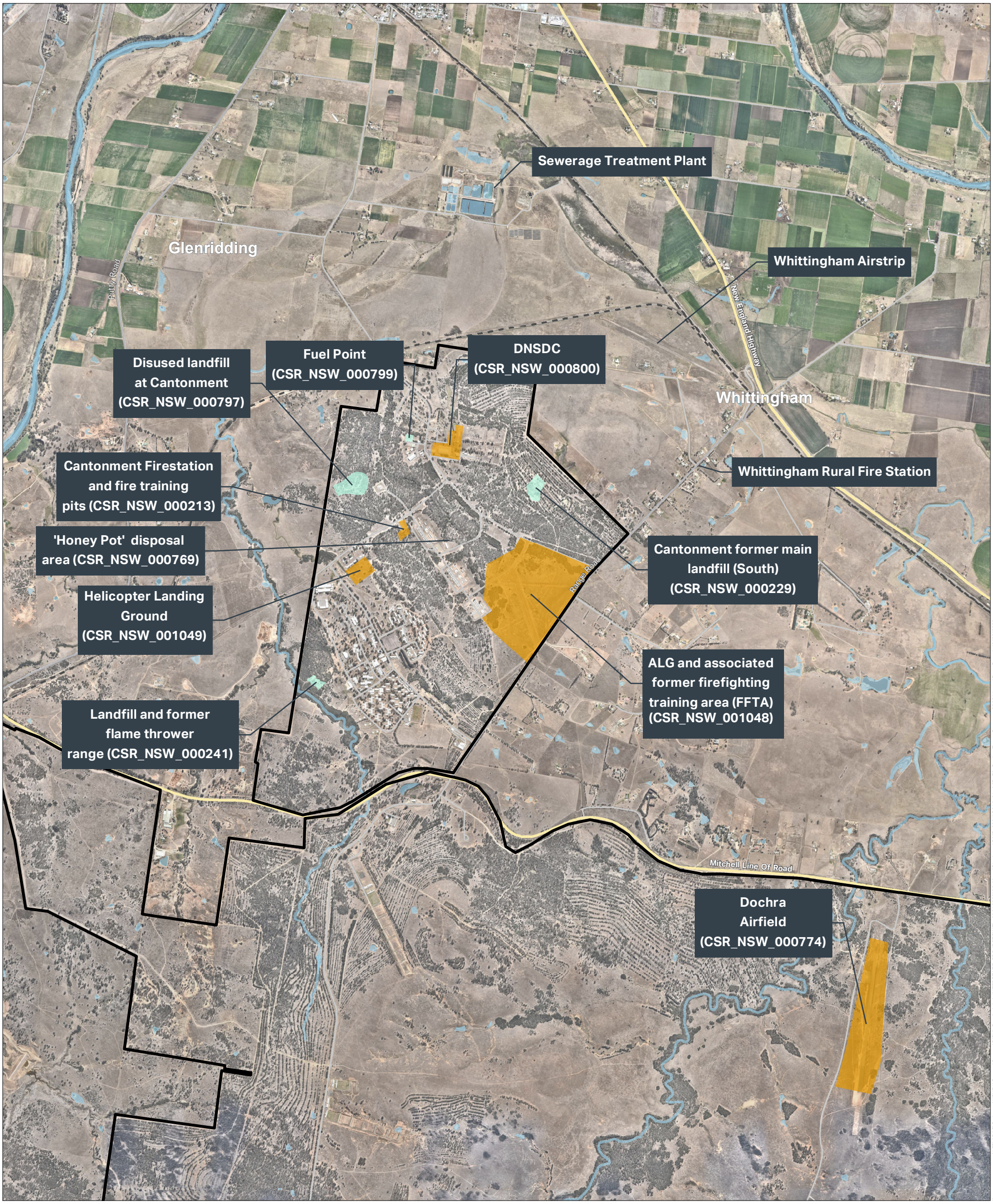


FIGURE F3: PMAP SOURCE AREAS

Legend

- Property Boundary
- PMAP Source
- Other Site Features
- State Forest
- Waterbody
- Highways
- Main Roads
- Local Roads
- Railway
- Watercourses

