Stage 2B Environmental Investigation Report

Executive Summary

RAAF Base Williamtown, Williamtown NSW
Department of Defence

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RAAF Base Williamtown, Williamtown, NSW

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Executive Summary

Introduction

AECOM Services Pty Ltd (AECOM) was engaged by the Department of Defence (Defence) to undertake a Stage 2B Environmental Investigation (Stage 2B EI) at the Royal Australian Air Force (RAAF) Base Williamtown ('the Site') located at Medowie Road, Williamtown, NSW. The Stage 2B EI also included investigation of the surrounding off-Site areas, including the NSW Environment Protection Authority (NSW EPA) Investigation Area. The Site and NSW EPA Investigation Area are presented on **Figures F1** and **F2** in **Appendix A**.

The Site has been an active airbase since 1941, and is a critical Defence facility. The Site is headquarters of the Air Combat Group, which includes several aviation squadrons and support organisations that conduct training and operational activities on the airbase. As part of typical airbase activities, aqueous film forming foam (AFFF) was used at the Site for fire training and emergency response from around 1976. 3M Lightwater™ was the main AFFF product in use until approximately 2004, and is now known to have contained per- and poly-fluorinated alkyl substances (PFAS), including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). 3M Lightwater™ was replaced by Ansulite®, which was reported to contain significantly lower concentrations of PFOS and PFOA.

Investigations completed to date have identified seven key on-Site PFAS source areas, which are presented in **Figure F2** in **Appendix A**. These PFAS source areas include four 'primary' and three 'secondary' source areas:

- Primary source areas (located where AFFF was historically used or disposed of):
    - Former Fire Station and Current Fire Station (Facility 165)
    - Former DEMS Landfill (Facility 394)
    - North Eastern Landfill
    - Disused Fire Training Pit (Facility 479).
- Secondary source areas (locations where PFAS has migrated to create additional impact):
    - Lake Cochran
    - Trade Waste Treatment Plant (Facility 480
    - Sewage Treatment Plant (Facility 410).

There are also likely to be a range of smaller on-Site PFAS source areas such as aircraft hangars and emergency response locations where localised AFFF/PFAS impact may have occurred.

The purpose of this Stage 2B EI Report is to detail the results of the investigations undertaken between September 2015 and April 2016 which have further evaluated the issues identified in previous investigations and to provide information for the development of a human health risk assessment (HHRA) and ecological risk assessment (ERA).

NSW Government Response

Previous environmental investigations identified the presence of PFAS, including PFOS and PFOA, in soil, groundwater, surface water, sediment, and aquatic and terrestrial biota both on-Site and off-Site. In response to the previous investigation results, the NSW government identified the NSW EPA Investigation Area in September 2015. The NSW EPA Investigation Area includes the Site itself as well as off-Site areas, where groundwater in the Tomago and Stockton Sand Beds were considered to be potentially impacted with PFAS.

The NSW government issued precautionary advice to residents within the NSW EPA Investigation Area to not drink bore water and to not eat fish caught in the nearby area or eggs from backyard chickens that have been drinking bore water in the area.

On 4 September 2015, by notification under Sections 8 and 9 of the *Fisheries Management Act 1994*, the NSW government issued an '*Urgent Fishing Closure'* which prohibited the taking of any species of fish from defined areas within Tilligerry Creek and Fullerton Cove. On 2 October 2015, by notification under Sections 8 and 11 of the *Fisheries Management Act 1994* the NSW Government revoked the *Urgent Fishing Closure* and replaced it with a '*Fishing Closure'* which prohibited the taking of any species of fish from defined areas within Tilligerry

Creek and Fullerton Cove until 31 October 2015. On 30 October 2015, by notification under Section 8 the *Fisheries Management Act 1994* the NSW Government extended the '*Fishing Closure'* by eight months to 30 June 2016.

An Expert Panel was established under Division 4 of the *Protection of the Environment Administration Act 1991*. The role of the Expert Panel was to provide informed scientific advice to the NSW EPA to assist in developing the NSW Government's response to the identified contamination at the Site and in off-Site areas.

The Expert Panel established two working groups, comprising of independent experts, to collaborate and provide an additional source of informed scientific advice to the Chair of the Expert Panel:

- water working group (WWG): to provide informed scientific advice relating to surface water and groundwater to the Expert Panel, to assist in the NSW government's response in relation to investigations of PFAS contamination.
- risk assessment working group (RAWG): to provide advice relating to the potential risk pathways associated with the off-Site migration of PFAS.

