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Defence

PFAS INVESTIGATION AND MANAGEMENT PROGRAM

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RAAF Base Edinburgh

PFAS MANAGEMENT AREA PLAN REVISION 1

March 2025

ACKNOWLEDGEMENT OF COUNTRY

Defence acknowledge the land of RAAF Base Edinburgh is the traditional lands for the Kaurna people and that Defence respects their spiritual relationship with their country.

Defence also acknowledge the Kaurna people as the custodians of the Adelaide region and that their cultural and heritage beliefs are still as important to the living Kaurna people today.

Defence also pay respects to the cultural authority of Aboriginal people visiting/attending from other areas of South Australia and across Australia.

Source: https://www.agd.sa.gov.au/aboriginal-affairs-and-reconciliation/statement-of-acknowledgement-welcome-to-country

ABOUT THIS DOCUMENT

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

This PMAP Revision replaces the PMAP for RAAF Base Edinburgh dated July 2019 (the 2019 PMAP).

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

The Environment Protection Authority South Australia (EPA SA) and other relevant state and local agencies have been consulted in the development of this document.

EXECUTIVE SUMMARY

Background

In 2019 Defence published the RAAF Base Edinburgh PFAS Management Area Plan (2019 PMAP) for managing risks to human health and the environment from per- and poly-fluoroalkyl substances (PFAS) contamination associated with RAAF Base Edinburgh (the base) and surrounding areas.

Since the 2019 PMAP for the base was developed, Defence has implemented many of the risk management actions in the plan and reassessed what further work is now required to best manage these contamination risks.

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

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

- minimising exposure to PFAS
- preventing or minimising migration (movement) of PFAS
- keeping the community informed.

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

Completed and ongoing remediation works

Defence has completed a number of investigation and remedial actions at the base and in the surrounding Management Area, including:

- Remediation of more than 37,000 tonnes of soil across eight PFAS source areas, including sending more than 4,000 tonnes of the most highly contaminated soils off-base for incineration (thermal destruction) of the PFAS contamination
- Removal and off-base destruction of approximately 400 square metres of concrete and bitumen
- Remediation of more than 270 million litres of groundwater across five source areas with more than 54 kilograms of PFAS removed to date. Groundwater remediation works were ongoing at the time of this PMAP revision
- Completion of a groundwater bore replacement program comprising the installation of four new deep water supply bores at properties impacted by the establishment of the Edinburgh Groundwater Prohibition Area (GPA)
- Implementation of an ongoing monitoring program to assess changes in PFAS impacts in surface water (stormwater) and groundwater, both on-base and in the off-base Management Area
- Commissioning an engineering and design study to install new waterproof liners in the waste water management infrastructure that is connected to the hangar fire suppression systems on-base. The relining of these critical waste water management features is scheduled to be complete in late 2025.

Further to the measures being implemented by Defence to control the risk of exposure to PFAS at RAAF Base Edinburgh and in the surrounding communities, the Environment Protection Authority South Australia (EPA SA) established the Edinburgh GPA. The Edinburgh GPA was established to protect both current and future landholders from accessing PFAS contaminated groundwater in the Quaternary aquifers via a bore on their property.

Defence has engaged the services of an independent EPA SA accredited Site Contamination Auditor to ensure that the management actions and remediation being undertaken at the base adequately minimise the risk of PFAS exposure. The role of the auditor is to provide an independent review of the establishment and implementation of PFAS management and remediation actions undertaken by Defence. Once the auditor is satisfied that the necessary risk management actions have been implemented, a Site Contamination Audit Report will be submitted to the EPA SA and published on the Defence website.

As the remaining risk management actions are progressed, Defence will provide regular updates to the local community on the Defence website.

CONTENTS

GLOSSARY

AFFF	Aqueous Film Forming Foam
ASC NEPM	*National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended 2013
base	RAAF Base Edinburgh
CSM	Conceptual Site Model
DSI	Detailed Site Investigation
EMOS	Estate Maintenance and Operational Services
EPA SA	Environment Protection Authority South Australia
GAC	Granular Activated Carbon
GPA	Groundwater Prohibition Area
HHRA	Human Health Risk Assessment
Management Area	The geographical area subject to Defence risk management actions. May include private or Defence owned detached properties beyond the boundaries of the base.
OMP	Ongoing Monitoring Plan
PERA	Preliminary Ecological Risk Assessment
PFAS	Per- and poly-fluoroalkyl Substances
PFAS NEMP	PFAS National Environmental Management Plan
PFHxS	Perfluorohexane sulfonate
PFOS	Perfluorooctane sulfonate
PMAP	PFAS Management Area Plan
RAP	Remediation Action Plan
Risk management actions	Remediation and management actions to address potential risks to receptors from PFAS contamination.
Risk assessment(s)	The HHRA and/or PERA
Source	A source can be primary or secondary. Primary sources are generally areas where AFFF was used or stored. Secondary sources may be an accumulation of contamination in the environment, such as in soil, sediments, or surface water bodies.

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

1 INTRODUCTION

1.1 Background and purpose

In July 2019 Defence published the PFAS Management Area Plan (2019 PMAP) for RAAF Base Edinburgh (the base) for managing risks to human health and the environment from per- and poly-fluoroalkyl substances (PFAS) contamination associated with the base and surrounding areas.

Since the 2019 PMAP for RAAF Base Edinburgh was developed, Defence has implemented many of the risk management actions in the plan, and reassessed what is now needed to best manage risks from PFAS contamination.

This PMAP revision provides an update with respect to:

- progress made on PFAS soil and groundwater remediation (clean-up) on the base;
- the increased understanding of PFAS movement on and from the base in surface water and groundwater;
- if potential risks to human health or the environment from PFAS contamination have changed;
- management actions apart from remediation, such as the establishment of the Edinburgh Groundwater Prohibition Area (GPA) by the Environment Protection Authority South Australia (EPA SA) (Stages 1 and 2) for Quaternary aquifers; and
- a review of factors such as changes to government policy settings, site conditions and scientific methodologies and technology.

This PMAP revision sets out the updated plan to manage risks to human health and the environment from exposure to PFAS contamination from RAAF Base Edinburgh. It has been placed on the Defence website so that the community, regulators, and other stakeholders can access it.

The PMAP revision has been developed in accordance with the PFAS National Environmental Management Plan (NEMP), which provides nationally consistent environmental guidance and standards for managing PFAS contamination.

PMAPs are reviewed and if required updated periodically to provide an update to the community and government agencies on progress in management and remediation, new data, changes in legislation, guidelines and policy, and advances in scientific information.

1.2 Independent site contamination audit

An independent EPA SA accredited Site Contamination Auditor has been engaged by Defence to audit the investigation and remediation (clean-up) work undertaken at the base. Three separate audits will be completed for the remediation work at RAAF Base Edinburgh in accordance with the South Australian *Environment Protection Act 1993*.

The remediation work that will be audited includes:

1. Land remediation of seven priority soil source areas (Audit ID G/63342)
2. Groundwater remediation (Audit ID G/62523).
3. Remediation and lining of hanger waste water management infrastructure (Audit ID G/63343)

The site contamination audit for the previous investigation of the nature and extent of PFAS contamination at the base and in the broader off-base investigation area was completed by Mr Paul Fridell on 5 October 2020. A copy of the Site Contamination Audit Report can be downloaded from the Defence website.

