



MELBOURNE AIRPORT (TULLAMARINE) – AVIATION RESCUE FIRE FIGHTING SERVICES
PRELIMINARY SITE INVESTIGATION

REPORT FOR AIRSERVICES AUSTRALIA

14 December 2018 - FINAL (REDACTED) - Project No: 2105.022

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1. ABBREVIATIONS

Acronym	Definition
ACM	Asbestos Containing Material
AEP	Airport Emergency Procedure
AFFF	Aqueous Film Forming Foam
Airservices	Airservices Australia
APAC	Australia Pacific Airports Corporation Limited
APAM	Australian Pacific Airports (Melbourne) Proprietary Limited
ARFF	Aviation Rescue and Fire Fighting
ARFFTE	Aviation Rescue Fire Fighting Training Excellence
AST	Above-ground Storage Tank
BTEXN	Volatile Monocyclic Aromatic Hydrocarbons [benzene (B), toluene (T), ethyl-benzene (E), o,m&p xylenes (X) and naphthalene (N); commonly referred to as BTEXN]
CAA	Civil Aviation Authority
CFA	Country Fire Authority
CFFG	Current Fire Training Ground
CoPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DEPI	Department of Environment and Primary Industries
EAD	Environmental Audit Database
FAC	Federal Airports Corporation
FFTG	Former Fire Training Ground
FTG	Fire Training Ground
FtS	Fluorotelomer Sulfonate
GBAS	Ground-based Augmentation System
JUHI	Joint Use Hydrant Installation
LAHFTG	Learning Academy Hot Fire Training Ground
LMU	Large Mock-up
LPG	Liquefied Petroleum Gas
MBAS	Methylene Blue Active Substances
mbgs	Metres Below Ground Surface
MFB	Metropolitan Fire Brigade
MFS	Main Fire Station

Acronym	Definition
MNES	Matters of National Environmental Significance
PAH	Polycyclic Aromatic Hydrocarbons
PFAS	Per- and Poly- fluorinated Alkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulphonate
PRS	Priority Sites Register
PSI	Preliminary Site Investigation
SAQP	Sampling Analysis and Quality Plan
SEMF	SEMF Pty. Ltd.
SFS	Satellite Fire Station
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UST	Underground Storage Tank
VPP	Victorian Planning Provisions

2. EXECUTIVE SUMMARY

Airservices commissioned SEMF Pty Ltd (SEMF) to carry out a Preliminary Site Investigation (PSI), including limited intrusive sampling, at Melbourne (Tullamarine) Airport (the 'Airport'). The main focus of the PSI was potential per- and poly- fluorinated alkyl substances (PFAS) contamination from the historical use of aqueous film forming foam (AFFF) by Airservices at sites currently managed by Airservices.

The objectives of the PSI were to:

- Obtain and document information pertaining to the historical use of AFFF at the Airport (the main focus being potential PFAS contamination from the historical use of AFFF by Airservices at sites currently managed by Airservices).
- Identify potential areas of PFAS contamination, potentially affected media and receptors.
- Develop a Sampling Analysis and Quality Plan (SAQP) to address the following data gaps at three identified areas managed by Airservices where AFFF may have been historically used by Airservices:
 1. Current PFAS-contamination status of the near-surface soil.
 2. Current PFAS-contamination status of the surface water in adjacent waterways (Dry Creek, Deep Creek and Arundel Creek).
 3. Current PFAS-contamination status of the stormwater drainage networks.
- Conduct limited intrusive investigations at the following three sites to address the above data gaps:
 1. Main fire station.
 2. Current fire training ground.
 3. Smoke hut.
- Update the conceptual site models (CSMs).

Based on a review of available information, interviews and inspections documented herein, a number of Sites (Sites A-K) have been identified where AFFF may have been used (by any Stakeholder) at the Airport (Table 1):

- Airservices have conducted ARFFS and training activities since 1995 and has not used AFFF in the provision of ARFFS since 2010, when they ceased using PFAS-containing AFFF and transitioned to a PFAS-free foam (Solberg RF6).
- Airservices was established in 1995 and has provided Aviation Rescue and Fire Fighting Services (ARFFS) at the Airport since this date. Pre 1986, Federal Airports were owned and operated by the Commonwealth and the Department of Aviation provided ARFFS services at Federal Airports. In 1986, the Federal Airports Corporation (FAC) was established and certain Airports were vested in the FAC. However, the ARFFS function was not allocated to the FAC and was undertaken by the Department of Transport and Communications (the successor to the Department of Aviation). In 1988, the Civil Aviation



Authority (CAA) was established and its role included providing ARFFS services until 1995 when Airservices was established.

- AFFF and fuels have (or have potentially) been stored and/or used (by any on Airport AFFF users) at the following sites until 2010 and may still be stored and/or used at other Airport areas by other on Airport AFFF users:
 - o Site A – Main Fire Station (MFS)
 - o Site B – Satellite Fire Station (SFS)
 - o Site C – Former Fire Training Ground (FFTG)
 - o Site D – Current Fire Training Ground (CFTG)
 - o Site E – Smoke Hut
 - o Site F – Old Aviation Rescue Fire Fighting Training Excellence (ARFFTE) School
 - o Site G – F28 Training Area
 - o Site H – Billy's Bunker
 - o Site I – Joint User Hydrant Installation (JUHI)
 - o Site J – Aircraft Hangars
 - o Site K – Operational Response Sites within the Airport (Airport Emergency Procedures (AEPs), grass fires, car fires, house fire, truck rollover)
 - o Site L – Off Airport (Gellibrand Hill, Golf Course and North of Sunbury Road)
- The delineation between Site C and Site D is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).
- PFAS compounds have historically been detected in soil, sediment, surface water and/or groundwater investigations (commissioned by Airservices) at Site A, Site D, Site E, Deep Creek and Arundel Creek,

The PSI has enabled an investigation of the Sites managed by Airservices, where AFFF has historically been used (since their establishment in 1995) through the collection of data from limited intrusive investigations, a review of historical data collected over a nine year period (2010-2018) and conducting interviews. Associated hydrocarbon use has also been considered.

Based on the findings of the PSI, there is currently insufficient information to determine the likelihood of an unacceptable risk to receptors from the historical use of AFFF. A detailed site investigation (DSI) is required to allow collection of sufficient information to devise a risk-based management strategy for PFAS contamination.

The results of the PSI indicated:

- Limited data exists and the source/s of the identified PFAS contamination cannot be determined without significant additional investigations.
- Low level PFOS and PFOA impact (i.e. above laboratory limits of reporting (LORs) but within adopted guideline criteria) is pervasive throughout the soils tested (during this PSI and historically).

- At some locations PFAS concentrations in soil were more elevated at 0.5m than at 0.1m.
- MFS:
 - o Soil – all locations were within the adopted human health criteria for PFAS. Six locations from the proposed GBAS area (east of the MFS) reported exceedances of the adopted ecological criterion for PFOS.
 - o Stormwater – three locations reported exceedances of the adopted human health criteria for PFOS and one location also reported exceedances of the adopted human health criteria PFOA, PFHxS, 6:2FtS and 8:2 FtS and the ecological criteria for PFOS.
 - o Groundwater (historical) – the single investigated location was within adopted human health and ecological criteria for PFAS.
 - o Down Gradient Receiving Waters (Arundel Creek) – two investigated locations reported exceedances of the adopted human health criteria for PFOS. One location also reported exceedances of the adopted ecological criterion for PFOS and the human health criterion for PFHxS.
- CFTG:
 - o Soil – three investigated locations reported exceedances of the adopted ecological criterion for PFOS. All locations were within the adopted human health criteria for PFAS.
 - o Sediment (historical) – three investigated locations from the Evaporation Pond reported exceedances of the adopted ecological criterion for PFOS. All locations were within the adopted human health criteria for PFAS.
 - o Groundwater (historical) – two investigated locations reported exceedances of the adopted human health and ecological criteria for PFOS and one location also reported exceedances of the adopted human health criteria PFOA.
 - o Down Gradient Receiving Waters:
 - Dry Creek (sediment) – the single investigated location reported exceedances of the adopted ecological criteria for PFOS at 0.5m. The 0.1m sample at this location was within relevant investigation criteria. Both samples were within the adopted human health criteria for PFAS.
 - Dry Creek (surface water) – the single investigated location reported exceedances of the adopted human health and ecological criteria for PFOS and the adopted human health criteria for PFOA and PFHxS.
 - Deep Creek (surface water) - three investigated locations reported exceedances of the adopted human health criterion for PFOS. All locations were within the adopted human health and ecological criteria for TPH.

- Smoke Hut:
 - Soil – all investigated locations were within the adopted human health and ecological criteria for PFAS.
 - Stormwater – two investigated locations reported exceedances of the adopted human health criteria for PFOS and PFHxS and the ecological criteria for PFOS. One location also reported exceedances of the adopted human health criteria for PFOA. .
 - Down Gradient Receiving Waters (Arundel Creek) – two investigated locations reported exceedances of the adopted human health criteria for PFOS. One location also reported exceedances of the adopted ecological criterion for PFOS and the human health criterion for PFHxS
- Groundwater conditions at Sites managed by Airservices are not well understood and rely on historical results from one well at Site A (MFS) and two wells at Site D (CFTG). Similarly hydrogeology has not been investigated and consequently the interactions between groundwater and surface water are unknown.
- The potential for contamination from off-Airport impacting on the Airport and from the wider Airport impacting on identified Sites managed by Airservices, where AFFF is likely to have been used, has not been investigated as a component of the PSI. Similarly, the potential for PFAS contamination from the greater Airport (i.e. the hangars, previous ARFFS providers etc.) impacting on Airservices managed Sites has not been quantified.

3. INTRODUCTION

3.1 INTRODUCTION

Airservices Australia (Airservices) continues to take a scientific, risk-based approach in managing potential per- and poly- fluorinated alkyl substances (PFAS) contamination at airports where aqueous film forming foam (AFFF) has historically been used by Aviation Rescue and Fire Fighting Services (ARFFS). As part of Airservices' national program to manage potential PFAS residues at airports, and to improve data on potential risks to beneficial users, Airservices commissioned SEMF Pty Ltd (SEMF) to carry out a Preliminary Site Investigation (PSI) at Melbourne (Tullamarine) Airport (the 'Airport').

The PSI has been completed in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013* (ASC NEPM) and has included several key stages:

- Stage 1 – development of a Stakeholder Communication Brief.
- Stage 2 – desktop PSI¹, including reviewing historical documentation, interviews, Airport visit, identifying sites where AFFF has potentially been used historically (by any Stakeholder) and developing preliminary conceptual site models (CSMs) for identified sites managed by Airservices, where AFFF may have been used by Airservices.
- Stage 3 – development of a Sampling Analysis and Quality Plan (SAQP)² for limited intrusive investigations at selected Sites managed by Airservices.
- Stage 4 – implementation of the SAQP and reporting on the results in a Factual Report³.
- Stage 5 – additional sampling in the drainage networks at the Sites selected for intrusive investigations and reporting on results in a Factual Report⁴.
- Stage 6 – finalise the PSI investigation by compiling the findings from Stages 4 and 5 into the desktop PSI report and integrating with previous available data (this report).

The main focus of the PSI was potential PFAS contamination from the historical use of AFFF by Airservices at sites currently managed by Airservices.

¹ Melbourne Airport (Tullamarine) – Aviation Rescue Fire Fighting Services, Preliminary Site Investigation, Report for Airservices Australia, 12 August 2017 - Draft 1 - Project No: 2105.022, SEMF Pty Ltd.

² Melbourne (Tullamarine) Airport – Aviation Rescue Fire Fighting Services, Preliminary Site Investigation, Sampling and Analysis Quality Plan, for Airservices Australia, 20 July 2017 - Final-v4 - Project No: 2105.022, SEMF Pty Ltd.

³ Melbourne (Tullamarine) Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation, Sampling Report for Airservices Australia, 30 November 2017 – Final - Project No: 2105.022, SEMF Pty Ltd.

⁴ Melbourne Airport (Tullamarine) Additional Site Works, Targeted Drainage Sampling Report for Airservices Australia, 9 April 2018, Project No: 2105.022, SEMF Pty Ltd.



3.2 BACKGROUND

The Airport began operation in 1970 and ARFFS have been provided since that time. AFFF has been used for firefighting purposes in Australia since the 1970s and has been stored and used at airports for training purposes, testing and maintenance of firefighting equipment and operational responses. AFFF contains PFAS which are persistent chemicals that can bioaccumulate and are considered to present potential risks to human health and the environment.

Airservices was established on 6 July 1995 and has provided ARFFS at the Airport since this date. The following chronology of prior ARFFS management authorities was provided by Airservices:

- Pre 1986 – Federal Airports were owned and operated by the Commonwealth and the Department of Aviation provided ARFFS services at Federal Airports.
- 16 June 1986 – the Federal Airports Corporation (FAC) was established and certain Airports were vested in the FAC. However, the ARFFS function was not allocated to the FAC and was undertaken by the Department of Transport and Communications (the successor to the Department of Aviation).
- 15 June 1988 – the Civil Aviation Authority (CAA) was established and its role included providing ARFFS services

Airservices ARFFS operations at the Airport (i.e. since 1995) include:

- Main fire station – operated (historically by others) since 1970;
- Satellite fire station – operated (historically by others) since 1970;
- Current fire training ground – operated (historically by others) since around 1975 (the former fire training ground, which encompasses the current fire training ground, has operated by others since 1970); and
- Smoke hut – operated (historically by others) since the late 1980s/early 1990s.