Defence has considered the advice and input from the NSW EPA, which is understood to also include the advice provided to NSW EPA by the Expert Panel in planning and conducting this Stage 2B EI.

Context of the Stage 2B EI

Tasks undertaken by AECOM during the period September 2015 and April 2016 for the Stage 2B EI have included the following:

- **Residential Water Sampling:** sampling and analysis of bore water (at landholder request to Defence) from residences and a school within and near the NSW EPA Investigation Area. In some instances water was also sampled from rainwater tanks and swimming pools and some soil sampling was conducted. Surveys of water usage patterns were undertaken. Selected data from this program has been utilised to inform the Stage 2B EI.
- **Stage 2B EI (this Report):** investigations have included historical reviews of the use of AFFF on-Site; investigation of on- and off-Site PFAS concentrations in soil, sediment, pore water, surface water, groundwater and marine water; hydrogeological investigations; development of a groundwater flow model and PFAS fate and transport model. Data collected from previous environmental investigations, the residential water sampling program and testing data from Site redevelopment projects have also been incorporated into this Stage 2B EI Report.
- **Human Health Risk Assessment (in preparation):** multiple pathway HHRA to evaluate the potential human health risks to identified receptors within the Williamtown area. This report will include consideration of direct contact exposures to environmental media (e.g. soil, groundwater, surface water, pore water and sediment) as well as secondary exposures via dietary intakes, including both seafood and home grown plant and animal produce (garden crops, eggs and pasture). This assessment includes: the development of toxicological profiles for PFAS including PFOS, PFOA, perfluorohexane sulfonic acid (PFHxS) and perfluorohexanoic acid (PFHxA); survey of community for relevant lifestyle factors; consideration of data from the Stage 2B EI; consideration of seafood analysis data from NSW government; and consideration of home grown plant and animal produce analysis data.
- **Ecological Risk Assessment (in preparation):** will assess the potential risk from for identified PFAS contamination to ecological receptors with habitats present at the Site and in the surrounding area, and the potential for wider ecosystem impacts to result from the accumulation of PFAS in terrestrial and aquatic organisms exposed to PFAS contamination. This assessment includes: an ecological survey; consideration of seafood and home grown plant and animal produce analysis data reported in the HHRA; and consideration of rabbit analysis data.
- **Community engagement:** facilitation of community engagement as related to conduct of the Stage 2B EI and other tasks as listed above including land access, water and lifestyle surveys and community information events.

Objectives of the Stage 2B EI

The objectives of this Stage 2B EI were to:

- improve the understanding of the current and historical use and release of PFAS
- assess the nature and extent of PFAS impact
- understand PFAS fate and transport
- refine the conceptual site model (CSM)
- generate input data for the development of a HHRA and ERA
- generate data to assist in the future development of management options for PFAS impacts.

To meet these objectives in accordance with Defence's project schedule, some of these investigations have been conducted in parallel.

Stage 2B EI Findings

Objective: Improve the Understanding of the Current and Historical Use and Release of PFAS

The following table summarises the findings of the current and historical PFAS use review and provides an enhanced understanding of potential source areas both on- and off-Site. Not all areas were targeted for sampling investigation due to time constraints and/or accessibility limitations.

Table ES1 Source area details

Source Areas	Approximate Date of PFAS Use	PFAS Activity	PFAS Type
Disused Fire Training Pit (Facility 479).	1976-2003.	Firefighting training.	3M Lightwater™ (1976-2003).
			Ansulite® was not used.
Fire Station and Fire Training Pad (Facility 165).	1976 – 2004	Firefighting training, equipment checking.	3M Lightwater™
Fire Station and Fire Training Pad (Facility 165).	2004 – present.	Firefighting equipment checking	Ansulite®
Lake Cochran.	1976 – present.	Received runoff from Site	PFAS dissolved in water.
Trade Waste Treatment Plant (Facility 480).	1976-2004.	Received AFFF concentrate and runoff.	3M Lightwater™.
Sewage Treatment Plant (Facility 410).	1976 – present.	Wastewater generated on the Site treated at the Sewage Treatment Plant (Facility 410)..	Dissolved PFAS.
Former DEMS Landfill (Facility 394).	After closure of North Eastern Landfill.	Potential disposal of material with residual PFAS (unconfirmed).	Unknown.
Former North Eastern Landfill.	Prior to operation of Former DEMS Landfill.	Potential disposal of material with residual PFAS (unconfirmed).	Unknown.
Air Management Hangar and K Group.	1980's (unconfirmed date).	Two accidental activations of fire suppression system.	3M Lightwater™.
Runway.	1996 and 1998.	AFFF use associated with aircraft accidents.	AFFF concentrate.