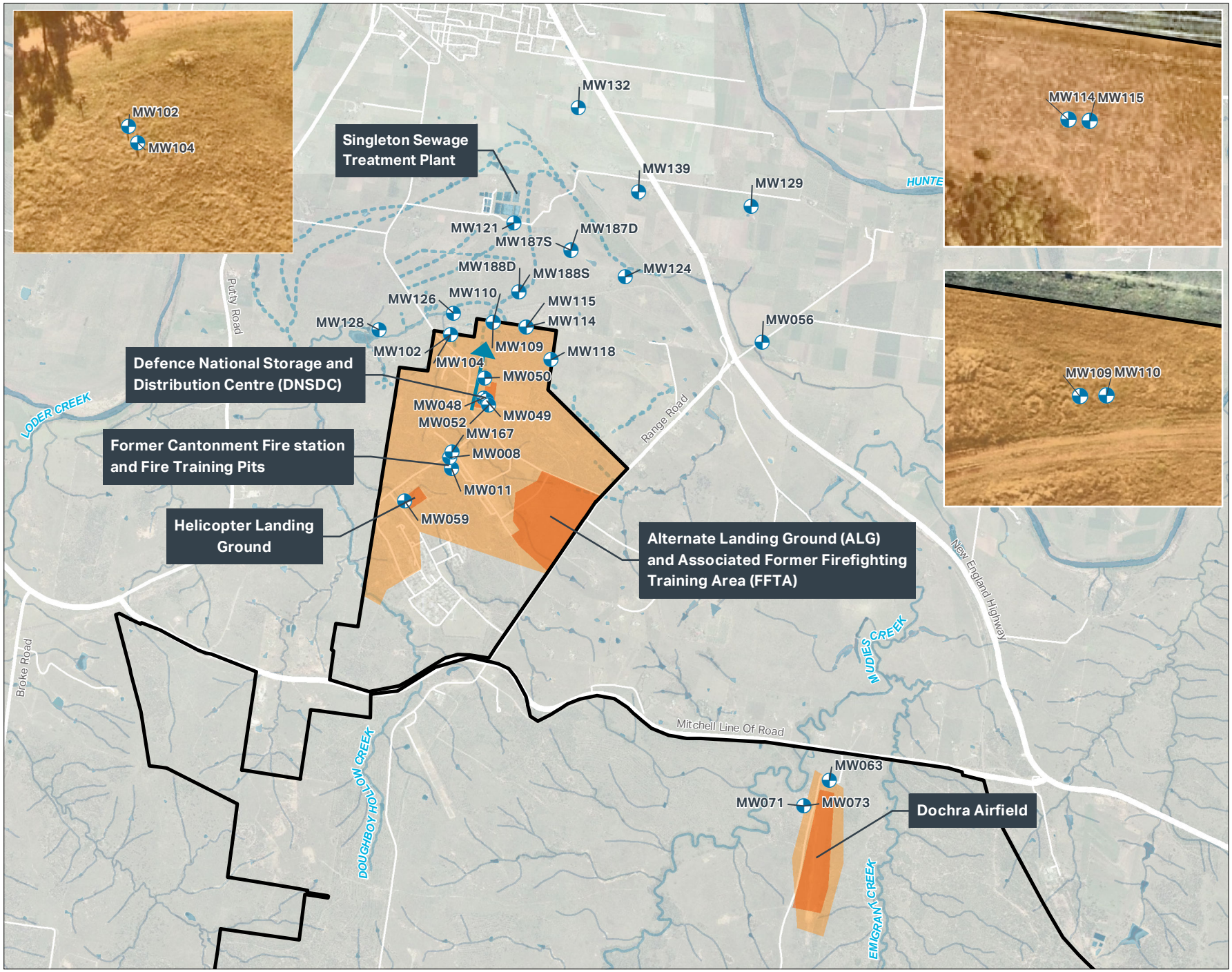
AECOM

N

0 0.5 1 km

PROJECT NAME:
PFAS OMP
REPORT NAME:
PFAS OMP
Singleton Military Area (0356)
CLIENT NAME:
Department of Defence
PROJECT NUMBER:
60612562