Airservices also manage the air traffic control compound and a number of small areas for air navigation equipment.

Airservices has not used AFFF in the provision of ARFFS at the Airport since 2010 when they transitioned to a PFAS-free foam (Solberg RF6).

Storage and/or use (historical or current) of AFFF by other Stakeholders at the Airport is not known and this was not investigated as a component of the PSI.

3.3 OBJECTIVE

The objectives of the PSI were to:

- Collect site information;
- Identify the potential for PFAS contamination from the historic use of AFFF by ARFFS to have occurred within areas on the Airport managed by Airservices;
- Identify potential areas of PFAS contamination;
- Identify potentially affected media and receptors;
- Review available information;

- Conduct interviews; and
- Conduct limited intrusive investigations.

Although the main focus of the PSI is potential PFAS contamination from the historical use of AFFF by Airservices, other contaminants of potential concern (CoPC) (e.g. hydrocarbons) were also considered.

The PSI will enable Airservices to identify potential AFFF-impacted sites within areas of the Airport managed by Airservices, which will assist with future management of AFFF-impacted areas, if required.

3.4 LIMITATIONS AND EXCLUSIONS

The PSI has been limited to a desktop review of available information, interviews with Airservices and Airport personnel, a site visit and a limited environmental sampling program⁵. SEMF has endeavoured to assess the accuracy of third party information received during the PSI, but cannot guarantee accuracy of any part, without further investigation.

The following limitations should be noted:

- The main focus of the PSI is potential PFAS contamination from the historical use of AFFF by ARFFS in areas managed by Airservices (i.e. since their establishment in 1995); associated hydrocarbon use has also been considered.
- The desktop component of the PSI identified a number of Sites where AFFF may have been used by any Stakeholder (Table 1) and from these, three sites (managed by Airservices) were selected for intrusive investigations.
- The intrusive investigations were limited to soil and surface water sampling in the vicinity of the following three sites, which are managed by Airservices for ARFFS purposes and have an identified likelihood of historic AFFF usage by Airservices:
 - o Site A – Main Fire Station (MFS);
 - o Site D – Current Fire Training Ground (CFTG)⁶; and
 - o Site E – Smoke Hut.
- Although managed by Airservices, no intrusive investigations were undertaken at Site B (Satellite Fire Station) as a component of the PSI. Site B was not considered to be a priority site.

⁵ Melbourne (Tullamarine) Airport – Aviation Rescue Fire Fighting Services, Preliminary Site Investigation, Sampling Report, for Airservices Australia, 30 November 2017 – Final – SEMF Pty Ltd, Project No: 2105.022

⁶ The delineation between Site C (FFTG) and Site D (CFTG) is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).

- No investigations have been undertaken into the contamination status of potentially PFAS-contaminated infrastructure such as concrete pads, wastewater oil-water separators and other wastewater treatment systems, stormwater pits and pipes.
- Intrusive investigations were not undertaken at the remainder of the Sites identified during the desktop PSI (Table 1), as these Sites are not occupied or managed by Airservices.
- No investigation into other CoPC, potential for building contaminants such as asbestos, or lead-based paints has been undertaken.
- Interviews were limited to Airservices personnel and the Australia Pacific Airports Corporation Limited (APAC) Airport Environment Manager. Interviews were not held with other personnel from Australian Pacific Airports (Melbourne) Proprietary Limited (APAM) or Melbourne Airport (MelAir).
- A full audit of non-Airservices sites at the Airport has not been undertaken to obtain a comprehensive inventory of current and/or historic AFFF storage areas or potential use.
- A complete review of demolished and existing buildings, roadway slabs/hardstand, etc. (e.g. age, construction materials and services) has not been undertaken.
- A Tier 1 risk assessment has been undertaken by comparing analytical results to interim assessment criteria applicable to each investigated Site. Contextual information has also been used to update the Conceptual Site Models (CSMs) and determine relative risks at each Site.
- The potential for contamination from off Airport impacting on the Airport or from areas not managed by Airservices (i.e. the wider Airport) impacting on Airservices' Sites, has not been directly investigated. Current surrounding Airport uses include a mix of non-urban land (agriculture and low-density activities) and urban development (industrial and residential). Agricultural practices can use a range of products (e.g. pesticides and fertilisers) which can be spread broadly. Associated contamination is possible but has not been accounted for in the PSI.

4. SCOPE OF WORK

In order to satisfy the project objectives, the PSI was undertaken in several stages through implementation of the following:

- Stage 1 – development of a Stakeholder Communication Brief.
- Stage 2 – draft PSI, including:
 - o Requesting and reviewing relevant historical and current Airport information;
 - o Reviewing and obtaining copies of historical aerial photographs;
 - o Conducting an Airport visit and interviews with Airservices' personnel (a phone interview was also held with APAC's Airport Environment Manager);
 - o Identifying the potential for PFAS contamination from the historic use of AFFF by ARFFS to have occurred within areas on the Airport managed by Airservices;
 - o Identifying areas where AFFF may have been used by Stakeholders other than Airservices on the Airport;
 - o Inspecting Sites A to I (Table 1), within the Airport, where AFFF may have been used by any Stakeholder and collecting photographs;
 - o Developing a preliminary CSM for each of the Sites managed by Airservices where AFFF has been used by Airservices;
 - o Providing recommendations for intrusive investigations based on the evaluation of the potential risks identified being realised;
 - o Identifying off-Airport receptors that may be affected by any identified contamination; and
 - o Compiling the findings into a draft PSI report⁷.
- Stage 3 – development of a Sampling Analysis and Quality Plan (SAQP), including:
 - o Determining the requirements (or not) for limited intrusive sampling at each identified Site where AFFF may have been historically used by Airservices (and other Stakeholders), based on the preliminary CSMs; and
 - o Compiling the SAQP⁸.
- Stage 4 – implementation of the SAQP and reporting on the results in a Factual Report⁹.

⁷ Melbourne Airport (Tullamarine) – Aviation Rescue Fire Fighting Services, Preliminary Site Investigation, Report for Airservices Australia, 12 August 2017 - Draft 1 - Project No: 2105.022, SEMF Pty Ltd.

⁸ Melbourne (Tullamarine) Airport – Aviation Rescue Fire Fighting Services, Preliminary Site Investigation, Sampling and Analysis Quality Plan, for Airservices Australia, 20 July 2017 - Final-v4 - Project No: 2105.022, SEMF Pty Ltd.

⁹ Melbourne (Tullamarine) Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation, Sampling Report for Airservices Australia, 30 November 2017 – Final - Project No: 2105.022, SEMF Pty Ltd.



- Stage 5 – additional sampling in the drainage networks at the Sites targeted in the SAQP and reporting on results in a Factual Report¹⁰.
- Stage 6 – finalise the PSI investigation by compiling the findings from Stages 4 and 5 into the PSI report and integrating with previous available data (this report).

¹⁰ Melbourne Airport (Tullamarine) Additional Site Works, Targeted Drainage Sampling Report for Airservices Australia, 9 April 2018, Project No: 2105.022, SEMF Pty Ltd.



5. AIRPORT INFORMATION

5.1 AIRPORT IDENTIFICATION

The Airport location and details of identified Sites where AFFF may have been used are summarised in Table 1 and illustrated on Figure 1 (Appendix A - Figures).

Table 1: Location and Details of Identified Sites where AFFF May Have Been Used

AIRPORT LOCATION: Melbourne (Tullamarine) Airport – Departure Drive, Melbourne Airport, Victoria, 3045
IDENTIFIED SITES WHERE AFFF MAY HAVE BEEN USED (by any Stakeholder): Based on the findings of the desktop PSI, the following Sites where AFFF may have been used (by any Stakeholder) were identified: - Site A – Main Fire Station (MFS) - Site B – Satellite Fire Station (SFS) - Site C – Former Fire Training Ground (FFTG) - Site D – Current Fire Training Ground (CFTG) - Site E – Smoke Hut - Site F – Old Aviation Rescue Fire Fighting Training Excellence (ARFFTE) School - Site G – F28 Training Area - Site H – Billy's Bunker - Site I – Joint User Hydrant Installation (JUHI) - Site J – Aircraft Hangars - Site K – Operational Response Sites within the Airport (Airport Emergency Procedures (AEPs), grass fires, car fires, house fire, truck rollover) - Site L – Off Airport (Gellibrand Hill, Golf Course and North of Sunbury Road) Site locations are shown on Figure 1 (Appendix A).
CERTIFICATE OF TITLE: Melbourne Airport – various lots on TP801448
SITES MANAGED BY AIRSERVICES: Airservices was established on 6 July 1995 and acquired the function of providing ARFFS services at the following Sites: - Site A – MFS - Site B – SFS - Site D – CFTG - Site E – Smoke Hut Airservices' lease boundaries are shown on Figure 1a (Appendix A). Note the delineation between Site C and Site D is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).
CURRENT LAND USE: Airport – opened for international services on 1 July 1970, with domestic airlines transferring from Essendon Airport on 10 June 1971
HISTORICAL LAND USES: Agriculture (prior to Airport operations)

PROPOSED LAND USE:

- No change in land use proposed, potential Airport expansion.
- No changes currently proposed to existing ARFFS Sites.

5.2 AIRPORT OWNER AND OPERATOR

Melbourne Airport is a Commonwealth-owned airport.

Since 1997, Melbourne Airport has been operated by Australian Pacific Airports (Melbourne) Proprietary Limited (APAM) under a 50-year lease (with the option for a further 49 years).

5.3 REGIONAL SETTING

5.3.1 *Airport Locality and Surrounding Land Use*

Melbourne Airport is located 22 kilometres north-west of the Melbourne central business district on the Principal Public Transport Network. The Airport was built on a plateau between Moonee Ponds Creek and the Maribyrnong River, surrounded by agricultural land, which consists of approximately 2,460 hectares. Today, the Airport is predominantly surrounded by non-urban land (agriculture and low-density activities), particularly to the north and west. These non-urban areas act as a buffer between Airport operations and urban areas. There is urban development to the east and south of the Airport, comprising a mix of industrial and residential uses.

The Airport is divided into five land use precincts, as designated in the Melbourne Airport Master Plan¹¹, these are:

- Airside Operations Precinct;
- Airport Expansion Precinct;
- Terminals Precinct;
- Landside Main Precinct; and
- Landside Business Precinct.

The Airport location is shown on Figure 1 (Appendix A).

The five Airport land use precincts are shown on Figure 5.1 of the Master Plan (Appendix A).

5.3.2 *Potential AFFF-use Site Locality and Surrounding Land Use*

The Airport Precinct locations of each of the on-Airport Sites where AFFF may have been used (by any Stakeholder) identified during the desktop PSI, together with the surrounding land uses, are

¹¹ Melbourne Airport 2013 Master Plan

listed in Table 2. Sites where AFFF may have been used by Airservices (from 1995) are shaded orange. The Site locations are shown on Figure 1 (Appendix A - Figures). The Airservices lease boundaries for Sites managed by Airservices, together with surrounding land uses, are shown on Figure 1a (Appendix A).

Table 2: On-Airport Potential AFFF-use Site Locations and Surrounding Land Use

Site ID	Site Description	Site Location	Surrounding Land Use
Site A	MFS	Airside Operations Precinct – west of the north-south runway and south of the east-west runway, off Operations Road	Completely surrounded by Airport land, farmland further to the west
Site B	SFS	Landside Main Precinct – on the corner of Centre Road and Francis Briggs Road	Completely surrounded by Airport land
Site C	FFTG	Airport Expansion Precinct – west of the Grey Box Woodland	Completely surrounded by Airport land, Grey Box Woodland to the east (up slope), farmland further to the north and west, former landfilling in the area
Site D	CFTG	Airport Expansion Precinct – west of the Grey Box Woodland	Completely surrounded by Airport land, Grey Box Woodland to the east (up slope), farmland further to the north and west, former landfilling in the area
Site E	Smoke Hut	Airport Expansion Precinct – west of the north-south runway and south of the east-west runway, west of Operations Road	Completely surrounded by Airport land, former Airport incinerator to the south-west, cattle grazing to the west
Site F	Old ARFFTE School	Airport Expansion Precinct – west of the north-south runway and south of the east-west runway, west of Operations Road (now demolished)	Completely surrounded by Airport land, former Airport incinerator to the south-west, the Smoke Hut and cattle grazing to the west
Site G	F28 Training Area	Airside Operations Precinct – east of the north-south runway and north of the east-west runway, west of Sunbury Road	Completely surrounded by Airport land

Site ID	Site Description	Site Location	Surrounding Land Use
Site H	Billy's Bunker	Airside Operations Precinct – east of the north-south runway and north of the east-west runway, west of Sunbury Road	Completely surrounded by Airport land
Site I	JUHI	Landside Main Precinct – east of Sunbury Road	Completely surrounded by Airport land, farmland to the north and east
Site J	Aircraft Hangars	Landside Business Precinct – south-east of the north-south runway, north of Operations Road	Completely surrounded by Airport land, golf course further to the west, various commercial businesses to the south
Site K	Operational Response Sites within the Airport	Various AEPs, grass fires, car fires, house fire, truck rollover	Completely surrounded by Airport land

5.3.3 Airport Zoning

Under the Victorian Planning Provisions (VPP), the Airport has the following zoning:

- Activity Centre Zone – applicable to the Terminals Precinct, the Landside Main Precinct and the Landside Business Precinct; and
- Special Use Zone – applicable to the Airside Operations Precinct and the Airport Expansion Precinct.