Source Areas	Approximate Date of PFAS Use	PFAS Activity	PFAS Type
Medowie Road between Richardson Avenue and Nelson Bay Road, Williamtown (off-Site).	1994.	Accident involving a hazardous oil tanker. Firefighting by local authority.	Dissolved PFAS.

Objective: Assess the Extent of PFAS Impact

The following tables present, based on the data available to date, the interpreted extent of PFAS impact in groundwater, surface water and sediment related to the source areas investigated, as well as the overall extent of PFAS impact both on- and off-Site.

The results are presented in tables provided in **Appendix B**.

Groundwater

In summary, the groundwater data confirmed that multiple PFAS plumes exist, which are likely to have originated from on-Site source areas. PFAS concentrations decrease with distance from the Site. The dominant flow direction is to the south and southeast. PFAS impact is also present in groundwater to the east of the Site and is inferred to be related to surface water impact migrating along the drain network (Moors Drain and associated tributaries) before infiltrating to groundwater. However, it is also possible that there is an unidentified PFAS source in the area.

Table ES2 Key groundwater PFAS impact (see Figures F36 through F50)

Source Areas	Groundwater Impact
Fire Station and Fire Training Pad (Facility 165)	- Maximum PFOS concentration of 35.6 µg/L in MW196, installed in the shallow groundwater (3.8 m bgs) immediately northwest. - PFAS impact extends to at least 300 m to the southeast and 630 m to the south. - PFOS impact appears to extend to the deeper portions of the Tomago Sand Beds Aquifer in the area but not to the lateral extent to the southeast and south. - PFOS plume is likely to comingle with the Lake Cochran and Sewage Treatment Plant plumes.
Former DEMS Landfill (Facility 394)	- Maximum PFOS concentrations were 2.45 µg/L at MW174I, 13.8 µg/L at MW171I and 2.18 µg/L at MW173I (all approximately 12 m bgs) - PFOS impact appears to extend to the deeper portions of the Tomago Sand Beds Aquifer in the area - Western extent not evaluated due to heavily vegetated, inaccessible area - PFOS impact appears to extend approximately 500 m to the south and 650 m to the southeast
Former North Eastern Landfill	- PFOS only detected in one well (0.03 µg/L at W11) at landfill and in a deep well immediately southeast of the landfill (2.50 µg/L at MW209) - PFOS impact extends south and southeast approximately 700 m
Disused Fire Training Pit (Facility 479)	- Impacted groundwater flowing south - Maximum PFOS concentration of 13.8 micrograms per litre (µg/L) identified 350 m down-hydraulic gradient at 12 m below ground surface (bgs) (MW174I) and may be partially associated with the Former DEMS Landfill (Facility 394). - Maximum PFOS concentration of 0.31 µg/L reported further east in the deep well (MW169D) at 21 m bgs - PFOS impact appears to extend to the deeper portion of the Tomago Sand Beds Aquifer at least 350 m down gradient of the source area

Source Areas	Groundwater Impact
Lake Cochran	- Maximum PFOS concentration of 24.5 µg/L in MW109D (approximately 20 m bgs) 100 m south - PFAS impact originating from Lake Cochran is considered to migrate and discharge to the Fourteen Foot Drain or Ten Foot Drain or emerge at the ground surface in nearby wetlands - PFAS impact is likely to ultimately discharge via surface water pathways to Fullerton Cove - Tilligerry Creek is interpreted to prevent groundwater from flowing further south-southeast of the drains
Trade Waste Treatment Plant (Facility 480)	- Maximum PFOS concentration was 13.2 µg/L in MW208S (approximately 4.2 m bgs) south of the Trade Waste Treatment Plant (Facility 480) - PFOS impact appears to extend to the deeper portions of the Tomago Sand Beds Aquifer in the area - PFOS impact appears to extend laterally to the west at least 150 m and to the south at least 900 m
Sewage Treatment Plant (Facility 410)	- Maximum PFOS (8.73 µg/L) and PFOA (0.35 µg/L) concentrations in MW110I (approx. 12 m bgs) 100 m to the east - PFOS impact appears to extend approximately 600 m to the southeast and 900 m to the south - PFOS plume is likely to comingle with the Lake Cochran plume in the area of the northern extent of the Tilligerry Clay Member

On-Site Surface Water, Sediment and Pore Water

In summary, PFAS impact is present in all but two surface water and sediment samples collected from drains at the Site. The highest concentrations of PFOS and PFOA were reported in surface water and sediment samples collected from drains within Catchment C, which discharges into Lake Cochran and ultimately into Dawsons Drain.