1.3 Management priorities

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

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

1.4 Supporting information

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

The reports identified a range of elevated risks to receptors from exposure to PFAS, which are the focus of the risk management actions outlined in this document. Further information on the elevated risks to receptors is presented in Section 3.3.

1.5 Limitations and assumptions

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

- Adopted management/remediation options were based on current proven technologies available at the time of writing this document including:
  - management and remedial technologies summarised in the PFAS NEMP
  - additional technologies based on successful trials by Defence and conducted by others within and outside of Australia (based on publicly available information).
- The presence of significant base infrastructure and related access constraints, which influenced suitable remediation options and remedial extents.

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

2 MANAGEMENT AREA

The Management Area covers all of the base and discrete areas outside of the base where PFAS has been identified, and is the primary area throughout which risk management actions and ongoing monitoring have been completed to date. This includes Helps Road Drain and the Kaurna Park Wetland, as well as groundwater beneath parts of the suburbs of Penfield, Direk, Burton, Salisbury North, Paralowie, Waterloo Corner, St Kilda and Bolivar. The PFAS Management Area is shown on Figure C1 in Appendix C.

A summary of the current land uses surrounding the base, with consideration of the land use zones identified in the South Australian Planning and Design Code, is provided below:

- **North:** A child care facility is located within 200 m of the base boundary (on Argent Road). Commercial/industrial (strategic employment), agricultural (rural horticultural), and recreational (master planned neighbourhood and rural living) land uses are located to the north of the base, with low-density residential land (general neighbourhood) further to the north-east.
- **East:** Commercial/industrial (strategic employment and innovation, urban activity centre) land uses are located to the east of the base, including the Defence Science and Technology Group (DSTG) site located immediately south-east. Further to the east there is residential (established neighbourhood and housing diversity neighbourhood) land use.
- **South:** Agricultural (rural and rural living), industrial/commercial (strategic employment) and residential (general neighbourhood) land uses are located to the south of the base, with some areas designated open space (e.g., Kaurna Park Wetland).
- **West:** Agricultural (rural and rural horticultural) and commercial/industrial (strategic employment) land uses are located to the west of the base, with some recreational land uses.

Broadly, the agricultural areas off-base include broad acre cultivation of edible produce (e.g., wheat, vegetables) interspersed with more intensive market garden and hydroponic farming of fruits and vegetables, and smaller scale hobby farms used primarily for domestic scale production of edible produce. In addition, there are several properties that are used for domestic and commercial horse training activities to the north and west of the base.

Changes to land uses occur over time and any future revisions of the PMAP will consider these changes.

Information about the Management Area environmental setting, such as climate, topography, geology, hydrology and various other aspects is provided in the 2019 PMAP.

2.1 Edinburgh GPA

The Management Area is aligned with Stage 1 of the Edinburgh GPA. The Edinburgh GPA was established by the EPA SA in early 2022 to protect both current and future landholders from accessing PFAS contaminated groundwater via a bore on their property. Stage 1 of the GPA prohibits the taking of groundwater from the 1st, 2nd and 3rd Quaternary aquifers (Q1 – Q3) and the Carisbrooke Sand (Q4) aquifer. The lateral extent of the Stage 1 GPA for the different aquifers varies throughout the Management Area, as shown on Figure C2 in Appendix C.

A subsequent extension of the GPA was established by the EPA SA in early 2023 (identified as Stage 2). The Stage 2 GPA extends beyond the Management Area and applies only to the Q1 and Q2 aquifers, to a depth of 20 metres below ground surface. The lateral extent of the Stage 2 GPA is also shown on Figure C2 in Appendix C.

3 EXTENT OF PFAS CONTAMINATION

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

This information is often referred to as a Conceptual Site Model (CSM), which is provided in Appendix B. As part of this PMAP revision, the CSM for RAAF Base Edinburgh and surrounding areas was reviewed for currency and updated to reflect a degree of interaction/connection between the Q3/Q4 and T1 aquifers in some portions of the Management Area (noting further detail is provided in Section 3.2).

For more detailed information informing the CSM, refer to the reports listed in Appendix A.

3.1 Source areas

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

The PFAS source areas that have been identified through previous investigations (Appendix A) are provided in Table 1. A map showing these source areas is provided as Figure C3 in Appendix C. Further detail regarding the extent of contamination identified at each source area is provided in the Detailed Site Investigation (DSI) report (JBS&G, 2018) and the associated DSI Addendum report (JBS&G, 2019a). These reports can be downloaded from the RAAF Base Edinburgh documents archive.

Table 1. Known source areas of PFAS

Source Area ID	CSR Number	Source area description	Extent of PFAS contamination	Remedial activities
P1	CSR_SA_000278	AFFF waste water retention tank (Building 521) and AFFF waste water evaporation pond (T0770), including soils in the vicinity of this infrastructure.	Sediment in waste water evaporation pond, soil (leachate), concrete (leachate), and groundwater	Excavation and off-base disposal/ incineration of 3,855 tonnes of highly contaminated sediments and clays from the base of the AFFF waste water evaporation pond have been completed. Installation of a liner in the waste water evaporation pond is planned to occur in 2025.
P2	CSR_SA_000292	The base's bulk fuel storage facility, which includes an automated AFFF deluge system.	Groundwater, soil (leachate)	No direct remedial works in this area. Groundwater remediation activities occurring in nearby source areas (P3B and P27).
P3A & P3B	CSR_SA_000421	AFFF waste water holding tanks (T0520 and T0522), identified as the 'Chesterfield' sumps, located at the eastern and western end of the aircraft hangars.	Concrete (leachate), surface water (stormwater), and groundwater	Groundwater pump and treat remediation activities in progress at P3B. Installation of liners in the waste water holding tanks is planned to occur in 2025.
P4	CSR_SA_000282	Former fire training area and sub-surface waste dump in the central northern portion of the airside operations area.	Soil (leachate) and groundwater	Soil remediation works completed treating and reinstating a total mass of approximately 8,300 tonnes of PFAS impacted soils.
P8	CSR_SA_000286	Former sub-surface waste dump located along the central portion of the western base boundary.	Groundwater	A groundwater remediation trial was completed in this area. Replacement of licensed Quaternary aquifer bores with deeper Tertiary aquifer (T1) bores located nearby this area was completed by Defence.