Planning zones are shown on Figure 5.2 of the Master Plan (Appendix A - Figures).

As per the Master Plan, in accordance with the VPPs, several overlays apply to the Airport land, including:

- Environmental Significance Overlay – applies to land along Deep Creek, the Maribyrnong River, Moonee Ponds Creek, the Golf Course and the Grey Box Woodland;
- Heritage Overlay – applicable to areas recognised as having heritage significance as identified in the Victorian Heritage Register including, the former St Marys Church, the Grey Box Woodland and the Keilor Archaeological site; and
- Melbourne Airport Environs Overlay – generally applicable to land on the approaches to the Airport's existing and proposed runways.

An overlay identifies areas where the development of land may be affected by certain constraints (i.e. environmental, heritage, noise, safety, etc.).

5.3.4 Airport Topography

The Airport topography consists of a relatively flat plateau which slopes gently to the south. The land to the north is at around 130m AHD¹² and to the south is at around 90m AHD, a drop of around 40m altitude over approximately 5kms. Two noticeable features exist on the Airport land, a hill to the north west (north west of the north-south runway) which reaches just over 150m AHD, and a steeply dissected creek valley formed by Arundel Creek, which is situated less than 1km west of the north-south runway and drains southwards towards Maribyrnong River. The plateau is bounded by steeply dissected creek and river valleys to the west and north, and gentler creek valleys to the east.

5.4 ENVIRONMENTAL SETTING

5.4.1 Airport Environmental Setting

The land use setting for the Airport is discussed in Section 5.3.1, with areas of ecological significance discussed in Section 5.4.2.

5.4.2 Airport Areas of Ecological Significance

As detailed in the Master Plan, the Airport and its surrounds provide known and potential habitat for threatened and listed species (protected under Commonwealth and State Government legislation). These habitats are largely within the Grey Box Woodland, which is recognised as one of the largest remaining stands of this vegetation type in Victoria and is included on listings of the Australian Heritage Council, Department of the Environment, Australian Heritage Database, the Register of the National Estate and the Commonwealth Heritage List.

Identified areas of ecological significance at and surrounding the Airport include the following and are shown on Figure 11.1 of the Master Plan (Appendix A - Figures):

- The Grey Box Woodland – representative of a nationally-threatened ecological community, suitable habitat for the endangered (under Commonwealth legislation) Swift Parrot and known habitat for a threatened species of bull ant;
- The area surrounding Moonee Ponds Creek – inhabited by the Growling Grass Frog (a *vulnerable species* listed under the *Environmental Protection and Biodiversity Conservation Act 1999* and as *threatened* under the *Victoria Flora and Fauna Guarantee Act 1988*);
- Surrounding waterways (Moonee Ponds Creek, Steele Creek, Steele Creek North, Deep Creek, Arundel Creek and Maribyrnong River) – a range of endangered vegetation types have been mapped in waterways adjoining the Airport;

¹² www.land.vic.gov.au

- Small areas across the Airport – are designated as National Temperate Grasslands of the Victorian Volcanic Plains and, although degraded, the ecological community is nationally critically endangered; and
- Annandale Road Grassland – cultural heritage.

5.4.3 *APAM Biodiversity Management Priority*

APAM provided the Airport Ecology overlays for Sites selected for intrusive investigation (Section 6.11) as a component of the PSI. These were taken into account during drilling however their significance is not known. The biodiversity management priorities for each are summarised in Table 3 and shown on the referenced figures.

5.4.4 *Airservices Ecological Survey*

A fauna and flora assessment¹³ at Site D (CFTG), completed by Eco Logical Australia in 2013 (Eco Logical, 2013), identified five Critically Endangered Ecological Communities, two Endangered Vegetation Communities, 65 threatened species (30 flora and 35 fauna) and 13 migratory species recorded or with the potential to occur within a 10km radius of the CFTG (through a review of State and Commonwealth flora and fauna databases). The native vegetation at the CFTG did not classify as a matter of National Environmental Significance (MNES) under the Commonwealth Environment protection and Biodiversity Conservation Act 1999 and no threatened species were recorded.

An assessment of the likelihood of occurrence of threatened species, ecological communities and migratory species was undertaken by Eco Logical and identified two likely species; *Litoria raniformis* (Growling Grass Frog) and *Pseudophryne bibronii* (Bibron's Toadlet).

Eco Logical determined that based on the known site values and the activities associated with ARFF training activities at the CFTG, it was unlikely that there will be significant impact upon MNES. Firefighting training activities were not considered likely to impact the environment provided the listed safeguards are adhered to.

5.4.5 *Identified Potential AFFF-Use Sites Environmental Setting*

The environmental setting of each of the identified Sites, where AFFF may have been used (by any Stakeholder) is discussed in Section 5.3.2 and summarised in Table 3 for Sites managed by Airservices which were selected for intrusive investigation. The Site locations are shown on Figure 1 (Appendix A), with the APAM biodiversity management priorities shown on the Figures (Appendix A - Figures) referenced in Table 3.

¹³ Melbourne Fire Training Ground Area, Ecological Survey, Eco Logical Australia, 25 June 2013 (Eco Logical, 2013).

Table 3: Environmental Setting of Potential AFFF-use Sites Selected for Intrusive Investigations

Site ID	Site Description	Environmental Setting	APAM Biodiversity Management Priority	Figure
Site A	MFS	Non-urban areas and Arundel Creek to the west.	Low to medium	Figure 2b (Ecology)
Site D	CFTG	- Grey Box Woodland to the east. - Unnamed dry creek to the west (tributary to Deep Creek).	Low to high	Figure 3b (Ecology)
Site E	Smoke Hut	- Non-urban areas and Arundel Creek to the west. - Former Airport incinerator and landfill to the south-west.	Low to high	Figure 4b (Ecology)

5.5 GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

5.5.1 Geology

The geology underlying the Airport area is described within the Geological Survey of Victoria Sunbury Sheet¹⁴ as '*Olivine basalt, minor limburgite, trachy-andesite, scoria, thin interbedded sand, clay and tuff*'.

The geology beneath the Grey Box Woodland is mapped as '*Bulla Granodiorite*'.

As a component of the PSI, SEMF hand auger investigations only extended to a maximum of 0.5m depth. Soils encountered within those intervals included:

- Around Site A – MFS: a veneer of sandy loam, underlain by mostly gravelly sandy fill around the west and north of the buildings, and sandy clay around the south of the buildings;
- Around Site D – CFTG: gravelly fill was encountered in three boreholes. Weathered sandstone was intersected near the CFTG, clay, sand and silt were intersected near and along the creek line; and

¹⁴ Geological Survey of Victoria, Sunbury, Part 7822, Zone 55, 1:63,360, 1973.

- Around Site E – Smoke Hut: some locations closest to the buildings had a veneer of gravel mixed with sand and clay; the rest of the profile consisted mostly of sticky clay mixed with either sand or silt.

Soil sampling conducted as a component of this PSI, together with historical analytical results (from sampling conducted for Airservices), are discussed in Section 8.

5.5.2 Acid Sulphate Soils

The *Coastal Acid Sulfate Soils Distribution – Map 3 for Central Coast of Victoria*¹⁵, published by the Department of Environment and Primary Industries indicates that the Airport is not within a coastal acid sulphate soil area.

5.5.3 Airport Hydrology and Surface Water

Hydrology / Drainage:

As noted in Section 5.3.4, the topography of the Airport consists of a relatively flat plateau which slopes gently south. Surface water flow is expected to have a general southerly direction over most of the land.

Arundel Creek and its steeply incised valley, situated less than 1km west of the north-south runway, is expected to receive surface waters from a catchment consisting of up to a third of the Airport land. That catchment covers all of the central area of the Airport. The remaining peripheral areas, around the Arundel Creek catchment, are estimated to drain as follows:

- North and north-west, to Deep Creek and its tributaries, which all flow to Maribyrnong River;
- West, to Maribyrnong River;
- South-east, to Steele Creek and Steele Creek North which feed to Maribyrnong River, south of the Airport; and
- East, north-east, to Moonee Ponds Creek which feeds to the Yarra River near Melbourne.

SEMF drainage investigations (March, 2018) indicated:

- Site A (MFS):
 - Drainage between the MFS building and the carpark drains from the north-south drain to the adjacent interceptor (confirmed by visual inspection during truck washing).
 - Stormwater drainage runs to the south-west of the MFS along the southern side of the access road and discharges in the paddock between the MFS and the

¹⁵[http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_coastal-acid-sulfate-soils_documents/\\$FILE/CASS_map3.pdf](http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_coastal-acid-sulfate-soils_documents/$FILE/CASS_map3.pdf)

Airservices' Traffic Control Compound. Ultimate discharge would be Arundel Creek.

- o There are other drainage lines and access pits around the MFS (other than those sampled) but the covers were unable to be removed which prevented sampling.
- Site D (CFTG):
 - o There are two valves at the manifold, one diverts water to the Evaporation Pond via a sump (previous set up) and the second diverts water to the 10kL underground tank (current set up).
 - o Current practice is to collect runoff water from the LMU pad in the 10kL underground tank which gets pumped out and trucked offsite.
 - o Previous practice was to pump water from the 10kL underground tank through the separator (to skim off the kerosene) prior to offsite disposal.
- Site E (Smoke Hut):
 - o Stormwater drainage discharges in the paddock to the west of the Smoke Hut and ultimately discharges in Arundel Creek.
 - o There is a concrete headwall outfall filled with water to the west of the Smoke Hut at the start of Arundel Creek. This is the main stormwater discharge from the Airservices Air Traffic Control Compound.

Water Licences:

A search of the Victorian Water Register Entitlement Statistics¹⁶ identified a number of licences for extracting surface water from Deep Creek and Arundel Creek as detailed below:

- Deep Creek:
 - o Domestic and Stock – 18 licences.
 - o Irrigation - 22 licences.
- Arundel Creek:
 - o Irrigation – 1 licence.

Potential Beneficial Users:

Potential beneficial uses of surface water in Deep Creek and Arundel Creek, downgradient of investigated Sites leased by Airservices, include domestic, stock, irrigation, recreational users and consumption of fish.

¹⁶ <http://waterregister.vic.gov.au/>

Airservices Surface Water Monitoring:

Surface water monitoring conducted as a component of this PSI, together with historical surface water monitoring results (from sampling conducted for Airservices), are discussed in Section 8.

5.5.4 Airport Hydrogeology and Groundwater Quality

Hydrogeology:

As detailed in the Master Plan, the Airport is located above a regional groundwater aquifer and the average depth to groundwater is 20 metres below ground surface. The Master Plan identifies approximately 70 groundwater bores at the Airport with no known areas of significant contamination.

Documented groundwater conditions from historical groundwater monitoring reports (Appendix C) suggest that there is a clay and sandy clay horizon overlying the Newer Volcanic Basalt that underlie most of the Airport area. The clay and sandy clay are expected to represent deep weathering profiles, with minor amounts of coarser erosion materials near the base. This upper profile has been reported to have perched water. Due to the clay horizons, hydraulic connection between the perched water and deep groundwater (around 20m in bedrock) is expected to be minimal. Shallow, perched groundwater would be expected to drain preferentially laterally to the nearest surface water drainage line. Given the depths and deep incisions (30 – 60m beneath the Airport plateau) formed in the land by Arundel Creek, and Deep Creek and Maribyrnong River valleys to the west, it is possible that deep groundwater (over 20m deep beneath the Airport areas) could report directly to these surface water drainage lines through fractures in the rock.

Registered Groundwater Bores:

The Visualising Victoria's Groundwater portal¹⁷ indicates a number of registered groundwater bores in the vicinity of the Airport. Registered groundwater bores near investigated Sites leased by Airservices are summarised in Table 4.

Potential Beneficial Uses:

Potential beneficial uses of groundwater downgradient of Sites leased by Airservices, include domestic, stock and industrial use.

¹⁷ <http://www.vvg.org.au/>

Table 4: Summary of Registered Groundwater Bores near Sites Selected for Intrusive Investigations

Site ID	Bore ID	Proximity to Site	Depth (m)	Groundwater Use
Site A (MFS)	WRK990318	<500 m to the south-west	25	Not Listed
	WRK069737	>500m to the south	20	Observation
	97018	>1km to the west	43	Domestic / Stock
Site D (CFTG)	WRK981998	<500m to the west	30	Not Listed
	WRK043370	>1km to the south-west	91	Industrial
Site E (Smoke Hut)	97019	>1km to the south-west	55	Stock
	97020	>1km to the south-west	71.99	Domestic / Stock

Airservices Groundwater Monitoring:

Groundwater monitoring was not conducted as a component of this PSI. Historical groundwater monitoring results (from sampling conducted for Airservices), are discussed in Section 8.