Table ES3 On-Site surface water and sediment PFAS impact (see Figures F51 and F52 and F55 and F56)

Source Area	Catchment Area	Surface Water Impact
Disused Fire Training Pit (Facility 479)	-	Not applicable – no formed drains and discharge is inferred to be primarily by infiltration to groundwater
Former Fire Station and Current Fire Station (Facility 165)	C	- Maximum PFOS (31.6 µg/L) and PFOA (0.9 µg/L) concentrations in surface water in drain located to the south of the runway discharging to Lake Cochran - Maximum PFAS concentrations in sediment (22.4 mg/kg, 0.0913 mg/kg and 0.007 mg/kg for PFOS, PFOA and 6:2 FtS respectively) in drain located to the east of the Current Fire Station (Facility 165) - Lake Cochran max PFOS concentrations 19.2 µg/L (surface water) and 0.146 mg/kg (sediment) and PFOA concentrations of 0.47 µg/L (surface water) and 0.0028 mg/kg (sediment). Maximum sediment pore water PFOS concentration of 16.1 µg/L and PFOA of 0.9 µg/L
Lake Cochran	C	
Trade Waste Treatment Plant (Facility 480)	T	Not applicable – entirely piped network, no samples collected
Sewage Treatment Plant (Facility 410)	No discharge	Not applicable – no formed drains and discharge is inferred to be primarily by infiltration to groundwater

Source Area	Catchment Area	Surface Water Impact
Former DEMS Landfill (Facility 394)	D	- Lower PFAS concentrations than Catchment C - Maximum PFOS (0.1 µg/L) and PFOA (0.07 µg/L) concentration in surface water in drain located to the west of Lake Cochran and discharges directly into Dawsons Drain - Maximum PFOS (0.0014 mg/kg) concentration in sediment in drain located to the west of Lake Cochran - Surface water concentrations of 5.17 µg/L and 0.25 µg/L for PFOS and PFOA, respectively in sample from Dawsons Drain. PFOS concentration of 0.007 mg/kg in the corresponding sediment sample
Former North Eastern Landfill	-	Not applicable – no formed drains and discharge is inferred to be primarily by infiltration to groundwater
Fuel Farms 3a and 3 (Facility 384 and 508)	T	Not applicable – entirely piped network, no samples collected
Air management hangar and K Group	T	Not applicable – entirely piped network, no samples collected
Runway	D, C, NA and F	- See above for Catchments C and D - Surface water sample analysed (BD02) contained 0.06 µg/L of PFOS. Sediment contained 0.0014 mg/kg of PFOS

Off-Site Surface Water, Sediment and Pore Water

PFAS was present in all of the drains sampled off-Site. The samples within the drains that ultimately discharge to Fullerton Cove generally had higher concentrations of PFOS and PFOA than were found in Moors Drain and Tilligerry Creek.

Table ES4 Off-Site surface water and sediment impact (Figures F53, F54, F57 and F58)

Drain/Waterway	Surface Water Impact
Moors Drain	- Maximum PFOS surface water concentration (2.52 µg/L) at the outfall of Catchment T and maximum PFOA concentration (0.11 µg/l) at MD1 - Maximum PFOS sediment concentration (0.0185 mg/kg) at MD6 - PFAS concentrations in sediments varied with distance from the Site - Catchment T likely providing the larger input of PFAS than Catchments F and NA - PFAS concentrations decrease with distance from Site
Tilligerry Creek	- PFOS concentration ranged from 0.02 to 0.39 µg/L, indicating there may be PFAS discharging to the middle section of the creek - PFOS sediment concentrations were less than the laboratory limit of reporting (LOR) upstream and greater than LOR downstream - Complex series of drains possibly connected to Moors Drain potentially providing additional PFAS impact
Port Stephens	- PFAS surface water impact not reported greater than LOR - Maximum PFOS sediment concentration (0.0015 mg/kg) at 1G (Tilligerry Creek and Port Stephens)
Dawsons Drain	- Maximum PFOS surface water concentration was 4.08 µg/L - Maximum PFOS sediment concentration was 0.0075 mg/kg - Maximum PFOS tributary surface water concentration (DD8) was 7.56 µg/L and 0.0602 mg/kg in sediment - PFAS concentration variable with distance
Fourteen Foot Drain	- Maximum PFOS surface water concentration was 2.26 µg/L at FED1 - Maximum PFOS sediment concentrations was 0.013 mg/kg at FFD2 - Maximum PFOS tributary surface water concentration (DD3) was 10.3 µg/L and 0.0097 mg/kg in sediment - PFAS concentration variable with distance