Source Area ID	CSR Number	Source area description	Extent of PFAS contamination	Remedial activities
P9	CSR_SA_000276	Former fire training area, including smokeroom training building (Building 618), located in the southern portion of the airside operations area near the Ordnance Unloading Area.	Soil (leachate), concrete (leachate) and groundwater	Soil remediation works completed treating and reinstating a total mass of approximately 7,000 tonnes of PFAS impacted soils. Groundwater pump and treat remediation works completed. More than 58 million litres of water has been treated and returned to the aquifer.
P10	CSR_SA_000484	Former fire training area located in the most southern point of the airside operations area, adjacent to the Helps Road Drain discharge point (across the south-western base boundary), and Southern Detention Basin.	Soil (leachate), and groundwater	Soil remediation works completed treating and reinstating a total mass of approximately 2,500 tonnes of PFAS impacted soils.
P11ATC	CSR_SA_000112	Former AFFF concentrate storage area located near the newer Air Traffic Control Tower.	Soil (leachate), groundwater, and concrete (leachate)	Soil remediation works completed treating and reinstating a total mass of approximately 650 tonnes of soil. A further 320 tonnes of highly contaminated materials were transported off-base for disposal/ incineration. In addition, approximately 400 m^2 of concrete and bitumen was excavated and disposed off-base. Capping of contaminated materials was completed across the balance of the area where materials could not be excavated and treated due to the presence of critical underground services. This prevents water interacting with the PFAS contaminated soils. Groundwater remediation activities are ongoing.

Source Area ID	CSR Number	Source area description	Extent of PFAS contamination	Remedial activities
P11FS	CSR_SA_000112	Base fire station and surrounding area.	Soil (leachate) and groundwater	Soil remediation works completed treating and reinstating a total mass of approximately 900 tonnes of PFAS impacted soils. This included off-base disposal/incineration of approximately 30 tonnes of highly contaminated materials. Groundwater remediation activities are ongoing.
P15A & P15B	CSR_SA_000277	Former fire training area in the Ordnance Unloading Area, located in the southern portion of the airside operations area.	Soil (leachate) and groundwater	Soil remediation works completed treating and reinstating a total mass of approximately 5,900 tonnes of PFAS impacted soils.
P16	CSR_SA_000285	Former fire training area around the Engine Run-up Facility, located to the northwest of the main apron.	Groundwater	Soil remediation works completed treating and reinstating a total mass of approximately 8,000 tonnes of PFAS impacted soils.
P23	CSR_SA_000289	Approximate location of a historical train and semi-trailer crash, at the corner of the western and south-western base boundaries.	Groundwater, soil (leachate)	No targeted remediation activities considered necessary. Area subject to ongoing monitoring.
P27	CSR_SA_000295	Suspected former fire training area adjacent to a parking area for aircraft refuelling tanker trucks, located to the west of the bulk fuel storage facility.	Groundwater, soil (leachate)	Groundwater remediation activities in progress.

3.2 Transport pathways

PFAS can travel from a source to human or environmental receptors via transport pathways, such as surface water, groundwater and stormwater. The transport pathways identified at and surrounding RAAF Base Edinburgh were summarised in the DSI report completed in 2018 (JBS&G, 2018), and are briefly described below. A copy of the DSI report can be downloaded from the RAAF Base Edinburgh documents archive.

Laboratory analysis conducted on soil and concrete samples showed that the key analytes of interest, namely perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS), were readily able to leach from the samples when exposed to water. Without management, the soil and concrete source areas at the base present an ongoing source of PFAS contamination to nearby stormwater drainage features (including Helps Road Drain) and the underlying groundwater system.

Defence targeted remediation of highly impacted soils and concrete at the major source areas across the base to reduce leaching and hence limit the movement of PFAS from the base over the longer term.

Due to the persistence of PFAS in the environment, when PFAS contamination enters surface water and groundwater it can migrate long distances in the direction of flow. Evidence of off-base migration of PFAS in both surface water and groundwater has been confirmed by Defence's monitoring programs.

It was determined that the majority of PFAS discharging from the base is from surface water flows rather than groundwater (JBS&G, 2023). More specifically, the mass of PFAS discharging from the base during a typical rainfall year (i.e., where average stormwater discharge is expected) was estimated to be as much as ten times higher in surface water than groundwater.

In addition to the lateral migration of PFAS contamination in groundwater, sampling programs also identified vertical migration of PFAS contamination through the shallow Quaternary aquifers beneath and down hydraulic gradient of the base. PFAS contamination was found to extend to the Q4 Aquifer in some areas although at significantly lower concentrations than that observed in the overlying Q1 and Q2 Aquifers (the aquifers are shown on Figure B1, Appendix B). Field observations, groundwater analytical results, and assessments of water chemistry indicated a varying degree of hydraulic connectivity between the Quaternary Aquifer units, with a general downward hydraulic gradient between the Q1 and Q2 Aquifers and the underlying Q3 and Q4 Aquifers.

A transient water level monitoring program completed after the DSI program also identified a degree of interaction/connection between the Q3/Q4 and T1 aquifers in some portions of the Management Area (noting this updated understanding has been reflected in the refined CSM presented on Figure B1, Appendix B). Continued monitoring of Q3 and Q4 groundwater wells as part of the ongoing monitoring program will allow an assessment of potential risks to the T1 aquifer. Furthermore, targeted monitoring of water quality in the T1 aquifer is being undertaken as part of the ongoing monitoring program (which supplements sampling completed during the DSI), with no identification of PFAS impacts in the T1 Aquifer.

The major stormwater drainage features throughout the base and the broader Management Area are unlined stormwater drains and detention basins. It is noted that the distribution of PFAS in the shallow groundwater system off-base tends to follow these water courses.

As noted above, soil and concrete remedial works at the base have been focussed on reducing the spread of PFAS to waterways and the underlying groundwater system by targeting remediation in shallow soils across key source areas where the highest PFAS concentrations and mass were identified.

3.3 Receptors and risks

Three potential exposure risk scenarios were identified by the Human Health Risk Assessment (HHRA) and Preliminary Ecological Risk Assessment (PERA) (JBS&G, 2019b).

Table 2 below describes each of these exposure scenarios and provides a summary of the control measures and management actions implemented by Defence, the EPA SA, and the City of Salisbury Council. Further details relating to the risk management actions implemented by Defence, and the status of each action identified in the 2019 PMAP, are provided in Section 4.

Table 2. Potentially elevated PFAS exposure risks

Original risk scenarios	Current status of risks
Elevated human exposure through unlicensed use of Quaternary Aquifer groundwater, including potential future risk to licensed users.	• A program implemented by Defence to replace licensed Quaternary aquifer bores with deeper Tertiary aquifer (T1 and T2) bores in the Management Area. • Establishment of the Edinburgh GPA (as shown on Figure C2 in Appendix C). • The measures have removed current or future risks to potential receptors that may be exposed to PFAS contaminated Quaternary aquifer groundwater. • Ongoing monitoring will continue to assess any potential for impacts to the underlying T1 Aquifer.
Elevated human exposure through consumption of carp from Kaurna Park Wetland, or other locations within Helps Road Drain downstream of the base.	• Existing signage that prohibits fishing was established by the City of Salisbury Council due to the wetland being a man-made stormwater detention basin. This prohibition existed prior to the PFAS investigations. • Additional signage has been erected at all entrances to the wetland and areas where other permanent surface water features are present to enhance the existing controls.
Exposure to ecological receptors (i.e., protected migratory birds) associated with consumption of aquatic biota in Kaurna Park Wetland.	• On-base remedial activities have been completed across key source areas to mitigate the ongoing risk of impact to surface water, including stormwater that discharges from the base and which is ultimately directed to the wetland via Helps Road Drain (refer to Section 3.2). • Over the longer term, this will reduce concentrations of PFAS leaving the base and reduce these risks further.