Source: © Department Finance, Services & Innovation (2018)
Imagery © Nearmap, 2018



AECOM

N

0 0.5 1 km

Legend

- Site Boundary
- On-site Monitoring Area
- PFAS Source Areas
- Watercourse
- Drainage line
- Undefined Drainage Lines
- Inferred Groundwater Flow Direction
- Groundwater Sample Location

FIGURE F4:
GROUNDWATER SAMPLE LOCATIONS

PROJECT NAME:
PFAS OMP
REPORT NAME:
PFAS OMP
Singleton Military Area (0356)
CLIENT NAME:
Department of Defence
PROJECT NUMBER:
60612562

Source:
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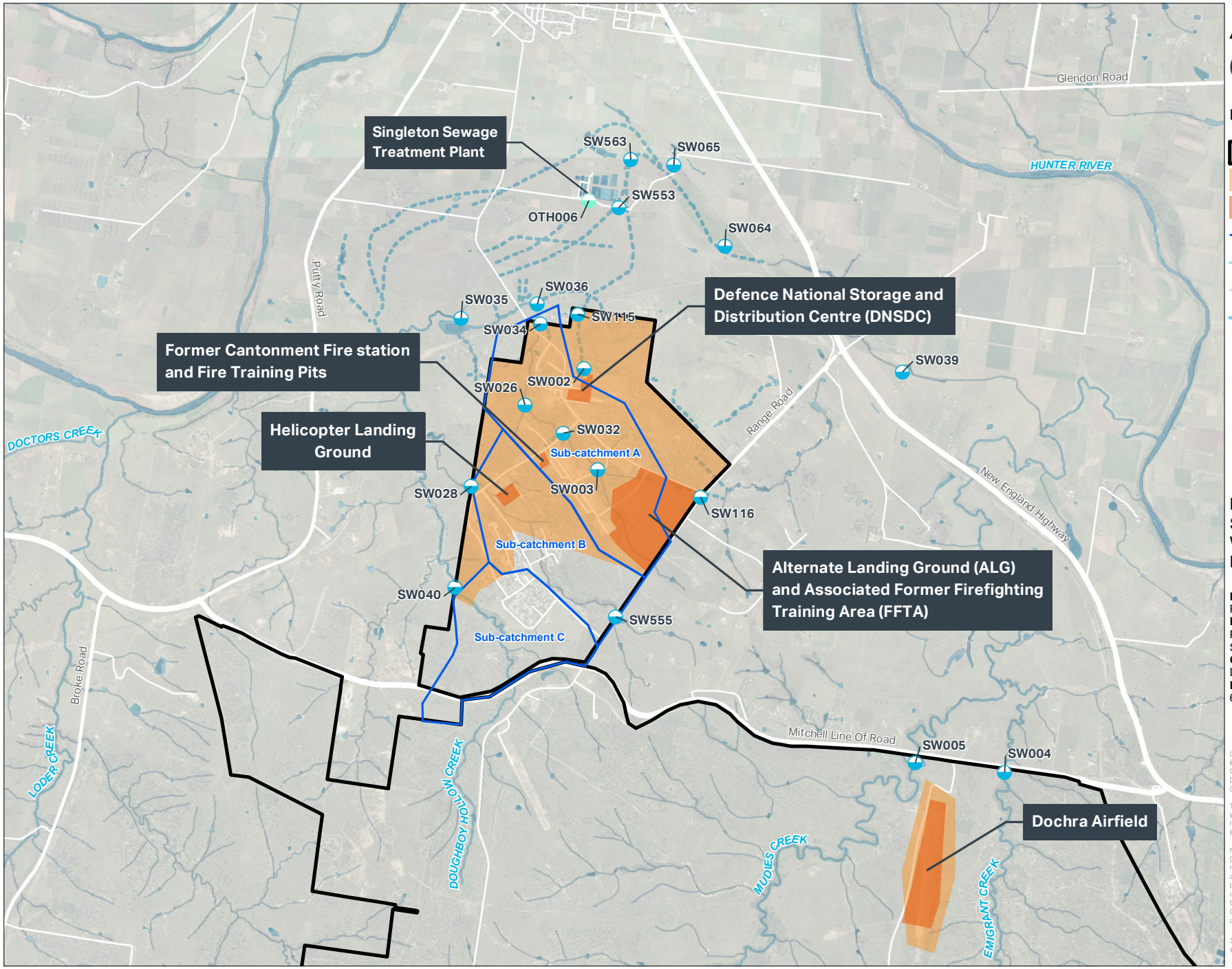