Drain/Waterway	Surface Water Impact
Ten Foot Drain	- Maximum PFOS surface water concentration was 52 µg/L - Maximum PFOS sediment concentrations was 0.0266 mg/kg
Fullerton Cove	- PFOS concentrations reported in intertidal area surface water (0.2 µg/L) and sediment (0.0062 mg/kg) - PFAS reported less than laboratory LOR in permanent water area surface water samples - Maximum PFOS sediment concentration in permanent water area was 0.0092 mg/kg - PFAS reported less than laboratory LOR in pore water samples
Hunter River	- PFAS reported less than laboratory LOR in all surface water samples - PFOS reported in one sediment sample 14 km upstream of Fullerton Cove confluence - PFAS reported less than laboratory LOR in pore water samples
Wallis Lake (background water quality location)	- PFAS reported less than laboratory LOR in all samples in surface water, sediment and pore water

Objective: Understand PFAS Fate and Transport

The following work was conducted to better understand the fate and transport of PFAS at the Site and EPA Investigation Area:

- Review previous investigation data and comparison to the Stage 2B EI results
- Calculation of site specific partitioning / sorption coefficients for PFOS and PFOA
- Refinement of the hydrogeologic conceptual model
- Development of a numerical groundwater flow and solute transport model.

Based on the results of the Stage 2B EI, the current understanding of PFAS fate and transport is as follows:

- PFAS migrates vertically downward from source areas through the soil profile to groundwater
- PFAS migrates laterally from source areas through the drain network across the Site and off-Site areas. The lateral migration of PFAS in surface water has spread the impact more widely than would have been expected by transport in groundwater alone. PFAS groundwater impact underlying Tilligerry Creek to the east of the Site appears to be a result of this mechanism
- PFOS and PFOA are expected to migrate slower than the average linear groundwater velocity. PFOS has been estimated to migrate at a rate ranging from 6.2 to 6.7 times slower than average linear groundwater velocity and PFOA at a rate from 2.6 to 2.7 times slower than average linear groundwater velocity
- Groundwater model particle tracking indicates that PFAS migrates vertically and laterally to the south, with flowpaths that cover the entire thickness of the Tomago Sand Beds Aquifer.

Objective: Refinement of the CSM

The results of the Stage 2B EI allowed for the following parameters of the CSM to be refined:

- Primary sources have been assessed through the historical review
- Secondary sources have been characterised by sampling, flow gauging and by additional sampling
- Transport mechanisms have been characterised by sampling, flow gauging and by groundwater modelling
- Exposure pathways have had data collected for use in the risk assessments
- Exposed populations have had data collected for use in the risk assessments.

Objective: Generate Input Data for the Development of a HHRA and ERA

The following work was conducted to generate additional data for the development of a HHRA and ERA are:

- Terrestrial biota sampling, comprising chicken eggs, grazing flora, vegetables, soil and irrigation water, from properties within the NSW EPA Investigation Area (reported separately).

- Review of aquatic data collected by DPI between October 2015 and January 2016, and sampled from Hunter River, Port Stephens and Wallis Lake estuaries (reported separately).
- Collection of water and sediment samples from locations in Hunter River and Port Stephens.

The additional data and refinement of the CSM have allowed the development of the HHRA and ERA, which are reported under separate cover.

Conclusions

History

The Stage 2B EI historical review, which also included a review of current PFAS use, has enhanced understanding of the history of AFFF and PFAS use and refined the identification of likely key primary sources (i.e. where AFFF was initially used / applied or wastes dumped). The limited information obtained during the current and historical PFAS use review is generally consistent with the observed extent and concentrations of PFAS impact in surface and groundwater. A range of off-Site sources of potential PFAS impact have been identified but the key sources all appear to be associated with historical AFFF use on the Site.

Hydrogeology

The Site is located on highly permeable sandy soils of the Tomago Sand Beds with a shallow aquifer flowing south-southwest under the Site. The shallow groundwater table rises rapidly with rainfall and rises to intersect with on- and off-Site drainage channels.