4 RISK MANAGEMENT ACTIONS

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

4.1 Background

Risk management actions are taken to minimise exposure of humans and ecological receptors to PFAS. This can be through remediating source areas, reducing migration through the environment by managing transport pathways, or preventing exposure at the receptor (e.g., through administrative controls or providing alternative drinking water supplies). Defence prioritises source management and pathway management as preferable to receptor management, but these components may also be progressed concurrently.

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

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

4.2 Implementation

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

Key factors for progressing and prioritising PMAP actions include:

Mitigating PFAS migration and protecting human health	Implementation of practicable solutions to prevent or minimise the migration of PFAS beyond the Defence property boundary, and measures to protect the community from exposure to PFAS.
Higher risks	The relative level of risk being addressed, including changes in land use.
Outcomes of completed works	Outcomes from further studies, technology trials or validated remedial works may change the profile or priority of source areas or works.
Linked actions	Whether the implementation of one response action is dependent on the implementation of another response action.

Use of public resources	Application of the Commonwealth Procurement Rules (issued under the *Public Governance, Performance and Accountability Act 2013*) including the Defence Infrastructure Panel – Environment, Heritage and Estate Engineering Services 2020-2025, to achieve value for money in procurement; and to use public money in an efficient, effective, economical and ethical manner. Cost-effectiveness may be facilitated through: • grouping the implementation of similar risk management actions within one or more Management Areas; and • aligning Defence infrastructure and maintenance plans with a PFAS risk management action.
Mandatory approvals	Timeframes for mandatory approvals and notification processes.
New legislation or policy	Development of relevant legislation, policy, guidelines and whole-of-government positioning.
Science and technology	The availability of new relevant science and technology.
Stakeholder input	Information from stakeholders that may impact a risk profile.

4.3 Completed and ongoing risk management actions

A screening assessment of options to manage the risks presented in Section 3 was undertaken as part of the 2019 PMAP. Based on this assessment, the strategy adopted was a combination of active remediation of soil and groundwater contamination at key source areas on-base as well as funding alternative water supply arrangements for off-base licensed Quaternary aquifer groundwater users in the Management Area (i.e., bore replacements).

The current status of the actions in the 2019 PMAP are detailed in Table 3 below.

Table 3. Status of 2019 PMAP recommended actions

Action	Description	Status
On-base management	Continue to implement controls on ground disturbance activities and management of intrusive works via relevant Defence Policies and Procedures.	**Complete** (and ongoing)
	Complete a review of the Estate Maintenance and Operation Services (EMOS) Contractor occupational health and safety policies and procedures to ensure that the administrative and operational controls identified in the HHRA and PERA (JBS&G, 2019b) are formally documented.	**Complete**
	Continue to manage AFFF waste water in accordance with existing EMOS Contractor procedures to prevent the potential for overflow from the AFFF evaporation pond (or associated infrastructure) that will impact on adjacent stormwater drainage features that ultimately direct stormwater off-base.	**Complete** (and ongoing)
Soil remedial works in source areas	Preparation of a Remediation Action Plan (RAP) for the purpose of clearly defining the remedial objectives and remediation criteria for soils in source areas.	**Complete** A soil RAP was prepared in 2021 and was endorsed by the appointed Site Contamination Auditor (AECOM, 2021a). Soil and concrete remediation works at key source areas across the base have since been implemented, as described in Table 1.
	Undertake additional detailed soil characterisation works to better define the extent of soil hot spots within the relevant source areas, including prioritisation of source areas based on those likely to be contributing the greatest degree of PFAS impacts to stormwater discharging from the base.	**Complete** Soil source area delineation works were completed in 2019 and 2020 and were used to inform preparation of the soil RAP (AECOM, 2021a).
	Commission a capping design study to determine the most appropriate capping method and capping extent for each of the soil source areas, with specific consideration given to the additional soil investigations proposed to better define hot spot areas requiring management.	**Complete** These works were completed as part of preparing the soil RAP, and included the preparation of both surface and sub-surface capping designs for remediated areas. Sub-surface capping was used where soils in the upper 0.5 m were excavated for treatment and subsequent reinstatement, to effectively cap soils at a depth beyond 0.5 m. Surface capping was used where soils could not practicably be excavated or treated due to the presence of critical base infrastructure, noting this occurred at source area P11ATC (refer Table 1).

Action	Description	Status
Soil remedial works in source areas	Engineering assessment of stormwater management at each source area for the purpose of identifying opportunities to prevent/minimise contaminated surface water flow. Additionally, investigate the potential ongoing PFAS contribution that the concrete sources identified at the base may be having on the surrounding environment (e.g., stormwater) and determine whether management is required to reduce PFAS movement from the base (e.g., removal of concrete sources).	**Complete** These works included artificial irrigation (hose-down) tests to enable assessment of PFAS leaching contributions from soil and concrete to surface water. The results of these additional investigations were used to inform preparation of the soil RAP, including identification of areas where concrete would also be targeted for remediation (i.e., P11ATC).
	Complete a detailed review of appropriate ex-situ and in-situ remedial technologies to support the proposed soil remediation works, including consideration of the results of the soil washing trial and potential use of this technology to aid remediation activities.	**Complete** A review of appropriate remedial technologies was completed as part of the soil RAP, including a review of the effectiveness of the soil washing trial and applicability of this technology to soil remediation works at the base. Ultimately a combination of remedial technologies was adopted, including off-base disposal/incineration of the most heavily contaminated soils and concrete, soil washing of highly contaminated materials to reduce PFAS mass, and soil stabilisation of less contaminated materials through the addition of granular activated carbon (GAC). In addition, a waterproof liner (low permeability membrane) was installed in the base of remediation excavations prior to reinstatement of stabilised soils to cap residual PFAS mass at greater depths. Contaminated materials that could not practicably be excavated or treated due to the presence of critical base infrastructure were also capped.
	Establishment of baseline mass flux in surface waters to enable future assessment of the effectiveness of soil remediation works in reducing the mass of PFAS discharging from the base.	**Complete** A detailed mass flux study (JBS&G, 2023) was completed prior to the commencement of soil and groundwater remediation works at the base. This study established baseline mass flux in both surface waters (stormwater) and groundwater discharging from the base.