5.6 CULTURAL HERITAGE

5.6.1 *Victorian Heritage Register*

The Victorian Heritage Register¹⁸ lists the State's most significant heritage places and objects.

A search of the Victorian Heritage Register (by address) identified twelve significant heritage places or objects at the Airport. None are within close proximity to the Airservices managed AFFF Sites and the likelihood of AFFF impact is unlikely.

5.6.2 *Commonwealth Heritage List*

The Commonwealth Heritage List¹⁹ is a list of natural, Indigenous and historic heritage places owned or controlled by the Australian Government.

A search of the Commonwealth Heritage List (by address) identified two significant heritage places or objects at / in the vicinity of the Airport:

¹⁸ <http://vhd.heritagecouncil.vic.gov.au/>

¹⁹ <https://www.environment.gov.au/heritage/places/commonwealth-heritage-list>

- At the Airport – Radar Hill Grey Box Forest (Sunbury Road); and
- Off the Airport – Microwave Landing System Antennas (Tullamarine Freeway).

5.6.3 APAM Heritage Management Priority

Heritage overlays for Sites selected for intrusive investigation (Section 6.11) were provided by APAM as a component of the PSI. The heritage management priorities for each are summarised below:

- Site A (MFS) – heritage overlay not provided;
- Site D (CFTG) – low to high priority (Figure 3c (Heritage)); and
- Site E (Smoke Hut) – low to high priority (Figure 4c (Heritage)).

5.7 SERVICES INFRASTRUCTURE

As detailed in the Master Plan, Airport services infrastructure are provided by:

- Water:
 - o City West Water supplies the reticulated water for domestic and fire supply services (there are connections to City West Water supply at four locations).
 - o All water supplies originate from Melbourne Water-managed reservoirs.
 - o APAM operates and maintains the reticulated water infrastructure within the Airport.
- Sewerage:
 - o City West Water treats the sewage at its sewage treatment plant.
 - o The Airport's system is connected to City West Water's outfall to the south of the Airport at Sharps Road and at Annandale Road.
 - o Small pump stations service the long-term car park, fuel facility, Customs' dog kennels and the Qantas Catering complex.
 - o Another pump station and rising main services the Airservices' operations and maintenance area and the MFS, with connection to the main sewer outfall to the south of these facilities.
 - o APAM operates and maintains the sewerage infrastructure within the Airport.
- Stormwater:
 - o The Airport stormwater system consists of seven catchment areas, with flows discharging to Melbourne-Water managed waterways (regulated by the Environment Protection Authority, Victoria).
 - o The Moonee Ponds catchment discharges to Moonee Ponds Creek.
 - o The remaining catchments discharge directly to the Maribyrnong River or drain to the Maribyrnong River via Steele Creek, Steele Creek North, Arundel Creek and Deep Creek.

- o APAM operates and maintains the stormwater drainage infrastructure within the Airport.
- Electricity:
 - o APAM purchases bulk power from Jemena and distributes the power via the Airport's high- and low- voltage networks (primarily via underground cables).

Site plans showing the location, elevation and size of sewers, stormwater drains and underground utilities (such as power or communications infrastructure) may assist in identification of preferential contamination migration pathways, in the event that potentially mobile contamination is identified.

6. HISTORY OF AFFF USAGE

6.1 INFORMATION SOURCES

Based on the scope and objectives of the project, Section 6 focusses on historical AFFF usage, however where other CoPC were identified during the review, these have also been noted.

A number of information sources pertaining to past uses of AFFF at the Airport have been investigated, including:

- Land Titles (Section 6.2);
- Airport ARFFS Management Authorities (Section 6.3);
- Environment Protection Authority (Section 6.4);
- Historical Aerial Photography (Section 6.5);
- Previous Investigations (Section 6.6); and
- Anecdotal Evidence (Section 6.7).

6.2 LAND TITLE INFORMATION

The *Land and Survey Spatial Information* (LASSI)²⁰, published by the Department of Land, Water and Planning provides land title information. Land title information for each of the Sites identified during the desktop PSI where AFFF may have been used (by any Stakeholder) is provided in Table 5. Sites managed by Airservices are shaded orange and lease boundaries are shown on Figure 1a (Appendix A). It should be noted that the indicative boundary of the FFTG (Site C) shown on Figure 1a encompasses the CFTG (Site C).

Table 5: Land Title Information for the Potential AFFF-use Sites Identified during the Desktop PSI

Site ID	Site Description	Lot	Plan	Estimated Area (m ²)
Site A	MFS	19	TP801448	2,600
Site B	SFS	12	TP801448	2,600
Site C	FFTG	23	TP801448	1,600
Site D	CFTG	23	TP801448	1,600
Site E	Smoke Hut	13	TP801448	2,600
Site F	Old ARFFTE School	19	TP801448	2,600

²⁰ <http://maps.land.vic.gov.au/lassi/LassiUI.jsp>

Site ID	Site Description	Lot	Plan	Estimated Area (m ²)
Site G	F28 Training Area	20	TP801448	2,300
Site H	Billy's Bunker	20	TP801448	2,300
Site I	JUHI	21	TP801448	1,200
Site J	Aircraft Hangars	12	TP801448	2,600
Site K	General Airport	Various	Various	Various
Site L	Off Airport (Gellibrand Hill, Golf Course and North of Sunbury Road)	Various	Various	Various

6.3 AIRPORT ARFFS MANAGEMENT AUTHORITIES

Airservices was established on 6 July 1995 and has provided ARFFS at the Airport since this date. The following chronology of prior ARFFS management authorities was provided by Airservices:

- Pre 1986 – Federal Airports were owned and operated by the Commonwealth and the Department of Aviation provided ARFFS services at Federal Airports.
- 16 June 1986 – the FAC was established and certain Airports were vested in the FAC. However, the ARFFS function was not allocated to the FAC and was undertaken by the Department of Transport and Communications (the successor to the Department of Aviation).
- 15 June 1988 – the CAA was established and its role included providing ARFFS services.

6.4 ENVIRONMENT PROTECTION AUTHORITY

Although not strictly relevant to Airport land, the following web-based searches were conducted:

- Priority Sites Register (PSR) – is a list of all sites for which the Environment Protection Authority (EPA) requires active management to clean up, monitor, or prevent pollution of land and/or groundwater.
- Environmental Audit Database (EAD) – is a list of all sites for which a 53X audit (environmental audit for land suitability) or 53V audit (environmental audit to determine risk or potential harm or detriment to the environment).

A search of the PSR²¹ indicated that the Airport is not listed as a priority site requiring investigation and/or remediation. Multiple sites in close proximity to the Airport, which may potentially be a

²¹ <http://www.epa.vic.gov.au/our-work/publications/publication/2011/november/735-2>

source of PFAS and/or other contaminants to local waterways, were listed in the PSR. Details are provided below:

- West of the Airport:
 - o 315 Loemans Road, Bulla – dumping of industrial waste.
 - o 375 Loemans Road, Bulla – dumping of industrial waste
 - o 65 Edwards Road, Diggers Rest – dumping of industrial waste.
- North-west of Airport
 - o 205 Bulla-Diggers Rest Road, Diggers Rest – dumping of industrial waste.
- South-west of the Airport:
 - o Western Avenue, Tullamarine – former landfill.
- South of Airport:
 - o 145 Annandale Road, Keilor – former landfill.

It is important to note that the PSR does not list all sites known to be contaminated in Victoria and a site should not be presumed to be free of contamination just because it does not appear on the PSR.

A search of the EAD²² by postcode (3045), did not provide any addresses at Melbourne Airport that have been issued with a certificate or statement of environmental audit as part of a 53X audit or with a report as part of a 53V audit, under part IXD of the *Environment Protection Act 1970*.

6.5 AERIAL PHOTOGRAPHY

A search of historical aerial photography held by the Victorian Department of Environment and Primary Industries (DEPI) was conducted. DEPI holds historical aerial photographs from 1931 to 1994. Twelve aerial photographs were identified (with an additional two more recent aerial images sourced), all of which are included in Appendix B, together with a summary of observations made. The observations are as precise as they can be given the age and scale of the older aerial photographs.

Notable information includes:

- Prior to 1960, the Airport was predominantly vacant land, likely to be agricultural.
- MFS – visible from 1969.
- SFS – building activities present in the vicinity from 1969.
- FFTG – ground disturbance in the vicinity from 1969.

²² <http://www.epa.vic.gov.au/our-work/environmental-auditing/environmental-audit-reports-online>

- CFTG – large mock-up unit (LMU) and potentially the Evaporation Pond visible from 1991.
- Smoke Hut – land disturbance in the vicinity from 1969, visible from 1985.
- Old ARFFTE School – visible from 1979 and no longer visible in 2004 (reportedly demolished in 1995).
- F28 Training Area – land disturbance in the vicinity from 1969.
- Billy's Bunker – land disturbance in the vicinity from 1969.
- JUHI – visible from 1969.
- Hangars – land disturbance in the vicinity from 1969, visible from 1991.

6.6 PREVIOUS INVESTIGATIONS

A number of investigations have previously been undertaken at the Airport. At the time of the desktop PSI, Airservices provided a list of reports completed for Airservices and these are documented in Appendix C. Relevant findings, predominantly relating to Sites managed by Airservices, are also summarised in Appendix C.

Previous PFAS, and associated hydrocarbon, data have been compiled as a component of the PSI (Appendix G) and are discussed alongside the PSI data in Section 0.

Notable information for Sites managed by Airservices, and investigated as a component of the PSI, includes:

- Site A – MFS:
 - o Operated from its current location since opening of the Airport (built between 1964 and 1970).
 - o Trade Waste Consent, 2 fuel separators were installed in 1998 (approximately) with wastewater discharge to sewer.
 - o 10kL UST, located on the western side of the main building, was decommissioned in 2000 (area was remediated and testing revealed no evidence of contamination).
 - o 2 x 9kL AFFF ASTs and 1 x 2kL AST for retrieval of vehicle AFFF were located in a shallow bund (AFFF was still stored in 1 x 9kL AST in 2011). There is no AFFF-related infrastructure remaining at the MFS (except for the bund).
 - o PFAS were detected in soil at the western end of the MFS and in groundwater in 2011, hydrocarbons were predominantly below laboratory limits of reporting (LORs) (SKM, 2011).
 - o Trade waste PFAS results were high in 2015 (BECA, 2015).
 - o Ground-based Augmentation System (GBAS) installation (south of the MFS) – PFAS were detected in soil in 2016, hydrocarbons (where tested) were below the LORs (GHD, 2016).
- Site D – CFTG:
 - o Landfilling activities prior to 1970.

- o Operated as a fire training ground since 1970.
- o Groundwater wells installed from 1994.
- o 1 fuel separator installed in 1998 (approximately), prior to this all wastewater was disposed via an outlet pipe to the Evaporation Pond.
- o 3M Light Water (6% concentration) was diluted to 3% for training and has not been used since 2000.
- o 12kL fuel UST was decommissioned by filling with cement slurry (2003 or prior), no validation testing was reported.
- o 30kL kerosene AST decommissioned (2003 or prior), no validation testing reported.
- o Soil (around the LMU), sediment (in the Evaporation Pond) and groundwater impact (downgradient of the Evaporation Pond) (TPH, BTEX, PAH, PFOS and/or PFOA) identified in 2008 (first time PFAS had been tested for) (GHD, 2008).
- o PFAS were detected in groundwater from 2008 to 2014 and again in 2017 (SEMF, 208-14, 2017).
- o PFAS were detected in soil around the LMU in 2013, hydrocarbons were below the LORs (EDGE, 2013).
- o PFAS were detected in stockpiled soil (from the MFS upgrade) in 2013 hydrocarbons were predominantly below the LORs (EDGE, 2013). This material is located within a lined containment cell.
- o PFOS (in excess of the human health fish consumption criterion (GHD, 2015)) have been detected in Deep Creek since testing began in 2014 (SEMF, 2014-2017). Concentrations are generally decreasing.
- Site E – Smoke Hut:
 - o Built in the late 1980s.
 - o Wastewater discharges to stormwater (not sewer).
 - o Contamination (PFOS/PFOA, TPH and PAH) of the soil and adjacent surface / stormwater (AECOM, 2010) – potential for historical use of AFFF.
 - o Potential for contamination along uncontrolled drainage / stormwater channels and in the paddock downgradient of the discharge channel towards Arundel Creek.
 - o PFOS (in excess of the human health fish consumption criterion (GHD, 2015)) was detected in Arundel Creek in 2010. (AECOM, 2010)
 - o Low concentrations of PFOS/PFOA in soil were detected in the southern portion of the paddock area, adjacent to the Smoke Hut (AECOM, 2010) – potential for historical use of AFFF.