Surface water flowing in the drainage channels seeps ('loses') to groundwater when groundwater levels are low and groundwater seeps into drains ('gains') when groundwater is high after rainfall.

PFAS behaviour

Where AFFF has been discharged, either at training areas or in response to emergency response or dumping of wastes, PFAS accumulates in the soil profile or soaks into pavements. Rainwater leaching carries the highly soluble chemicals to the groundwater table, and surface water runoff dissolves PFAS and carries it to surface water drains.

While AFFF containing high concentrations of PFAS is no longer used at the Site, residual PFAS contamination in soil, sediments in drains and lakes, and from pavements is likely to continue leaching to surface and groundwater for the immediate future.

A groundwater computer model has been developed based on multiple data sources including information from Hunter Water Corporation (HWC). The model has been used to evaluate potential historical and future groundwater and PFAS movement behaviour.

Groundwater impact

Primary PFAS source areas include the Disused Fire Training Pit (Facility 479), the Current and Former Fire Station (Facility 165) and waste emplacements at the former North Eastern Landfill and Former DEMS Landfill (Facility 394).

Secondary PFAS source areas have developed where PFAS impacted water has migrated or been concentrated and can leach to groundwater. Locations include: overflows and leakage at the Trade Waste Treatment Plant (Facility 480), Lake Cochran, and the Sewage Treatment Plant (Facility 410) lagoons, and both piped and unlined open drains both on- and off-Site (including Dawsons Drain and Moors Drain).

The multiple on-Site contamination sources have created a PFAS plume in the Tomago Sand Beds Aquifer. It is observed and modelled that the PFAS contamination migrates downward in the aquifer then laterally to the southwest before upwelling at the confluence of the Tomago and Stockton Sand Bed Aquifers. The modelling indicates that the main PFAS plume is approximately 5 km long (from source areas to southern extent), and 5 km wide (across the axis of migration).

PFAS impacted groundwater water upwells from the plume into the surface water drainage system. The plume to the south of the Site discharges into the drainage network including the Fourteen Foot Drain which ultimately leads to Fullerton Cove. The plume from the eastern part of the Site appears to discharge to Moors Drain and associated drains which flow to Salt Ash and Tilligerry Creek. Results from sampling during this Stage 2B EI, in modelling conducted by Hydrosimulations and in data provided by HWC (2016) generally correlate with the

impacts shown to the east of the Site and in the Salt Ash and Tilligerry Creek areas (refer to **Figure F72** in **Appendix A**).

Surface water impact

All major drainage systems on-Site contain PFAS in surface water runoff and sediments.

Runoff from the south-western boundary of the site principally discharges through Dawsons Drain. The three principle discharge points on the eastern boundary all discharge to Moors Drain.

Where these drains intersect the groundwater plume, it is inferred that when groundwater levels are elevated (and the drains are gaining), PFAS impacted groundwater upwells into the drains. When groundwater levels are lower (such as in prolonged dry weather when the drains are losing) it is inferred that PFAS impacted drain water is leaching into shallow groundwater.

It is inferred that the separate plume of groundwater impact observed in the Salt Ash / Tilligery Creek area (from Moors Drain) and along Cabbage Tree Road (from Dawsons Drain) areas are caused by this mechanism, although it is possible that there is an unidentified source in the areas.

It is inferred that flooding from the major drains has and will disperse PFAS to surface soils, and potentially to shallow groundwater as water levels fall.

Modelling has indicated that the main groundwater plume reached its current approximate extent in about the mid-2000s. While the plume is likely to continue to change, it appears to have reached close to its maximum approximate extent to the south-east of the Site. PFAS associated with soil is expected to continue to desorb and migrate with groundwater, and PFAS associated with surface water has the potential to continue to impact off-Site surface water and groundwater.

Future Considerations

The results of the Stage 2B EI provide an improved understanding of the nature, extent and potential migration of PFAS contamination within the NSW EPA Investigation Area based on data collected between late 2015 and early 2016.

It is understood Defence will undertake further assessment to address important limitations in current understanding of PFAS contamination arising from RAAF Base Williamtown within the NSW EPA Investigation Area. It is understood the outcomes of this Stage 2B EI will inform these further assessments and will also inform ongoing environmental monitoring and future management decisions in relation to PFAS contamination arising from RAAF Base Williamtown. The further assessments and ongoing monitoring programs of work will be developed in consultation with NSW EPA.