Action	Description	Status
Groundwater Remedial Works	Preparation of a RAP for the purpose of assessing and identifying groundwater remedial actions at the source areas and/or base boundaries.	**Complete** (with ongoing implementation of groundwater remediation activities). A groundwater RAP was prepared in 2021 and was endorsed by the appointed Site Contamination Auditor (JBS&G, 2021). Groundwater remediation works at key source areas across the base have since been commissioned (as described in Table 1) and will be ongoing until the remediation objectives defined in the groundwater RAP have been achieved (including any Auditor endorsed amendments).
	Investigation of data gaps in the source areas to inform the remedial assessment. This may include stress testing the aquifer to better understand the aquifer hydraulic properties, consideration of data gathered during the interim response groundwater treatment program to better understand contaminant fate and transport mechanisms, and additional works to better define the vertical and/or horizontal extent of impacts in individual source areas.	**Complete** Investigations completed to inform the groundwater RAP included a small-scale in-situ remediation trial comprising gravity fed injection of a powdered activated carbon (PAC) amendment slurry at source area P8, transient groundwater level monitoring in targeted Q3, Q4 and T1 Aquifer monitoring wells to assess hydraulic connectivity between the different aquifer units, and completion of falling and rising head hydraulic conductivity tests (slug tests) on selected Quaternary Aquifer monitoring wells (completed as part of the PFAS mass flux study). The outcomes of these investigations were used to inform the selection of suitable remedial options and for preparation of the groundwater RAP (JBS&G, 2021).
Minor Engineering Projects	Commission an engineering study to determine an appropriate method for upgrading and/or replacing the 'Chesterfield' sumps to mitigate the ongoing contribution this infrastructure may have on PFAS impacts in surface water and/or groundwater, and determine whether lining of the AFFF evaporation pond should occur to mitigate potential impacts to surface water (stormwater) should the capacity of the pond be exceeded (i.e., overflow occurs).	***Ongoing*** The AFFF waste water evaporation pond and 'Chesterfield' sumps are a critical component of the hangar fire suppression systems on-base. The evaporation pond and sumps will be lined with a low permeability membrane (i.e., waterproof material) in order to prevent water infiltrating into the concrete surfaces and the surrounding soil. These works are planned to be undertaken in 2025.
Ongoing Monitoring	Continue PFAS monitoring in accordance with the Ongoing Monitoring Plan (OMP) to measure changes to PFAS flux and distribution in surface waters and groundwater.	**Complete** (and ongoing). It is noted that the OMP has been revised, taking into account the results of ongoing monitoring since 2020. The OMP has been published as a standalone document on the Defence website.

4.4 Additional risk management actions

Additional management actions in relation to human exposure of users of the Quaternary aquifer have been identified and implemented since publication of the 2019 PMAP. A description and the status of these actions are set out in Table 4 below.

Table 4. Status of additional risk management actions

Action	Description	Status	Reason / timeframe
Bore Replacement Program	Quaternary aquifer bore replacement program comprising the installation of four new Tertiary Aquifer water supply bores at off-base properties impacted by the Edinburgh GPA.	**Complete**	The establishment of the Edinburgh GPA resulted in licensed Quaternary Aquifer groundwater users being prohibited from extracting water from their bores. To restore water use, Defence engaged a consultant to manage and implement a bore replacement program. These works were completed between January and August 2023 and included the procurement of new Tertiary Aquifer water supply licenses for the affected properties.
Groundwater remediation	Groundwater remediation works at key source areas across the base have been commissioned in accordance with the measures detailed in the Auditor-endorsed groundwater RAP (JBS&G, 2021).	**Ongoing**	Remediation will be ongoing until the remediation objectives defined in the groundwater RAP have been achieved (including any Auditor endorsed amendments).

4.5 Ongoing monitoring and trigger levels

Defence continues to monitor PFAS concentrations in the environment at the base through an ongoing monitoring program. This allows for the timely identification and management of any emerging risks or changes to existing risks. Monitoring requirements are outlined in an OMP, which is reviewed periodically and, if required, amended to ensure it continues to provide the data needed to monitor important changes in PFAS concentrations and distribution.

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

Based on the data collected to date, and the 2024 Ongoing Monitoring Report, there have been only minor changes to the CSM for RAAF Base Edinburgh, as outlined in Section 3.

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

5 NEXT STEPS

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

Defence will review, and if required revise the PMAP at regular intervals to ensure the PMAP remains current, relevant and prioritises the right actions to protect human health and the environment. Defence will continue to engage with the community, EPA SA, the City of Salisbury and City of Playford Councils, and other stakeholders to ensure information is available in an easily accessible form.

Remediation at RAAF Base Edinburgh will be undertaken so far as reasonably practicable, recognising it is not possible to remove all PFAS from the environment. However, all unacceptable PFAS risks will be identified through monitoring and appropriate management measures will be taken.

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

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

The EPA SA accredited Site Contamination Auditor will continue to review information relating to PFAS management at the base. Once the auditor is satisfied that assessment and remediation has been completed in accordance with relevant legislation and guidelines, and that ongoing management measures are appropriate, they will prepare a Site Contamination Audit Report and Statement. Long term management and monitoring of PFAS in the environment will continue as required.

APPENDIX A REFERENCES

Key documents

AECOM, 2021a. *PFAS Soil Source Areas - Remediation Action Plan, RAAF Base EDN Technical Memo 33*, AECOM Australia Pty Ltd, 19 August 2021.

AECOM, 2024a. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P4,* AECOM Australia Pty Ltd, 15 December 2023

AECOM, 2024b. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P9,* AECOM Australia Pty Ltd, 24 October 2023

AECOM, 2024c. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P10,* AECOM Australia Pty Ltd, 3 November 2023

AECOM, 2024d. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P11 Fire Station,* AECOM Australia Pty Ltd, 21 March 2024

AECOM, 2024e. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P11 ATCT,* AECOM Australia Pty Ltd, 4 December 2023

AECOM, 2024f. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P15,* AECOM Australia Pty Ltd, 10 November 2023

AECOM, 2024g. *RAAF Base Edinburgh PFAS Remediation - Soil Verification Report, Priority Area P16,* AECOM Australia Pty Ltd, 14 November 2023

JBS&G, 2018. *RAAF Base Edinburgh Environmental Investigation of PFAS, Detailed Site Investigation (Rev 0)*, JBS&G Australia Pty Ltd, 11 December 2018.

JBS&G, 2019a. *RAAF Base Edinburgh Environmental Investigation of PFAS, Detailed Site Investigation Addendum Report (Rev 0)*, JBS&G Australia Pty Ltd, July 2019.

JBS&G, 2019b. *RAAF Base Edinburgh Environmental Investigation of PFAS, Human Health Risk Assessment (HHRA) and Preliminary Ecological Risk Assessment (PERA) (Rev 0)*, JBS&G Australia Pty Ltd, July 2019.

JBS&G, 2021. *PFAS Groundwater Remediation Action Plan, RAAF Base Edinburgh*, JBS&G Australia Pty Ltd, 13 August 2021.

JBS&G, 2023. *PFAS Mass Flux Study at RAAF Base Edinburgh, Detailed Report*. JBS&G Australia Pty Ltd, 14 February 2023.