AECOM

N

0 0.5 1 km

Legend

- Site Boundary
- On-site Monitoring Area
- PFAS Source Areas
- Catchment Boundaries
- Watercourse
- Drainage line
- Undefined Drainage Lines
- Surface Water Sample Location
- Wastewater Sample Location

FIGURE F5:
SURFACE WATER AND WASTEWATER SAMPLE LOCATIONS

PROJECT NAME:
PFAS OMP
REPORT NAME:
PFAS OMP
Singleton Military Area (0356)
CLIENT NAME:
Department of Defence
PROJECT NUMBER:
60612562

Source:
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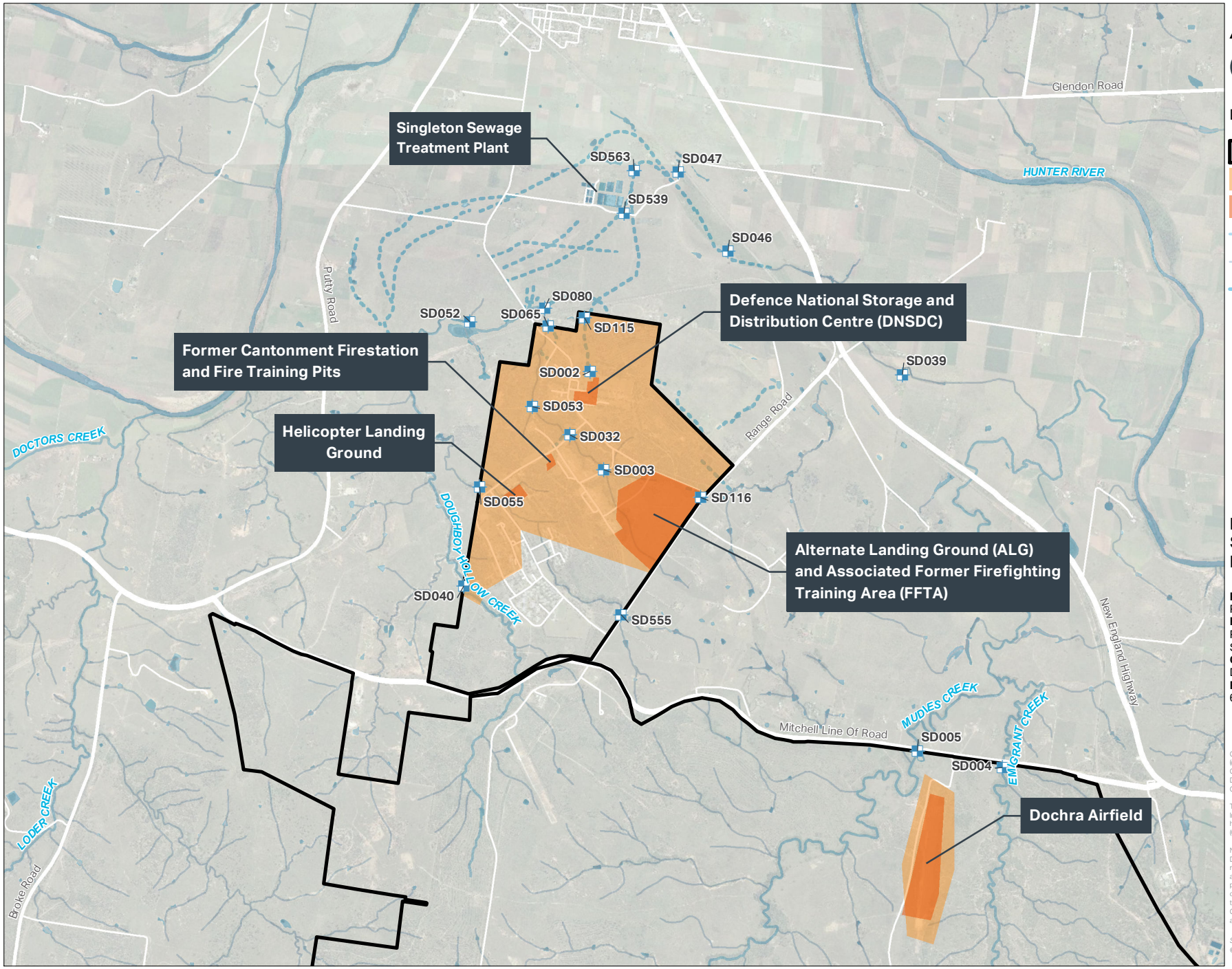