6.7 ANECDOTAL EVIDENCE

SEMF held interviews with key Airport-related personnel to obtain information pertaining to the historic use of AFFF at the Airport. Airservices Airport ARFFS personnel were interviewed at the MFS and a brief phone interview was held with the APAC Airport Environment Manager. Summaries of questions and responses from the two separate interviews are provided in Appendix D.

A synopsis of the information (obtained from these interviews) relating to AFFF use at the Airport (by Airservices and/or other Stakeholders) is listed below. A summary of the information for each of the identified Sites where AFFF has historically been used, and where AFFF may have been discharged, is provided below and in Table 6. Sites managed by Airservices are shaded orange

- Types of firefighting foams used include: Protein foam (from 1970's), 3M Light Water (from around 1978 or 1980); Ansulite (from around 2001) and Solberg RF6 (from around 2010).
- Airservices was established on 6 July 1995. Prior to this, ARFFS was provided at the Airport by the CAA (from 1988 to July 1995) and by various Commonwealth Departments (prior to 1988).
- ARFFS foam fire extinguishers contained AFFF until 2010.
- Actual quantities of AFFF used are unknown (estimates for a number of Sites have been provided in Table 6).
- Non-Airservices sources of AFFF include: airlines within hangars; Metropolitan Fire Brigade (MFB); Department of Defence and Country Fire Authority (CFA); previous ARFFS providers.
- AFFF is potentially stored by others within the hangars, fire deluge systems and extinguishers, JUHI and elsewhere on and around the Airport.
- Potentially impacted infrastructure includes: any above- and below-ground infrastructure such as underground service trenches, surface water/stormwater drainage networks, concrete pads, pavement and wastewater treatment equipment situated at, near and down-gradient from any fire-fighting training and operational response locations.
- Historical discharges of AFFF (by any Stakeholder) to soil are known to have occurred in the vicinity of: MFS; SFS; FFTG; CFTG; Old ARFFTE School; Smoke Hut; F28 Training Area; Billy's Bunker; hangars; any areas where a fire has been extinguished (i.e. operational response); and any areas where AEP's have been conducted. Sites managed by Airservices, where historical discharges of AFFF to soil by Airservices are known to have occurred include: MFS, CFTG and the Smoke Hut.
- Surface water run-off from some AFFF-impacted areas may discharge to surrounding waterways (Deep Creek and/or Arundel Creek).
- Water quality in stormwater drains is monitored by APAM. The analytical suite is not known.
- Aerial dispersion of AFFF was dependent on the type of truck, with foam potentially dispersed up to 80 m longitudinally / radially from the roof monitor.
- There is no dedicated Wastewater Treatment Plant for the Airport, with each tenant responsible for their own wastewater treatment under separate Trade Waste Agreements.

- Sensitive human receptors are believed to include: Airport operational and maintenance workers, visitors (on Airport) and neighbouring land users (off Airport).
- Ecologically sensitive areas and receptors are believed to include nearby surrounding waterways (Arundel Creek and Deep Creek) and living organisms within these ecosystems.

Table 6: Summary of Anecdotal Evidence in Relation to Potential AFFF-use Sites Identified during the Desktop PSI

Site ID	Site Name	Anecdotal Evidence
Site A	MFS	▪ Built in 1970 and modified since. Workshop was built in 2014 (northern part of the MFS was previously the workshop). ▪ AFFF usage at the MFS included: monthly monitor testing; annual discharge and refilling of foam extinguishers; truck/hose wash-down and rinsing; bulk storage (unbunded and banded); truck foam concentrate tank filling; former training drills; hot fire training and accidental release. ▪ Triple interceptor pit does not remove foam and water from the pit discharges to sewer under a Trade Waste Agreement. ▪ Built in 2014, there has been no AFFF used by Airservices in the new workshop. ▪ 2 x 9 kL above-ground AFFF tanks were removed in approximately December 2015. ▪ Stockpiled soil to the south of the MFS is from the GBAS installation.
Site B	SFS	▪ Built in 1970 and modified since. ▪ AFFF usage at the SFS from: truck/hose wash-down and rinsing, and monitor testing. ▪ No drainage infrastructure.
Site C	FFTG	▪ Encompasses the CFTG (Site D). ▪ Used for training since the 1970's (destroyed in the late 1990's) by numerous Airport tenants. ▪ AFFF usage at the FFTG from: use of entire area for training; concrete bunker; tunnels and garage. ▪ No concrete pad or controlled drainage. ▪ AFFF quantities included: 1 x 6-week recruit course approximately 30,000 L of foam concentrate; during a training drill half a truck load of foam (approximately 500 L) and up to 6 x 205L drums (unknown material, possibly fuel) and/or 1 x 800L trailer (unknown material, possibly fuel) could be dispensed.
Site D	CFTG	▪ Used for training since 1975 by numerous Airport tenants, main circular pad built in 1975, smaller pad built around 2001.

Site ID	Site Name	Anecdotal Evidence
		▪ AFFF usage at the CFTG from: fire-fighting training exercises. ▪ AFFF quantities included: during fire-fighting training drills ½ truck load of foam (approximately 500 L) could be dispensed. ▪ Drainage from the LMU pad reports to a 10 kL underground holding tank where it: ○ was previously pumped through a coalescing plate interceptor (doesn't remove foam) and gravity fed to the Evaporation Pond; and ○ Is now pumped out and disposed of by contractors as required. ▪ MFB have used the area (and their foam) for training exercises (early to mid-2000's). ▪ Downslope of the Grey Box Woodland. ▪ Large stockpile of contaminated soil (wrapped within a containment cell). The soil was excavated from the new workshop footprint at the MFS. ▪ Three groundwater wells down-gradient.
Site E	Smoke Hut	▪ Built ~1990. ▪ AFFF usage at the Smoke Hut from: hose and branch training and training exercises prior to construction. ▪ CFA have used the area (and their foam) for training exercises (in approximately 2001). The CFA may have also used Class A foam for breathing apparatus training. ▪ MFB and CFA have conducted combined drill exercises. ▪ Adjacent stockpiled material is from the demolition of the Old ARFFTE School and associated carpark. ▪ Perimeter drains flow to an interceptor to stormwater and then Arundel Creek.
Site F	Old ARFFTE School	▪ Built in 1975 and demolished in 1995 (therefore not managed by Airservices); it was adjacent to the Smoke Hut. ▪ AFFF usage at the Old ARFFTE School included: foam testing laboratory; washing hose whips; and hose and branch training (in the paddock to the south). ▪ 3M Light Water was used in the 1987 recruit course. ▪ Surface water flow is expected to be towards Arundel Creek. ▪ No drainage infrastructure was present (completely uncontained). ▪ Stockpiled material from the demolition of the Old ARFFTE School and associated carpark.
Site G	F28 Training Area	▪ No intentional AFFF usage, potential for accidental release. ▪ No drainage infrastructure (completely uncontained).

Site ID	Site Name	Anecdotal Evidence
Site H	Billy's Bunker	▪ Adjacent to the F28 Training Area – 2 x bunkers used for daily monitor checks (primarily water but there is potential for residual discharge of minor amounts of AFFF to have occurred). ▪ No drainage infrastructure.
Site I	JUHI	▪ Holds 11,000,000L of fuel in ASTs (Jet A1). ▪ Firefighting emergency response is designed to be via automatic injection suppression with approximately 1,000L of foam concentrate (stored). The type of foam is unknown (potentially AFFF at some point).
Site J	Aircraft Hangars	▪ Non-ARFFS sources of AFFF. ▪ Hangars contain foam suppression (cannons) and have had foam releases over the years. All hangars have foam fire extinguishers (which may have been AFFF-based) which are discharged and refilled annually (by others).
Site K	Operational Response Sites within the Airport	▪ AFFF usage within the general Airport from Operational Responses (i.e. fire-fighting incident responses) include: grass fires; multi-car fire in the Qantas carpark; terminal car park fires; McNabs Road car fire; house fire to the west; truck rollover near Qantas Catering; and training drill to the west of the east-west runway (1998). ▪ Typically, approximately 300-400L of foam is used for a car fire.
Site L	Off Airport (Gellibrand Hill, Golf Course and North of Sunbury Road)	▪ Gellibrand Hill – no foam storage; AEP was conducted in 2008 (no foam was used); aircraft crash in mid to late 1980's (it is likely that foam was used) and joint exercises conducted with CFA, MFB, Department of Sustainability and Environment / Department of Environment, Land, Water and Planning (may have used foam). ▪ Golf Course – AEP was conducted in the paddock prior to 2006 (may have used foam). ▪ North of Sunbury Road – AEP was conducted in the paddock prior to 2006 (foam was used, quantity is unknown).

6.8 POTENTIAL AFFF-USE SITE INSPECTIONS

A brief visual inspection of Sites A to I, where AFFF may have historically been used based on anecdotal information obtained during the interviews, was undertaken by SEMF on 13th July 2016. A summary of the key observations is provided in Appendix E.

Notable information includes:

- Disturbed, coloured or stained soils were observed at Site C, Site D, Site E, Site F and Site G.
- Bare soil patches were observed at Site C, Site D, Site E, Site F, Site H and Site I.

- No distressed vegetation or unusual odour were noted at any of the inspected Sites.
- Changes in vegetation (i.e. patchy in paddocks or very green at stormwater discharge points) were observed at Site A and Site E.
- Vegetation at Site C and Site D is sparse and an indication of historic abuse.
- Foam was observed on a surface puddle at Site C.
- Surface water drainage is uncontained at Site C, Site D, Site F, Site G and Site H.
- Three groundwater bores were observed at Site D.
- Soil stockpiles were observed at:
 - o Site A – in paddock to the west of the MFS, origin unknown (SEMF, March 2018), to the south of the MFS from the GBAS installation;
 - o Site D – from the MFS upgrade (in an engineered containment cell);
 - o Site E – from demolition of the Old ARFFTE School;
 - o Site F – from demolition of the Old ARFFTE School;
 - o Site G – origin unknown;
 - o Site H – origin unknown; and
 - o Site I – potential vegetated stockpiles, origin unknown.
- Evidence of cut and fill activities were observed in the vicinity of Site D, the area has been used as a quarry (adjacent) and for landfill activities.
- Drainage pits (stormwater / interceptor) were observed at Site A, Site D, Site E and Site I.
- Evaporation Pond is present at Site D (no longer in use).
- Chemical storage was observed at:
 - o Site A – 10kL diesel above-ground tank (AST) (bunded) and packaged oils / degreasers and coolants (bunded), in good condition;
 - o Site C – disused approximately 20kL kerosene AST (unbunded), within a fenced compound, in poor condition (ownership is unknown);
 - o Site D – 5kL kerosene AST (bunded), in good condition;
 - o Site E – liquefied petroleum gas (LPG) cylinder; and
 - o Site I – 11,000,000L of fuel in ASTs (bunded), in average condition.
- Drainage includes:
 - o Formal drainage network for sewer at Site A, Site B and Site I (Trade Waste Consents);
 - o Stormwater from Site A discharges in the paddock west of the MFS (SEMF, March 2018);
 - o Uncontained at Site C, Site F, Site G and Site H;

- o To a 10kL underground holding tank that is pumped out and disposed of by a waste contractor at Site D; and
- o Stormwater from Site E drains to an interceptor which discharges in the paddock to the west and ultimately to Arundel Creek.

6.9 ESTIMATED RISK FROM AFFF AT AIRSERVICES MANAGED SITES

Interview information (Appendix D) suggests that:

- Sites managed by Airservices with a high likelihood of contamination from AFFF are: Sites A (MFS); Site D (CFTG); and Site E (Smoke Hut).
- Sites managed by Airservices with a lower likelihood of contamination from AFFF are Site B (SFS).
- Other identified Sites (not the responsibility of Airservices), where AFFF may have been used includes:
 - o FFTG (Site C) – the delineation between Site C (FFTG) and Site D (CFTG) is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).
 - o Old ARFFTE School (Site F).
 - o F28 Training Area (Site G).
 - o Billy's Bunker (Site H).
 - o JUHI (Site I).
 - o Airline Hangars (Site J).
 - o Operational Response Sites (Site K) – numerous locations within the Airport, most of which are not well documented and any possible contamination is not the responsibility of Airservices.
 - o Potential off-Airport locations (Site L) – not investigated beyond initial identification.

A National review undertaken in 2010²³ ranked the Airport, and in particular the MFS (Site A), CFTG (Site D), Smoke Hut (Site E) and Old ARFFTE School (Site F) as having a “medium risk”, and the FFTG (Site C), as having a “low-medium risk” of contamination from AFFF. No other locations were ranked for potential risk of contamination from AFFF.

²³ SKM, AFFF Conceptual Site Model: Risk Assessment and Works Program, December 2010.

6.10 INTEGRITY ASSESSMENT

The information provided in the PSI is considered as accurate as it can be, based on cross checking a number of sources, including publicly available information, past reports, past documentation, several staff interviews, historical aerial photography and limited Airport inspection.

6.11 SITE SELECTION

As detailed in the SAQP²⁴, Sites A, D and E were selected for preliminary intrusive investigations based on a combination of:

The Site being managed by Airservices;

- The likelihood of AFFF usage by Airservices;
- Known impact area;
- Lack of soil and/or water data;
- Lack of current data;
- Lack of source determination;
- Need to confirm presence or absence of impact;
- Potential for migration to downgradient sensitive human and/or environmental receptors; and/or
- Existence of mapped vegetation of State-wide or Commonwealth significance downgradient of the Sites.