Other References

AECOM, 2021b. *Interpretive Report 2020, PFAS OMP - RAAF Base Edinburgh*, AECOM Australia Pty Ltd, 17 December 2021

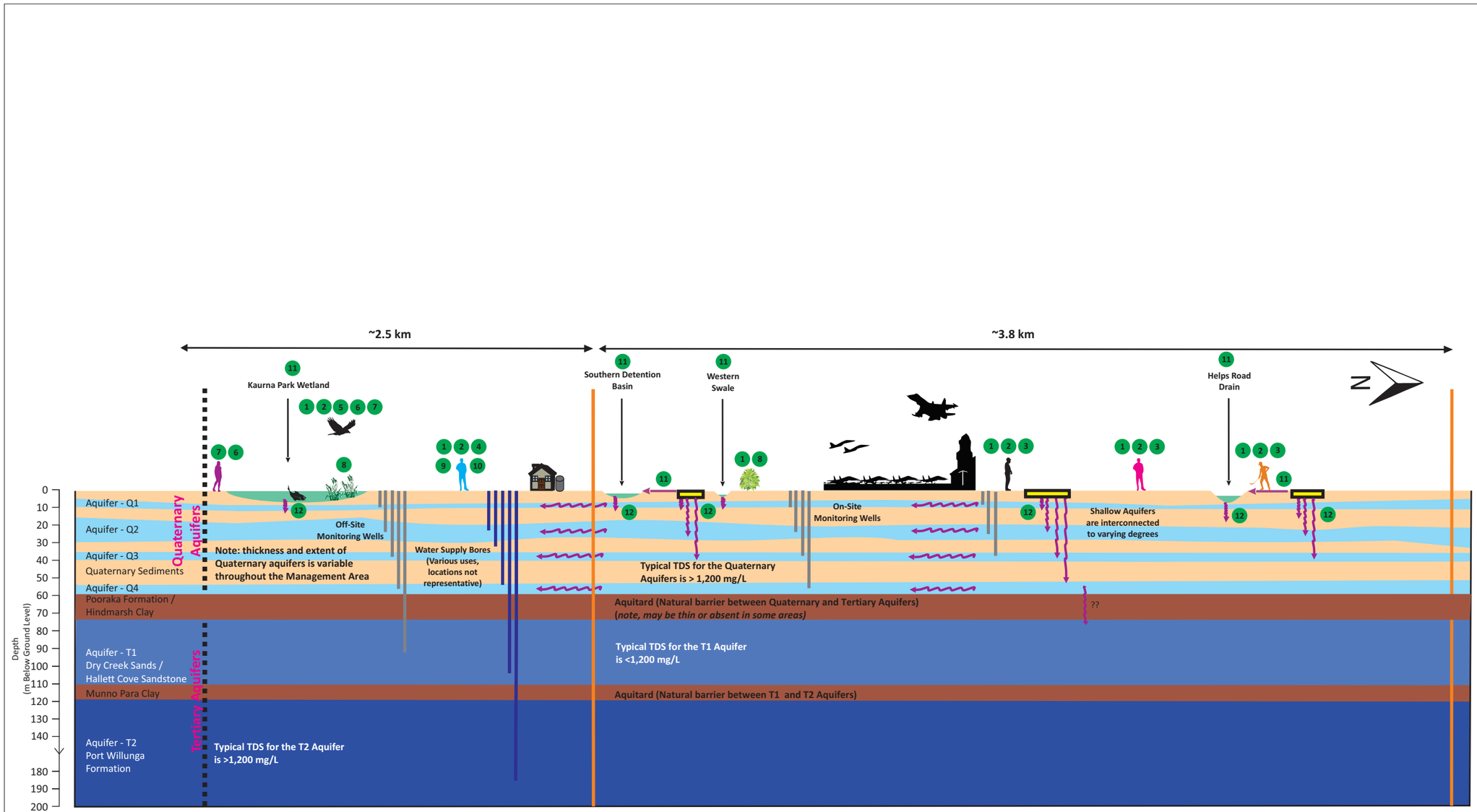
AECOM, 2023. *Interpretive Report 2021, PFAS OMP - RAAF Base Edinburgh*, AECOM Australia Pty Ltd, 18 October 2023

AECOM, 2024h. *Ongoing Monitoring Report 2022, PFAS OMP - RAAF Base Edinburgh*, AECOM Australia Pty Ltd, 8 July 2024

AECOM, 2024i. *Ongoing Monitoring Report 2023, PFAS OMP - RAAF Base Edinburgh*, AECOM Australia Pty Ltd, 17 July 2024

APPENDIX B CONCEPTUAL SITE MODEL

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



Receptors

Human

- Defence personnel
- Maintenance workers and contractors
- Visitors to site
- Members of the public
- Users of groundwater

Ecological

- Terrestrial fauna
- Aquatic fauna
- Terrestrial flora
- Aquatic flora
- Soil, Sediment, Surface Water and Groundwater

Exposure Pathways / Transport Pathways

1. Direct contact
2. Incidental ingestion
3. Inhalation (dust)
4. Consumption of local produce irrigated with groundwater
5. Ingestion of impacted surface water
6. Consumption of impacted flora
7. Consumption of impacted fauna
8. Uptake of PFAS from affected media
9. Consumption of produce irrigated with PFAS contaminated groundwater
10. Consumption of livestock, milk, eggs where PFAS contaminated groundwater has been used for stock water supply
11. Overland transport of particulate and dissolved PFAS
12. Leaching of dissolved PFAS

Legend:

- RAAF Base Edinburgh
- Refined Investigation Area
- PFAS Source Areas
- Water Bodies
- Drainage Lines
- PFAS Migration to Groundwater
- Inferred Surface Water Flow
- Inferred Regional Groundwater Flow Direction