AECOM

N

0 0.5 1 km

Legend

- Site Boundary
- On-site Monitoring Area
- PFAS Source Areas
- Watercourse
- Drainage line
- Undefined Drainage Lines
- Sediment Location (sampled)

FIGURE F6:
SEDIMENT SAMPLE LOCATIONS

PROJECT NAME:
PFAS OMP
REPORT NAME:
PFAS OMP
Singleton Military Area (0356)
CLIENT NAME:
Department of Defence
PROJECT NUMBER:
60612562

Source:
© Department of Customer Service 2020

APPENDIX C SAMPLE LOCATION INFORMATION

Table T1 - Sampling Location Information

On-base / Off-base	Area	Location Code	Historical Name	Easting	Northing	TOC (mAHD)	Screen Interval Depth	Sampling Frequency
On-base	Cantonment (Former Fire Station)	MW008	CNN0018_GW08	328347.54	6390164.94	74.1	11.9 - 14.9	Annual
On-base	Cantonment (Former Fire Station)	MW011	CNN0018_GW02/CNN0018_GW002	328364.794	6390053.977	74.13	9.7 - 12.7	Annual
On-base	Cantonment (DNSDC Compound)	MW048	CNN0039_GW01/CNN0039_GW001	328689.336	6390760.26	69.11	4-Jul	Annual
On-base	Cantonment (DNSDC Compound)	MW049	CNN0039_GW02/CNN0039_GW002	328714.567	6390735.258	69.76	2.7 - 8.7	Annual
On-base	Cantonment (DNSDC Compound)	MW050	CNN0039_GW03	328696.53	6390962.71	64.4	13.4 - 16.9	Annual
On-base	Cantonment (DNSDC Compound)	MW052	CNN0039_GW05	328737.46	6390684.35	72.05	0.8 - 3.8	Annual
On-base	Private Property (Residential)	MW056	GW12, MW12S	331479.8	6391318.41	34.71	5.3 - 8.3	Annual
On-base	Cantonment (Helicopter Landing Ground)	MW059	HLG_GW03	327894.5	6389726.64	61.14	2.75 - 4.75	Annual
On-base	STA (Dochra Airfield)	MW063	NSW1164_MW001D/NSW1164_MW01D	332153.951	6386921.677	42.88	16.8 - 19.8	Annual
On-base	STA (Dochra Airfield)	MW071	NSW1164_MW003D/NSW1164_MW03D	331897.4	6386665.65	47.87	24.4 - 30.4	Annual
On-base	STA (Dochra Airfield)	MW073	NSW1164_MW03S	331897.22	6386665.82	47.91	7-10'	Annual
On-base	Northern Cantonment Boundary	MW102	GW02D	328357.02	6391396.84	46.82	13.5 - 16.5	Annual
On-base	Northern Cantonment Boundary	MW109	GW03D	328780.99	6391520.8	45.1	24.5 - 30	Annual
On-base	Northern Cantonment Boundary	MW110	GW03S	328783.65	6391520.88	45.4	12.4 - 14.9	Annual
On-base	Northern Cantonment Boundary	MW114	GW04D	329111.47	6391472.18	45.9	24.3 - 30.3	Annual
On-base	Northern Cantonment Boundary	MW115	GW04S	329113.35	6391472.09	45.86	11.8 - 14.8	Annual
On-base	Northern Cantonment Boundary	MW118	GW05S	329361.85	6391140.79	52.72		Annual
Off-base	Private Property (Singleton Council)	MW121	GW06/GW06S	328989.26	6392517.07	39.82	9.5 - 12.5	Annual
Off-base	Private Property (Singleton Council)	MW124	GW07/GW07S	330106.13	6391974.53	38.68	9.4 - 13.8	Annual
Off-base	Private Property (Residential)	MW126	GW08S	328381.64	6391612.96	42.78	10.5 - 13.5	Annual
Off-base	Private Property (Residential)	MW128	GW09S	327641.43	6391446.15	44.08	9.2 - 12.2	Annual
Off-base	Private Property (Residential)	MW139	RESI_GW013/RESI_GW13					Annual
Off-base	Cantonment (Former Fire Station)	MW167	CNN0230_GW01	328371.408	6390221.55	72.65	14.5	Annual