Two additional Sites (Site C and Site F), were also detailed in the SAQP for intrusive investigations however, these Sites were not sampled as they are not managed by Airservices.

²⁴ Melbourne Airport (Tullamarine) – Aviation Rescue Fire Fighting Services, Preliminary Site Investigation, Sampling and Analysis Quality Plan, Final-v4 (SEMF, 20 July 2017).

7. IDENTIFIED POTENTIAL CONTAMINATION

7.1 NON-AFFF POTENTIAL CONTAMINATION

In addition to AFFF-related potential contamination areas, this PSI has opportunistically recorded other potential contaminating activities or incidents where these arose during interviews or from review of historical reports. This section is not comprehensive and only provides an indication of other potential contamination at the Airport, and close to potential AFFF-impacted areas.

Hazardous materials that may potentially be produced, collected, stored or used include:

- Asphalt/bitumen products, including waste from runway grooving activities;
- Polychlorinated biphenyl (PCB) in transformer oils;
- Pesticides and herbicides;
- Cleaning agents including solvents and degreasers;
- Aviation and automotive fuel/oils/hydraulic fluids/degreasers;
- Sludge from sumps, triple interceptors and wastewater treatment (biosolids);
- Removed asbestos / asbestos containing building materials;
- Paints, kerosene, LPG and solvents;
- Batteries;
- Burnt waste materials;
- Fire extinguishing and de-icing chemicals; and
- Quarantine wastes.

There is a former incinerator to the south-west of the Smoke Hut (Site E) that previously managed all quarantine and other Airport waste. Drainage from this area is towards Arundel Creek (MW4). It is not known where the ash was disposed of (potentially at the adjacent former landfill).

There are a number of known former landfills at the FFTG (Site C) and adjacent to the former incinerator, to the south-west of the Smoke Hut (Site E). Materials disposed of at these locations are unknown.

Risks listed in the Airservices Site Manifests include:

- Diesel fuel (MFS and SFS only);
- Kerosene;
- Fire-fighting foams;
- Hazardous chemicals;
- Site contamination; and
- Prescribed wastes.

7.2 CONTAMINANTS OF POTENTIAL CONCERN

Sites used by Airservices (i.e. since 1995) at, and near, the Airport, either for training or for emergency operational responses, are likely to be impacted by some historically-used AFFF compounds as a result of past fire-fighting activities and/or contaminants from workshop activities and fuel storages. Any impacts at these Sites however, may have been caused by Airservices' predecessor/s and cannot be solely attributed to Airservices. Similarly, AFFF impacts at operational response sites are not the responsibility of Airservices.

Expected CoPC related to Airservices AFFF-use include:

- Total petroleum hydrocarbons (TPH) / total recoverable hydrocarbons (TRH);
- Volatile monocyclic aromatic hydrocarbons [benzene (B), toluene (T), ethyl-benzene (E), o, m and p xylenes (X) and naphthalene (N); commonly referred to as BTEXN];
- Semi-volatile polycyclic aromatic hydrocarbons (PAHs);
- PFAS (full available analytical suite), and in particular those with interim assessment criteria:
 - o Perfluorooctane Sulfonate (PFOS);
 - o Perfluorooctanoic Acid (PFOA);
 - o Perfluorohexane Sulfonate (PFHxS); and
 - o Fluorotelomer Sulfonates (6:2 FtS and 8:2 FtS).

Although other potential contaminants may be present, the CoPC investigated in the PSI included PFAS and hydrocarbons only.

Based on a review of the information collected during the desktop component of the PSI, CoPC for each identified Site where AFFF may have been used (by any Stakeholder) are summarised in Table 7. Sites managed by Airservices and selected for intrusive investigations are shaded orange.

Table 7: Summary of Identified Contaminants of Potential Concern

Site ID	Site Name	Potentially Contaminating Activities (AFFF-use related)	CoPC (AFFF-use related)
Site A*^	MFS	▪ Storage / use of kerosene, diesel and AFFF (ASTs and UST). ▪ Vehicle refuelling and wash-down activities (vehicles and hoses). ▪ Historic monitor testing with AFFF in grassed areas to north and south of the MFS. ▪ Fire extinguisher discharge and refill with AFFF. ▪ Old training drill area. ▪ Historical storage of chemicals (unbunded).	BTEXN, TPH/TRH, PAH, PFAS

Site ID	Site Name	Potentially Contaminating Activities (AFFF-use related)	CoPC (AFFF-use related)
		- Hot fire training activities. - Workshop activities. - Failure of fuel separators / separators ineffective at removing foam. - Wastewater run-off. - Accidental AFFF release.	
Site B*^	SFS	- Storage of foam in the north-west corner of the building. - Historic monitor testing with AFFF. - Wash-down activities (vehicles and hoses). - Wastewater run-off. - Absence of drainage infrastructure. - Accidental AFFF release.	BTEXN, TPH/TRH, PFAS
Site C^	FFTG	- Historic training activities (across entire Site) using numerous accelerants and AFFF. - Storage / use of kerosene and diesel. - Wastewater run-off. - Landfill activities. - Absence of drainage infrastructure.	BTEXN, TPH/TRH, PAH, PFAS (unknown fill - landfill activities)
Site D*^	CFTG	- Historic training activities (across entire Site) using fuel and AFFF (training is currently limited to the LMU pad). - Storage (ASTs and UST) / use of kerosene and diesel. - Wastewater run-off. - Landfill activities. - Failure of fuel separator / separator ineffective at removing foam. - Historic containment of contaminated water in the evaporation pond. - Stockpile of contaminated soil in a lined containment cell, excavated from the new workshop footings at the MFS.	BTEXN, TPH/TRH, PAH, PFAS (unknown fill - landfill activities)
Site E*^	Smoke Hut	- Training activities (across entire Site including paddock to the south) using AFFF. - Training and wash-down activities from the Old ARFFTE School (up-gradient). - Landfill activities.	BTEXN, TPH/TRH, PAH, PFAS (unknown fill material, landfill activities & incinerator wastes)

Site ID	Site Name	Potentially Contaminating Activities (AFFF-use related)	CoPC (AFFF-use related)
		- Wastewater run-off. - Presence of fill material. - Historically inadequate drainage infrastructure. - Historic Airport incinerator to the south-west.	
Site F*^	Old ARFFTE School	- Hose and branch training activities using AFFF. - Wash-down activities (hose whips). - Wastewater run-off. - Absence of drainage infrastructure. - Accidental AFFF release.	BTEXN, TPH/TRH, PAH, PFAS
Site G*	F28 Training Area	- Absence of drainage infrastructure. - Accidental AFFF release. - Adjacent soil stockpile (unknown origin).	PFAS (stockpile of unknown origin)
Site H*^	Billy's Bunker	- Absence of drainage infrastructure. - Accidental AFFF release. - Adjacent soil stockpile (unknown origin).	PFAS (stockpile of unknown origin)
Site I	JUHI	- Fuel storage (ASTs) of Jet A1. - Automatic injection suppression – using foam – around 1000L stored at the site.	BTEXN, TPH/TRH, PAH, PFAS
Site J	Aircraft Hangars	- Maintenance activities. - Foam suppression (cannons) – using foam. - Foam fire extinguishers which are discharged and refilled annually (by others).	BTEXN, TPH/TRH, PAH, PFAS
Site K	Operational Response Sites within the Airport	Potential / actual use of AFFF for grass fires; multi-car fire in the Qantas carpark; terminal car park fires; McNabs Road car fire; house fire to the west; truck rollover near Qantas Catering; and training drill to the west of the east-west runway (1998).	BTEXN, TPH/TRH, PAH, PFAS
Site L	Off Airport	- Gellibrand Hill – potential use of foam during AEP (2008); aircraft crash (mid-late 1980's) and joint exercises conducted with others. - Golf Course – potential use of foam during AEP (2006). - North of Sunbury Road – potential use of foam during AEP (2006).	BTEXN, TPH/TRH, PAH, PFAS

* Indicates sites that were used by Airservices from 1995 onwards.

^ Indicates sites that were used by an aviation fire-fighting rescue service prior to Airservices' creation in 1995.

8. LIMITED SITE ASSESSMENT

8.1 CONTEXT

Details of the limited site assessment works undertaken as part of this PSI are provided in two separate reports^{25, 26}. Both reports present the analytical results and compare all data to all interim criteria outlined in Appendix F, regardless of setting and applicability.

The following sections discuss the results of the limited site assessment against applicable criteria. To allow a more complete understanding of the available PFAS data on the Airport, previous PFAS results (from investigations commissioned by Airservices) have also been included in the assessment. It should be noted that such data should be considered indicative due to differences in timeframe, season, sampling, decontamination methods, analytical methods and other possible variables between sampling events. PFAS compounds also degrade to other compounds. The data nonetheless provide an indication of the order of magnitude of PFAS detected at particular locations and in that particular sampling media at the time of sampling. The focus has been on compiling available PFAS data only, however, where hydrocarbon data were available for the same sample, hydrocarbon testing results have also been recorded in the summary results tables in Appendix G.

8.2 APPLICABLE CRITERIA

Interim PFAS criteria nominated for this investigation (Appendix F) apply to the assessment of contamination for a range of settings or uses including:

⇒ for water (surface and ground):

- Human health criteria for:
 - Recreational;
 - Consumption of fish; and
 - Drinking water (6:2 FtS in the absence of recreational criteria).
- Ecological criteria.

⇒ for soil:

- Human health criteria for:
 - Residential (potential for direct contact by intrusive / maintenance workers); and
 - Commercial / Industrial.
- Ecological criteria.

²⁵ Melbourne (Tullamarine) Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation, Sampling Report for Airservices Australia, 30 November 2017 – Final - Project No: 2105.022, SEMF Pty Ltd.

²⁶ Melbourne Airport (Tullamarine) Additional Site Works, Targeted Drainage Sampling Report for Airservices Australia, 9 April 2018, Project No: 2105.022, SEMF Pty Ltd.

Criteria for hydrocarbons include:

⇒ for water (surface and ground):

- Human health criteria for drinking water (in the absence of recreational criteria for TRH, benzo(a)pyrene and total xylenes).
- Ecological criteria for fresh water.

⇒ for soil:

- Residential Health Screening Levels (HSLs) for TRH (potential for direct contact by intrusive / maintenance workers).
- Commonwealth Airport (Environment Protection) Regulation 1997 (AEPR, 1997) ecological criteria (general airport and areas of ecological significance).

Soil criteria applicable for each Site have been determined based on their surrounding land uses (Section 5.3), environmental setting (Section 5.4) and the APAM interpreted Ecological – Biodiversity Management Priority Overlays (Appendix A) and are summarised in Table 8. Water criteria applicable for surface water and groundwater samples have been determined based on surrounding land uses, environmental setting, and potential nearest most sensitive users, and are summarised in Table 9 (for PFAS).

Total dissolved solids (TDS) concentrations also govern whether water is drinkable or not. The AEPR, 1997 considers concentrations under 1,000 mg/L TDS to be 'drinkable', though the National Health and Medical Research Council (NHMRC, 2011)²⁷ notes that 'good' (human) drinking water should have less than 600 mg/L TDS. Between 600 and 900 mg/L TDS water palatability is 'fair', between 900 and 1,200mg/L TDS palatability is 'poor', and over 1,200 mg/L water palatability is 'unacceptable'.

²⁷ NHMRC Australian Drinking Water Guidelines 6, 2011

Table 8: PFAS Criteria Applicable to Soil / Sediment Samples in this PSI

Site	Surrounding Land Use [#]	Environmental Setting*	Ecological Management Priority Overlays^	Sample IDs		Applicable PFAS Criteria
				PSI	Historical	
Site A – MFS and surrounds	Completely surrounded by Airport land, farmland further to the west (Figure 1a)	Non-urban areas and Arundel Creek to the west.	Low – all soil locations (Figure 2b)	Soil - MS01-07 (SEMF, 2017)	Soil - MRR-05-07 (EDGE, 2013) Soil - BH1-15 (SKM, 2011)	Human Health – commercial / industrial Ecological – commercial / industrial
					Soil - RSMU1-4, VDB, Shelter, Shelter 1-5, SB01-03 (GHD, 2016)	Human Health – commercial / industrial Ecological – commercial / industrial & 95% species protection
Site D – CFTG and surrounds	Completely surrounded by Airport land, Grey Box Woodland to the east (up slope), farmland further to the north and west, former landfilling in the area	Grey Box Woodland to the east. Unnamed dry creek to the west (tributary to Deep Creek)	High – sample location MS11 (soil) Low – all other soil locations (Figure 3b)	Soil - MS09-10, MS12-15 (SEMF, 2017)		Human Health – commercial / industrial Ecological – commercial / industrial
				Sediment – MS11 (SEMF, 2017)		Human Health – commercial / industrial Ecological – commercial / industrial & 95% species protection

Site	Surrounding Land Use [#]	Environmental Setting*	Ecological Management Priority Overlays [^]	Sample IDs		Applicable PFAS Criteria
				PSI	Historical	
	(Figure 1a)				Sediment - USS1, DSS1, DSS2 (SEMF, 2014)	Human Health – commercial / industrial Ecological – commercial / industrial & 95% species protection
					Soil - MRR-08-11 (EDGE, 2013) Soil - BH1-3 (GHD, 2008) Sediment - SED1-4 (GHD, 2008)	Human Health – commercial / industrial Ecological – commercial / industrial
Site E – Smoke Hut and surrounds	Completely surrounded by Airport land, former Airport incinerator to the south-west, cattle grazing to the west (Figure 1a)	Non-urban areas and Arundel Creek to the west. Former Airport incinerator and landfill to the south-west.	Low – all soil locations (Figure 4b)	Soil - MS16-21 (SEMF, 2017)	Soil - TP21, TP25, TP30, SB01-12, MW01 (AECOM, 2010) Soil - TP01-17 (GHD, 2016)	Human Health – commercial / industrial Ecological – commercial / industrial

[#] refer to Section 5.4.