Regional Geology

- Clays, Silts, Sands
- Clays

Aquifer

- Q1
- Q2
- Q3
- Q4
- T1
- T2

Groundwater Bores

- Monitoring Wells
- Water Supply Bores

JBS&G

Job No: 58761

Client: Department of Defence

Version: FINAL | Date: 2023

Drawn By: AS | Checked By: MC

Not to Scale

Coord. Sys. N/A

RAAF Base Edinburgh, South Australia Environmental Investigation of PFAS

CONCEPTUAL SITE MODEL (TWO DIMENSIONAL CROSS SECTION) SITE SETTING AND HYDROGEOLOGICAL

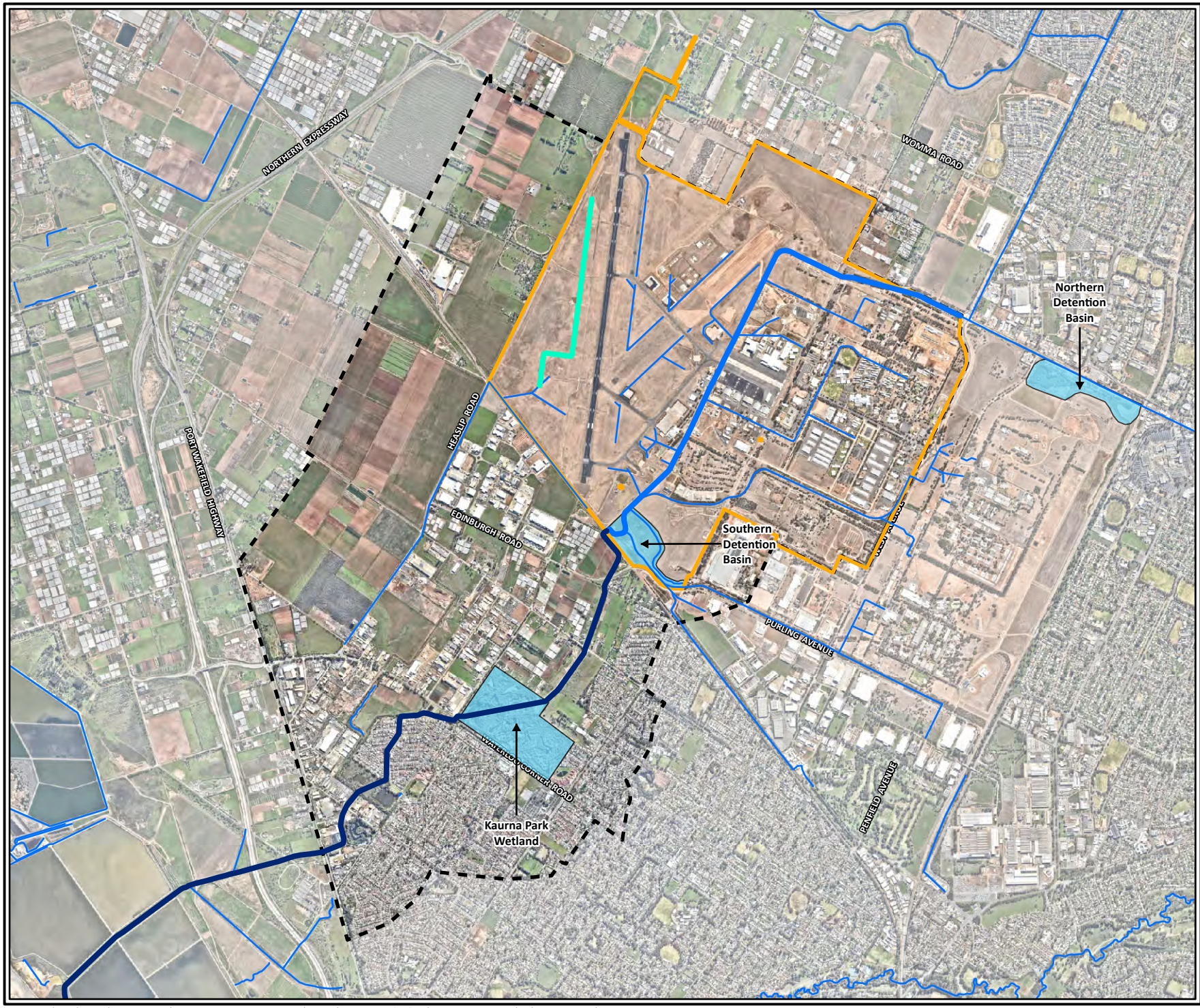
FIGURE B1

Document Path: S:\Projects JBSG\Adelaide\52234_Defence_Edinburgh_PFAS\ArcGIS\Maps\Reports\DSI\Figure 33_CSM-2D.crd

Image Reference: Google Earth

APPENDIX C FIGURES

List of Figures



Legend

- RAAF Base Edinburgh Boundary
- Management Area
- Detention Basin
- Stormwater Drainage
- Helps Road Drain Onsite
- Helps Road Drain Offsite
- Western Swale

JBS&G

Job No: 58761	
Client: Department of Defence	
Version: FINAL	Date: 25-Sep-2024
Drawn By: JS	Checked By: MC

Scale 1:45,000

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kilometres

Coord. Sys. GDA 1994 MGA Zone 54

RAAF Base Edinburgh, South Australia

RAAF BASE EDINBURGH AND SURROUNDS

FIGURE C1

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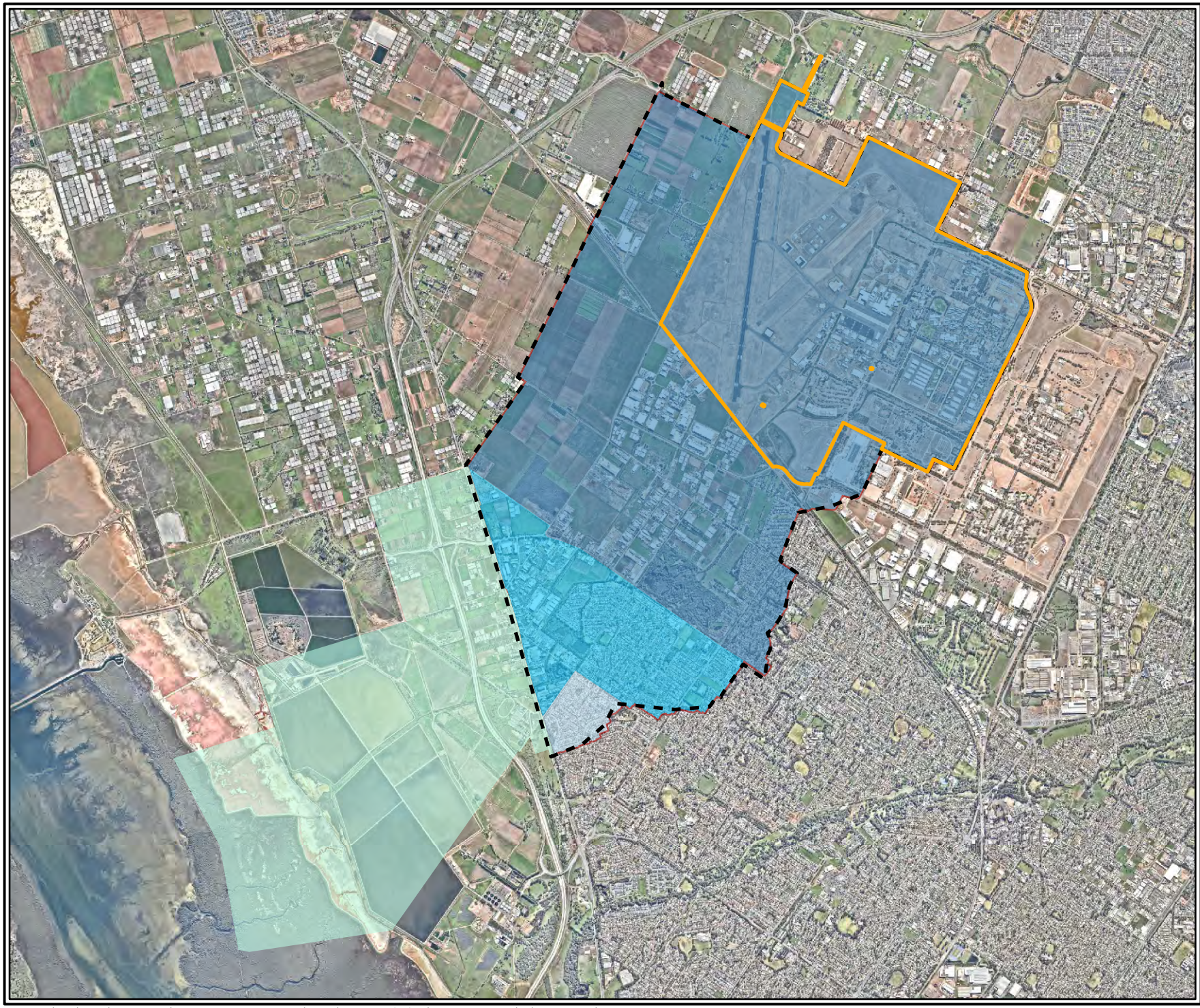
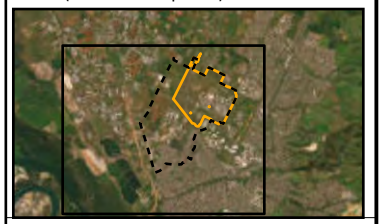