Off-base	Private Property (Singleton Council)	MW187D	MW09D	329563.18	6392244.65	40.23	18.7	Annual
Off-base	Private Property (Singleton Council)	MW187S	MW09S	329561.72	6392241.52	40.4	7	Annual
Off-base	Private Property (Singleton Council)	MW188D	MW10D	329045.14	6391822.39	41.25	25	Annual
Off-base	Private Property (Singleton Council)	MW188S	MW10S	329040.46	6391823.13	41.12	8.9	Annual

Table T1 - Sampling Location Information

On-base / Off-base	Area	Location Code	Historical Name	Easting	Northing	TOC (mAHD)	Screen Interval Depth	Sampling Frequency
Off-base	Sewerage Treatment Plant (STP). Effluent Pit. Private Property (Singleton Council).	OTH006		328776.9	6392588.58	n/a	n/a	Annual
On-base	Co-located SW/SD: SW002/SD002. Northern Cantonment (DNSDC)	SD002		328729.259	6390973.807	n/a	n/a	Annual
On-base	Co-located SW/SD: SW003/SD003. Northern Cantonment (ALG)	SD003		328863.483	6390010.018	n/a	n/a	Annual
On-base	Co-located SW/SD: SW004/SD004. STA (Dochra Airfield)	SD004		332768.77	6387094.72	n/a	n/a	Annual
On-base	Co-located SW/SD: SW005/SD005. STA (Dochra Airfield)	SD005		331936.67	6387252.51	n/a	n/a	Annual
On-base	Co-located SW/SD: SW032/SD032. Northern Cantonment (Sub-catchment A).	SD032		328530.667	6390352.491	n/a	n/a	Annual
On-base	Co-located SW/SD: SW039/SD039. Private Property (Residential)	SD039	RESI_SD039	331790.936	6390941.993	n/a	n/a	Annual
On-base	Co-located SW/SD: SW040/SD040. Southern Cantonment (Sub-catchment C)	SD040		327490.162	6388869.22	n/a	n/a	Annual
On-base	Co-located SW/SD: SW064/SD046. Private Property (Singleton Council)	SD046	RESI_SD041	330082.089	6392148.842	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW065/SD047. Private Property (Singleton Council)	SD047	RESI_SD042	329593.76	6392925.915	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW035/SD052. Private Property (Residential)	SD052	RESI_SD035	327551.145	6391459.49	n/a	n/a	Annual
On-base	Co-located SW/SD: SW026/SD053. Northern Cantonment (Sub-catchment A)	SD053	SMA13_SD	328164.578	6390625.598	n/a	n/a	Annual
On-base	Co-located SW/SD: SW028/SD055. Central Cantonment (Sub-catchment B)	SD055	SMA7_SD	327647.549	6389841.745	n/a	n/a	Annual
On-base	Co-located SW/SD: SW034/SD065. Northern Cantonment Boundary (Sub-catchment A)	SD065	SMA8_SD	328320.652	6391418.74	n/a	n/a	Annual
Off-base	Co-located SW/SD. SW036/SD080. Dam. Private Property (Residential).	SD080	RESI_SD013	328285.862	6391596.373	n/a	n/a	Annual
On-base	Co-located SW/SD: SW115/SD115. Northern Cantonment Boundary.	SD115		328672.7619	6391497.564	n/a	n/a	Annual
On-base	Co-located SW/SD: SW116/SD116. Cantonment (ALG)	SD116		329813.515	6389737.446	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW553/SD539. Private Property (Singleton Council)	SD539		329062.999	6392521.595	n/a	n/a	Annual
On-base	Co-located SW/SD: SW555/SD555. Central Cantonment (Sub-catchment B)	SD555		329034.221	6388589.839	n/a	n/a	Annual