^{*} refer to Section 5.3.

[^] refer to Figures 2b, 3b and 4b showing APAM interpreted Ecology Management Priority Overlays in Appendix A.



Table 9: PFAS Criteria Applicable to Surface Water and Groundwater Samples in this PSI

Site	Surrounding Land Use [#]	Environmental Setting*	Ecological Management Priority Overlays [^]	Beneficial Uses of Groundwater & Surface Water [~]	Sample IDs		Applicable PFAS Criteria
					PSI	Historical	
Site A – MFS and surrounds	Completely surrounded by Airport land, farmland further to the west (Figure 1a)	Non-urban areas and Arundel Creek to the west.	Low to medium (Figure 2b)	Surface Water – recreational users of and consumption of fish from Arundel Creek Groundwater – unknown	Stormwater – MW1 (SEMF, 2017); MW7-8 (SEMF, 2018)	Groundwater - MW01 (SKM, 2011) Wastewater – 2 locations (BECA, 2015, 2016)	Human Health – recreational & consumption of fish Ecological – (GHD, 2015)
Site D – CFTG and surrounds	Completely surrounded by Airport land, Grey Box Woodland to the east (up slope), farmland further to the north and west, former landfilling in the area (Figure 1a)	Grey Box Woodland to the east. Unnamed dry creek to the west (tributary to Deep Creek)	Low to high (Figure 3b)	Surface water – recreational users of and consumption of fish from Deep Creek Groundwater – industrial	Surface Water – MW5 (SEMF, 2017) Wastewater – MW6 (SEMF, 2017); MW9, MW9-1 (SEMF, 2018)	Surface Water – USS1, DSS1, DSS2 (SEMF, 2014, 2015, 2016, 2017) Groundwater - MW-1-3 (Connolly, 2013), (GHD, 2008), SEMF, 2014, 2015, 2016, 2017)	Human Health – recreational & consumption of fish Ecological – (GHD, 2015)

Site	Surrounding Land Use [#]	Environmental Setting [*]	Ecological Management Priority Overlays [^]	Beneficial Uses of Groundwater & Surface Water ⁻	Sample IDs		Applicable PFAS Criteria
					PSI	Historical	
						Wastewater – 1 location (BECA, 2016)	
Site E – Smoke Hut and surrounds	Completely surrounded by Airport land, former Airport incinerator to the south-west, cattle grazing to the west (Figure 1a)	Non-urban areas and Arundel Creek to the west. Former Airport incinerator and landfill to the south-west.	Low to high (Figure 4b)	Surface Water – recreational users of and consumption of fish from Arundel Creek Groundwater – domestic / stock	Surface Water – SW2 (SEMF, 2018), MW3, MW4 (SEMF, 2017) Stormwater – SW3, MW10 (SEMF, 2018), MW2 (SEMF, 2017)	Stormwater – SW3, SW4 (AECOM, 2010) Surface Water – SW1, SW2 (AECOM, 2010) Wastewater – 2 locations (BECA, 2015, 2016)	Human Health – recreational Ecological – (GHD, 2015)

Nominated criteria are not applicable to wastewater sampling locations.

[#] refer to Section 5.4.

^{*} refer to Section 5.3.

⁻ Refer to Section 5.5.

[^] refer to Figures 2b, 3b and 4b showing APAM interpreted Ecology Management Priority Overlays in Appendix A.



8.3 SITE A (MFS)

The Airservices lease boundary and investigated areas at and around the MFS (both during the PSI and historically) are shown on Figures 2a-2e (Appendix A). Hydrocarbon exceedances in samples tested for PFAS have also been shown.

8.3.1 Soil

Soil results at and in the vicinity of Site A (MFS), presented in the summary table in Appendix G, include results from:

- Hand augered soils from this PSI (MS01-MS07) – Figures 2a and 2c.
- Soil samples from the investigation done at the proposed GBAS area (GHD, 2016b)²⁸ (RSMU1-RSMU4, VDB, Shelter-Shelter_5 and SB01-SB03), in the vicinity of the MFS – Figures 2d and 2e.
- Soil samples from a stockpile of excavated soil from the LAHFTG at the MFS (EDGE, 2013)²⁹ (MRR-05 to MRR-07) – Figures 2a and 3a.
- Soil samples from the investigation done during the MFS upgrade (SKM, 2011)³⁰ (BH1 to BH15) – Figures 2d and 2e.

The data are believed to represent the extent of soil PFAS testing for Airservices at and in the vicinity of Site A. Other sampling may have been conducted by other Stakeholders.

Comments on the soil analytical results are provided in Table 10.

Most of the soil samples collected during this PSI were taken from near-surface and down to 0.5m depth. Whereas, many past samples from the western end of the MFS, were taken from greater depths of up to 3m. Reference should be made to the depth the sample was collected when interpreting the results. An acceptable concentration at one depth does not infer acceptable concentrations at all depths at the specified location. At some locations PFAS concentrations were more elevated at 0.5m than at 0.1m.

The 95% species protection ecological PFOS criterion (0.373 mg/kg) has only been considered applicable to a few sampling locations, namely those at, and near the proposed GBAS area, to the east of the MFS (Site A), which is located within an area of medium ecological biodiversity management priority.

All other samples collected from or in the vicinity of the MFS were collected from an active ARFFS operational area of low ecological biodiversity management priority. These areas are

²⁸ Melbourne GBAS Program, Site Contamination Assessment - Additional Sampling Event (GHD, August 2016).

²⁹ Excavation of PFOS/PFOA Contaminated Soil at the Hot Fire Learning Academy (Melbourne Airport) (EDGE, 7 October 2013).

³⁰ Phase 1 and 2 Environmental Site Assessment (ESA) 0245 ARFF Melbourne Fire Station CAT 10 Upgrade, Melbourne Airport, Victoria (SKM, June 2011).

not considered ecologically sensitive areas and do not warrant application of the 95% species protection criterion.

8.3.2 Surface Water

Surface water results at and in the vicinity of Site A (MFS), presented in the summary table in Appendix G include results from:

- Interceptor sample from this PSI (MW1) – Figures 2a-2e.
- Triple Interceptor samples taken during annual trade waste sampling (BECA, 2015)³¹ and (BECA, 2016)³² – Figures 2a-2e.

The data are believed to represent the extent of surface water PFAS testing for Airservices at and in the vicinity of Site A. Other sampling may have been conducted by other Stakeholders.

Comments on the surface water analytical results are provided in Table 10.

None of the surface water locations are being used or likely to be used for drinking water supply so the results have not been compared to drinking water criteria. It should be noted that the TRH LORs are higher than the drinking water criteria (WHO, 2008)³³.

Surface water samples collected from Arundel Creek, down gradient of the MFS, are discussed in Section 8.5.2.

8.3.3 Groundwater

No groundwater sampling was conducted as a component of the PSI.

Groundwater results at and in the vicinity of Site A (MFS), presented in the summary table in Appendix G include results from:

- Groundwater samples taken at the MFS during the upgrade works (SKM, 2011)³⁴ (MW01) - Figures 2a-2e.

The data are believed to represent the extent of groundwater PFAS testing for Airservices at and in the vicinity of Site A. Other sampling may have been conducted by other Stakeholders.

Comments on the groundwater analytical results are provided in Table 10.

TDS results – all groundwater tested have TDS>1,000 mg/L, with concentrations at the MFS around 3,100 mg/L. The quality is therefore not suitable for drinking water. It is not clear if the

³¹ Melbourne Airport Site Visit Report 2015 (BECA, 9 November 2015).

³² Melbourne ARFF Site Sampling Report 2016 (BECA, 13 October 2016).

³³ SEMF enquired with ALS laboratories who noted that they are not typically requested to drop the LOR and would check whether this was feasible.

³⁴ Phase 1 and 2 Environmental Site Assessment (ESA) 0245 ARFF Melbourne Fire Station CAT 10 Upgrade, Melbourne Airport, Victoria (SKM, June 2011).

TDS concentrations are due to contamination impact, or representative of regional groundwater quality.

Limited historical groundwater data – groundwater conditions at the MFS are not well understood and rely on historical results from one well. Similarly hydrogeology has not been investigated and consequently the interactions between groundwater and surface water are unknown. The single round of sampling at the MFS, in 2010, showed low level PFAS impact and non-detectable hydrocarbon impact.

Table 10: Summary of Analytical Findings – Site A (MFS)

Analyte	PSI Results	Historical Results	Summary
SOIL			
PFOS	Concentrations were within applicable human health and ecological criteria for all samples.	- Six soil samples collected from the proposed GBAS area (east of the MFS) (Shelter_0.2, Shelter_0.5, Shelter_1_0.2, Shelter_2_0.2, SB01_0.5 and SB1_0.7), exceeded the ecological 95% species protection criterion of 0.373 mg/kg (GHD, 2015). Three of the samples (Shelter_0.2, Shelter_0.5 and Shelter_1_0.2) also exceeded the ecological 60% species protection (Commercial / Industrial) criterion. - One soil sample collected from the western end of the MFS (BH10-0.5), exceeded the ecological 60% species protection (Commercial / Industrial) criterion (this soil is now stored in the lined containment cell at the CFTG). - All other samples were within applicable human health and ecological criteria.	Seven investigated locations (historically) at or in the vicinity of the MFS reported exceedances of adopted criteria.
PFOA	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.
6:2FtS & 8:2FtS	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.
PFHxS+ PFOS	Concentrations were within applicable human health and ecological criteria for all samples.	Historical samples were not tested for PFHxS.	Where tested, concentrations were within adopted criteria for all samples.
TPH / TRH:	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.

Analyte	PSI Results	Historical Results	Summary
BTEXN	Soil samples collected during the PSI were not analysed for BTEXN as none reported concentrations for TPH/TRH above the LORs.	Concentrations were within applicable human health and ecological criteria for all samples.	Where tested, concentrations were within adopted criteria for all samples.
PAH	Soil samples collected during the PSI were not analysed for PAH as none reported concentrations for TPH/TRH above the LORs.	Concentrations were within applicable human health and ecological criteria for all samples.	Where tested, concentrations were within adopted criteria for all samples.
SURFACE WATER			
PFOS	<u>Stormwater Drainage</u> Two stormwater samples (MW1 and MW7), exceeded the recreational water quality criterion of 0.7 µg/L (FSANZ, 2017). One of the samples (MW7) also exceeded the recreational water quality criterion of 5 µg/L (enHealth, 2016) and the ecological criterion of 6.6 µg/L (GHD, June 2015).	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Two investigated locations (during the PSI) at or in the vicinity of the MFS reported exceedances of the currently adopted interim PFOS criteria.
PFOA	<u>Stormwater Drainage</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Concentrations were within adopted criteria for all samples.
6:2FtS	<u>Stormwater Drainage</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Concentrations were within adopted criteria for all samples.
8:2FtS	<u>Stormwater Drainage</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Concentrations were within adopted criteria for all samples.
PFHxS	<u>Stormwater Drainage</u> One stormwater sample (MW7), exceeded the recreational water quality criteria of 0.7 µg/L (FSANZ, 2017) and 5 µg/L (enHealth, 2016).	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> One investigated location (during this PSI) in the vicinity of the MFS reported exceedances of the adopted criteria.