Legend

- RAAF Base Edinburgh Boundary
- Management Area

Stage 1 and Stage 2 Groundwater Prohibition Areas

- Stage 1 - 0-30 m below ground level (Q1 and Q2 Aquifers)
- Stage 1 - 0-45 m below ground level (Q1, Q2 and Q3 Aquifers)
- Stage 1 - 0-60 m below ground level (Q1, Q2, Q3 and Carisbrooke Sand (Q4) Aquifers)
- Stage 2 - 0-20 m below ground level (Q1 and Q2 Aquifers)



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Drawn By: JS	Checked By: MC
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kilometres

Coord. Sys. GDA 1994 MGA Zone 54

RAAF Base Edinburgh, South Australia

EDINBURGH GROUNDWATER PROHIBITION AREA EXTENTS

FIGURE C2

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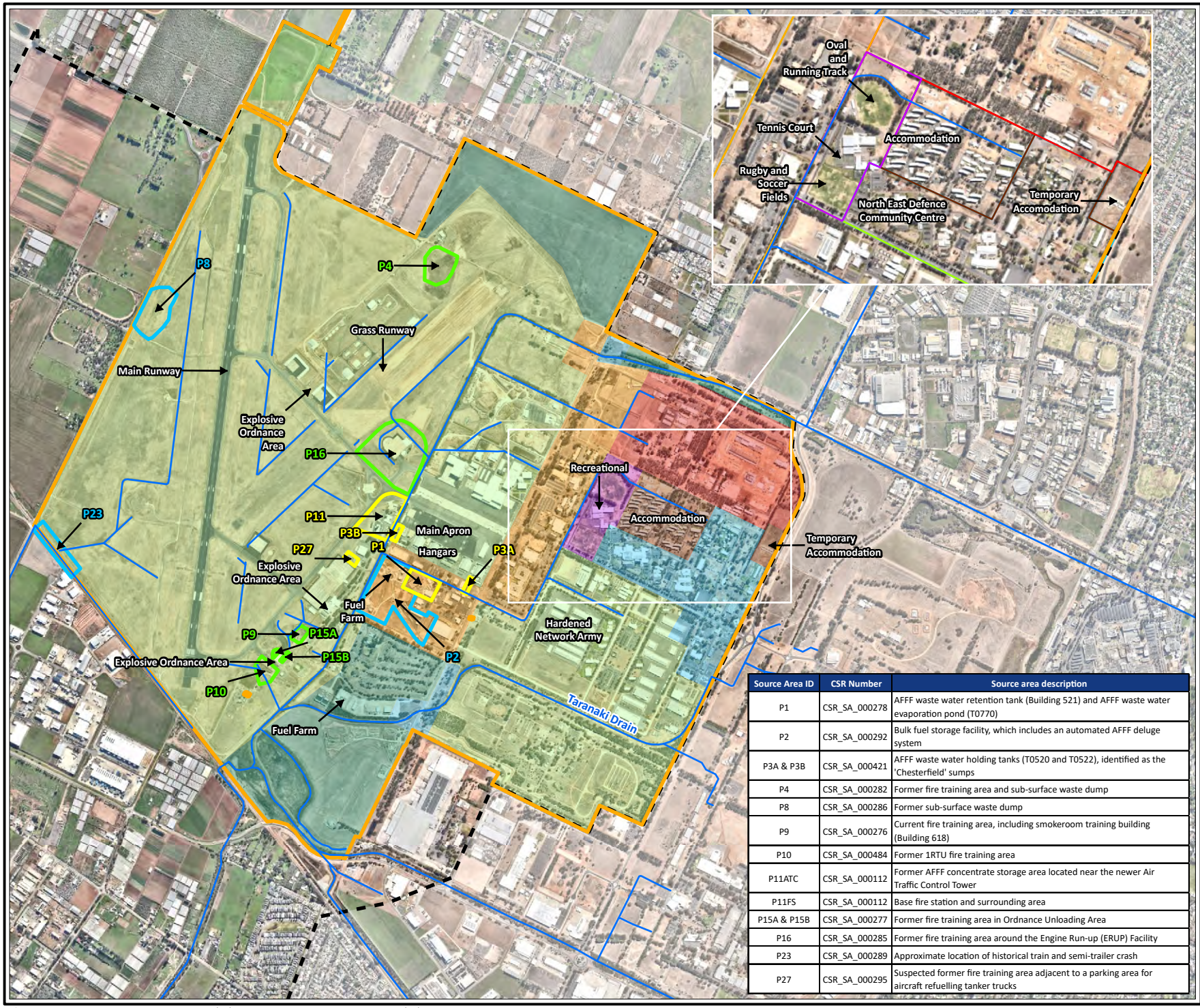

Source Area ID	CSR Number	Source area description
P1	CSR_SA_000278	AFFF waste water retention tank (Building 521) and AFFF waste water evaporation pond (T0770)
P2	CSR_SA_000292	Bulk fuel storage facility, which includes an automated AFFF deluge system
P3A & P3B	CSR_SA_000421	AFFF waste water holding tanks (T0520 and T0522), identified as the 'Chesterfield' sumps
P4	CSR_SA_000282	Former fire training area and sub-surface waste dump
P8	CSR_SA_000286	Former sub-surface waste dump
P9	CSR_SA_000276	Current fire training area, including smokeroom training building (Building 618)
P10	CSR_SA_000484	Former 1RTU fire training area
P11ATC	CSR_SA_000112	Former AFFF concentrate storage area located near the newer Air Traffic Control Tower
P11FS	CSR_SA_000112	Base fire station and surrounding area
P15A & P15B	CSR_SA_000277	Former fire training area in Ordnance Unloading Area
P16	CSR_SA_000285	Former fire training area around the Engine Run-up (ERUP) Facility
P23	CSR_SA_000289	Approximate location of historical train and semi-trailer crash
P27	CSR_SA_000295	Suspected former fire training area adjacent to a parking area for aircraft refuelling tanker trucks

Legend

- RAAF Base Edinburgh Boundary
- Management Area

Precinct Zone

- Base Support
- Domestic
- Future Delevlopment
- Open
- Operational
- Operational Support
- Recreational & Sporting Facility
- Stormwater Drainage

PFAS Source Areas

- Remediation Complete
- Remediation in Progress
- Monitoring Only

JBS&G

Job No: 58761

Client: Department of Defence

Version: FINAL | Date: 24-Feb-2025

Drawn By: JS | Checked By: MC

Scale 1:28,000

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Metres

Coord. Sys. GDA 1994 MGA Zone 54

RAAF Base Edinburgh, South Australia

BASE LAYOUT AND KEY SOURCE AREAS

FIGURE C3

Reference: ESRI Imagery Basemap - Accessed Imagery: 24/02/2025 & www.nearmap.com - Imagery Date: 30/07/2024