Table T1 - Sampling Location Information

On-base / Off-base	Area	Location Code	Historical Name	Easting	Northing	TOC (mAHD)	Screen Interval Depth	Sampling Frequency
Off-base	Co-located SW/SD: SW563/SD563. Private Property (Singleton Council).	SD563		329162.07	6392940	n/a	n/a	Annual
On-base	Co-located SW/SD: SW002/SD002. Northern Cantonment (DNSDC)	SW002		328729.259	6390973.807	n/a	n/a	Annual
On-base	Co-located SW/SD: SW003/SD003. Northern Cantonment (ALG)	SW003		328859.222	6390001.096	n/a	n/a	Annual
On-base	Co-located SW/SD: SW004/SD004. STA (Dochra Airfield)	SW004		332770.588	6387095.299	n/a	n/a	Annual
On-base	Co-located SW/SD: SW005/SD005. STA (Dochra Airfield)	SW005		331911.32	6387184.041	n/a	n/a	Annual
On-base	Co-located SW/SD: SW026/SD053. Northern Cantonment (Sub-catchment A)	SW026	SMA13_SW	328164.578	6390625.598	n/a	n/a	Annual
On-base	Co-located SW/SD: SW028/SD055. Central Cantonment (Sub-catchment B)	SW028	SMA7_SW	327647.549	6389841.745	n/a	n/a	Annual
On-base	Co-located SW/SD: SW032/SD032. Northern Cantonment (Sub-catchment A).	SW032		328530.667	6390352.491	n/a	n/a	Annual
On-base	Co-located SW/SD: SW034/SD065. Northern Cantonment Boundary (Sub-catchment A)	SW034	figures and	328312.374	6391404.917	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW035/SD052. Private Property (Residential)	SW035	RESI_SW035	327551.145	6391459.49	n/a	n/a	Annual
Off-base	Co-located SW/SD. SW036/SD080. Dam. Private Property (Residential).	SW036	RESI_SW036	328283.548	6391592.424	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW039/SD039. Private Property (Residential)	SW039	RESI_SW039	331790.936	6390941.993	n/a	n/a	Annual
On-base	Co-located SW/SD: SW040/SD040. Southern Cantonment (Sub-catchment C)	SW040		327490.162	6388869.22	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW064/SD046. Private Property (Singleton Council)	SW064	RESI_SW041	330082.089	6392148.842	n/a	n/a	Annual
On-base	Co-located SW/SD: SW115/SD115. Northern Cantonment Boundary.	SW115		328672.7619	6391497.564	n/a	n/a	Annual
On-base	Co-located SW/SD: SW116/SD116. Cantonment (ALG)	SW116		329813.515	6389737.446	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW553/SD539. Private Property (Singleton Council)	SW553		329062.999	6392521.595	n/a	n/a	Annual
On-base	Co-located SW/SD: SW555/SD555. Central Cantonment (Sub-catchment B)	SW555		329034.221	6388589.839	n/a	n/a	Annual
Off-base	Co-located SW/SD: SW563/SD563. Private Property (Singleton Council).	SW563		329162.07	6392940	n/a	n/a	Annual

Note: Locations with coordinates removed are opt out

APPENDIX D OMP REVIEW

Table D1 - 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
MW012	*No*	*No*	*No*	*No*	*Remove location from OMP*	*Location is suspected to have been destroyed in 2019 during the demolition of the former cantonment fire station.* *Given the remaining monitoring well network (including monitoring wells MW008, MW011, and MW167) provide sufficient coverage of groundwater in this area, it was recommended that MW012 be removed from the scope.* *This recommendation was discussed with Defence and the location had been removed from the program ahead of the January 2023 sampling event.* *It is recommended this location be removed from the OMP.*

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
MW104	*No*	*No*	*No*	*No*	*Remove location from OMP*	*Monitoring well MW104 (located on-Site, along the Northern Cantonment Boundary) has been dry or had insufficient water present to be sampled during all sampling events carried out under the OMP to date.* *Given the surrounding monitoring well network (including well MW110) provides sufficient coverage of groundwater in this area, it was recommended that monitoring well MW104 be removed from the OMP.*
MW129	*No*	*No*	*No*	*No*	*Remove location from OMP*	*Monitoring well MW129 (located north of the Site, on private property) was unable to be sampled during majority of the sampling events carried out under the OMP to date.* *The location was unable to be accessed due to inability to secure an access agreement with the property owners (ownership changed since the commencement of the program).* *It was recommended that monitoring well MW129 be removed from the OMP.*

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
MW132	*No*	*No*	*No*	*No*	*Remove location from OMP*	*Monitoring well MW132 (located northeast of the Site, on private property) was unable to be sampled during majority of the sampling events carried out under the OMP to date.* *The location was unable to be accessed due to inability to secure an access agreement with the property owners.*
SW114	*No*	*No*	*No*	*No*	*Remove location from OMP*	*Based on the recent changes in the landform and historically the location has often been dry, it was recommended that this surface water sampling location be removed from the OMP scope.*
SD114	*No*	*No*	*No*	*No*	*Remove location from OMP*	*Based on the recent changes in the landform and historically the location has often been dry, it was recommended that this sediment sampling location be removed from the OMP scope.*
SW554	*No*	*No*	*No*	*Yes*	*Replace location*	*The location was identified to not be within Singleton Council owned land as originally thought, and the owner of the parcel of land could not be determined.* *A new, replacement surface water location, SW563, has been identified,*

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
						which is further north of the original location, targeting the same body of water and within Singleton Council owned land. *It was recommended that SW554 is replaced by SW563.*
SD540	*No*	*No*	*No*	*Yes*	*Replace location*	*The location was identified to not be within Singleton Council owned land as originally thought, and the owner of the parcel of land could not be determined.* *A new, replacement sediment location, SD563, has been identified, which is further north of the original location, targeting the same body of water and within Singleton Council owned land.* *It was recommended that SD540 is replaced by SD563.*
All locations groundwater, surface water (including wastewater) and sediment sampling locations under the existing PFAS OMP	*Yes*	*Yes*	*Yes*	*Yes*	*Change to Annual Monitoring Frequency*	*Change monitoring frequency for all locations to an annual basis, replacing the biannual and biennial monitoring frequencies.* *Based on the data collected, there are no observable differences in PFAS analytical results between the biennial, biannual and annual events since OMP monitoring commenced.*

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
						All locations under the PFAS OMP will be sampled annually in Winter (June / July) each year when temporal conditions are considered to be most stable.

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