Analyte	PSI Results	Historical Results	Summary
TPH / TRH	<u>Stormwater Drainage</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Concentrations were within adopted criteria for all samples.
BTEXN	<u>Stormwater Drainage</u> Where tested, concentrations were within applicable human health and ecological criteria for all samples.	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Where tested, concentrations were within adopted criteria.
PAH	<u>Stormwater Drainage</u> Stormwater samples collected during the PSI were not analysed for PAH as none reported concentrations for TPH/TRH above the LORs.	<u>Stormwater Drainage</u> No stormwater drainage samples were collected historically.	<u>Stormwater Drainage</u> Not tested (during PSI or historically).
GROUNDWATER			
PFOS	Groundwater sampling was not conducted during the PSI.	Only one round of sampling has been undertaken in MW01 (SKM, 2011). The single sample from MW01 exceeded the human health recreational water quality criterion of 0.7 µg/L (FSANZ, 2017).	One investigated location (historically) at the MFS reported exceedances of the adopted human health criteria.
PFOA	Groundwater sampling was not conducted during the PSI.	The concentration was within the applicable human health and ecological criteria for the single sample.	The concentrations was within adopted criteria for the single sample.
6:2FtS	Groundwater sampling was not conducted during the PSI.	The concentration was within the applicable human health and ecological criteria for the single sample.	The concentrations was within adopted criteria for the single sample.
8:2FtS	Groundwater sampling was not conducted during the PSI.	The single sample was not analysed for 8:2FtS.	The single sample was not analysed for 8:2FtS.
PFHxS	Groundwater sampling was not conducted during the PSI.	The single sample was not analysed for PFHxS.	The single sample was not analysed for PFHxS.
TPH / TRH	Groundwater sampling was not conducted during the PSI.	The concentrations were within the applicable human health and ecological criteria for the single sample.	The concentrations were within adopted criteria for the single sample.



Analyte	PSI Results	Historical Results	Summary
BTEXN	Groundwater sampling was not conducted during the PSI.	The concentrations were within the applicable human health and ecological criteria for the single sample.	The concentrations were within adopted criteria for the single sample.
PAH	Groundwater sampling was not conducted during the PSI.	The concentrations were within the applicable human health and ecological criteria for the single sample.	The concentrations were within adopted criteria for the single sample.



8.4 SITE D (CFTG)

The Airservices lease boundary and investigated areas at and around the CFTG (both during the PSI and historically) are shown on Figures 3a-3e (Appendix A). Hydrocarbon exceedances in samples tested for PFAS have also been shown.

8.4.1 Soil

Soil results at and in the vicinity of Site D (CFTG), presented in the summary table in Appendix G, include results from:

- Hand augered soils from this PSI (MS09-MS15) – Figures 3a and 3d.
- Streamside soil samples from sampling along Deep Creek (SEMF, 2014)³⁵ (USS1-1, DSS1-1 and DSS2-1) – Figure 3e.
- Sediment samples from Deep Creek (SEMF, 2014) (USS1-2, DSS1-2 and DSS2-2) – Figure 3e.
- Soil samples from investigations done at the CFTG (MRR-08-MRR-11) (EDGE, 2013)³⁶ - Figures 3a and 3e.
- Soil (BH1-BH3) and sediment (SED1-SED4) samples from the investigation done at the CFTG (GHD, 2008)³⁷ - Figures 3a and 3e.

The data are believed to represent the extent of soil PFAS testing for Airservices at and in the vicinity of Site D. Other sampling may have been conducted by other Stakeholders.

Comments on the soil analytical results are provided in Table 11.

Most of the soil samples collected during this PSI were taken from near-surface and down to 0.5m depth. Whereas, many past samples from the CFTG, were taken from greater depths of up to 2m. Reference should be made to the depth the sample was collected when interpreting the results. An acceptable concentration at one depth does not infer acceptable concentrations at all depths at the specified location. At some locations PFAS concentrations were more elevated at 0.5m than at 0.1m.

The 95% species protection ecological PFOS criterion (0.373 mg/kg) has only been considered applicable to a few sampling locations, namely those at, and near:

- Deep Creek, which is located within an area of high ecological biodiversity management priority; and

³⁵ Perfluorinated Compounds (PFC) Speculative Sampling, Deep Creek, Melbourne Airport - Report (SEMF, 19 February 2014)

³⁶ Excavation of PFOS/PFOA Contaminated Soil at the Hot Fire Learning Academy (Melbourne Airport) (EDGE, 7 October 2013).

³⁷ Preliminary Site Contamination Assessment, Melbourne ARFF Drill Ground, Melbourne Airport (GHD, September 2008).



- Dry Creek, which is located within an area of high ecological biodiversity management priority.

All other samples collected from or in the vicinity of the CFTG were collected from an active ARFFS operational area of low ecological biodiversity management priority. These areas are not considered ecologically sensitive areas and do not warrant application of the 95% species protection criterion.

8.4.2 Surface Water

Surface water results at and in the vicinity of Site D (CFTG), presented in the summary table in Appendix G include results from:

- Surface water samples from this PSI (Dry Creek, MW5) – Figures 3a-3e.
- Interceptor sample from this PSI (MW6) – Figures 3a-3e.
- Surface water samples from Deep Creek (SEMF, 2014)³⁸, (SEMF, 2014a)³⁹, (SEMF, 2015a)⁴⁰, (SEMF, 2016a)⁴¹ and (SEMF, 2017a)⁴² (USS1, DSS1 and DSS2) – Figure 3e.
- Separator outlet samples taken during annual trade waste sampling (BECA, 2015)⁴³ and (BECA, 2016)⁴⁴ – Figures 2a-2e.

The data are believed to represent the extent of surface water PFAS testing for Airservices at and in the vicinity of Site D. Other sampling may have been conducted by other Stakeholders.

Comments on the surface water analytical results are provided in Table 11.

None of the surface water locations are being used or likely to be used for drinking water supply so the results have not been compared to drinking water criteria. It should be noted that the TRH LORs are higher than the drinking water criteria (WHO, 2008)⁴⁵.

Trade waste concentrations are included in the surface water summary table (Appendix G), however they are not discussed in the following sections in terms on guideline exceedances.

8.4.3 Groundwater

No groundwater sampling was conducted as a component of the PSI.

³⁸ Perfluorinated Compounds (PFC) Speculative Sampling, Deep Creek, Melbourne Airport - Report (SEMF, 19 February 2014).

³⁹ Aviation Rescue & Fire Fighting Services, Melbourne Airport Fire Training Ground, Surface Water Monitoring Event (SEMF, 24 October 2014).

⁴⁰ Aviation Rescue & Fire Fighting Services, Melbourne Airport Fire Training Ground, Surface Water Monitoring Event (SEMF, 22 June 2016) (first issued 1 July 2015).

⁴¹ Melbourne Airport (Tullamarine) Deep Creek, April 2016 Surface Water Monitoring Event (SEMF, 24 May 2016) (v1 dated 13 October 2016).

⁴² Melbourne Airport (Tullamarine) Deep Creek, July 2017 Surface Water Monitoring Event (SEMF, 28 August 2017).

⁴³ Melbourne Airport Site Visit Report 2015 (BECA, 9 November 2015).

⁴⁴ Melbourne ARFF Site Sampling Report 2016 (BECA, 13 October 2016).

⁴⁵ SEMF enquired with ALS laboratories who noted that they are not typically requested to drop the LOR and would check whether this was feasible.



Groundwater results at and in the vicinity of Site D (CFTG), presented in the summary table in Appendix G include results from:

- Groundwater samples taken at the CFTG as part of annual groundwater monitoring (SEMF, 2014)⁴⁶, (SEMF, 2015)⁴⁷, (SEMF, 2016)⁴⁸ and (SEMF, 2017b)⁴⁹ (MW-2 and/or MW-3) – Figures 3a-3e.
- Groundwater samples taken at the CFTG as part of the annual groundwater monitoring (Connolly, 2013)⁵⁰ (MW-2 and MW-3) – Figures 3a-3e.
- Groundwater samples taken at the CFTG during the preliminary site investigation (GHD, 2008)⁵¹ (MW-3) – Figures 3a-3e.

The data are believed to represent the extent of groundwater PFAS testing for Airservices at and in the vicinity of Site D. Other sampling may have been conducted by other Stakeholders.

Comments on the groundwater analytical results are provided in Table 11.

Results for MW-2 are from 2013 and 2014 and subsequently the well has been dry. MW-1, located in the landfilling materials, has been dry for many years. MW-3, located closest to the creek bed, is the only well at the CFTG which has sufficient water for annual sampling.

TDS results – all groundwater tested have TDS>1,000 mg/L, with concentrations at the CFTG ranging from 4,435 to 8,120 mg/L. The quality is therefore not suitable for drinking water. It is not clear if the TDS concentrations are due to contamination impact, or representative of regional groundwater quality.

Limited historical groundwater data – groundwater conditions at the CFTG are not well understood and rely on historical results. Similarly hydrogeology has not been investigated and consequently the interactions between groundwater and surface water are unknown. Only one well (MW-3) is monitored at the CFTG, as others have been dry since at least 2015 (MW-2) and earlier (MW-1). Results in MW-3 have been consistently below nominated assessment criteria since the one exceedance of PFOS human health recreational water quality in 2013. Elevated concentrations of PFOS, PFOA were detected in MW-2 in 2013 and 2014, in excess of adopted criteria. The well has been dry since and has not been sampled.

⁴⁶ Aviation Rescue & Fire Fighting Services, Melbourne Airport Fire Training Ground, Groundwater Monitoring Event (SEMF, 24 October 2014).

⁴⁷ Aviation Rescue & Fire Fighting Services, Melbourne Airport Fire Training Ground, Groundwater Monitoring Event (SEMF, 26 June 2015).

⁴⁸ Melbourne Airport (Tullamarine) Fire Training Ground, April 2016 Groundwater Monitoring Event (SEMF, 24 May 2016).

⁴⁹ Melbourne Airport (Tullamarine) Fire Training Ground, July 2017 Groundwater Monitoring Event (SEMF, 19 September 2017).

⁵⁰ Groundwater Monitoring Event, Melbourne International Airport, Fire Training Ground, Tullamarine, Vic (Connolly Environmental, May 2013).

⁵¹ Preliminary Site Contamination Assessment, Melbourne ARFF Drill Ground, Melbourne Airport (GHD, September 2008).

Table 11: Summary of Analytical Findings – Site D (CFTG)

Analyte	PSI Results	Historical Results	Summary
SOIL			
PFOS	- One soil sample (MS11-02_0.5) collected from Dry Creek (to the west of the CFTG), exceeded both the ecological 95% species protection and 60% species protection (Commercial / Industrial) criteria of 0.373 mg/kg and 4.71 mg/kg (GHD, 2015) respectively at 0.5m depth. The 0.1m sample at this location was within relevant investigation criteria. - All other samples were within applicable human health and ecological criteria.	- Three soil samples collected from the CFTG (MRR-11, BH3_0.1 and BH3_0.1), exceeded the ecological 60% species protection (Commercial / Industrial) criterion. - Three sediment samples collected from the Evaporation Pond (SED2, SED3 and SED4), exceeded the ecological 60% species protection (Commercial / Industrial) criterion. - All other samples were within applicable human health and ecological criteria.	Seven investigated locations (1 during the PSI and 5 historically) at or in the vicinity of the CFTG reported exceedances of the adopted criteria (4 soil and 3 sediment).
PFOA	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.
6:2FtS & 8:2FtS	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.
PFHxS+ PFOS	Concentrations were within applicable human health and ecological criteria for all samples.	Historical samples were not tested for PFHxS.	Where tested, concentrations were within adopted criteria for all samples.
TPH / TRH:	Concentrations were within applicable human health and ecological criteria for all samples.	- One of the sediment samples from the Evaporation Pond (SED4), exceeded the AEPR, 1997 (general airport) TPH C₁₀-C₃₆ criterion of 5,000 mg/kg. - All other samples (soil and sediment) were within applicable human health and ecological criteria.	One investigated location (historically) at the CFTG reported exceedances of the adopted criterion.

Analyte	PSI Results	Historical Results	Summary
BTEXN	Soil samples collected during the PSI were not analysed for BTEXN as none reported concentrations for TPH/TRH above the LORs.	Concentrations were within applicable human health and ecological criteria for all samples.	Where tested, concentrations were within adopted criteria for all samples.
PAH	Soil samples collected during the PSI were not analysed for PAH as none reported concentrations for TPH/TRH above the LORs	Concentrations were within applicable human health and ecological criteria for all samples.	Where tested, concentrations were within adopted criteria for all samples.
SURFACE WATER			
PFOS	<u>Surface Water</u> One surface water sample from Dry Creek, to the west of the CFTG (MW5), exceeded the human health fish consumption criterion of 0.00065 µg/L (GHD, 2015), the recreational water quality criteria of 0.7 µg/L (FSANZ, 2017) and 5 µg/L (enHealth, 2016) and the ecological criterion of 6.6 µg/L (GHD, June 2015).	<u>Surface Water</u> Three surface water samples from Deep Creek, to the west of the CFTG (DSS1, DSS2 and USS1), exceeded the human health fish consumption criterion of 0.00065 µg/L (GHD, 2015).	<u>Surface Water</u> Four investigated locations reported exceedances of adopted PFOS criteria: • Dry Creek – 1 location during the PSI. • Deep Creek – 3 locations historically.
PFOA	<u>Surface Water</u> One surface water sample from Dry Creek (MW5), exceeded the human health fish consumption criterion of 3.45 µg/L (GHD, 2015).	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Surface Water</u> One investigated location (Dry Creek, during the PSI) reported exceedances of adopted criteria.
6:2FtS	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for the single sample.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Surface Water</u> Concentrations were within adopted criteria for all samples.
8:2FtS	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for the single sample.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Surface Water</u> Concentrations were within adopted criteria for all samples.
PFHxS	<u>Surface Water</u>	<u>Surface Water</u> Historical samples were not tested for PFHxS.	<u>Surface Water</u>



Analyte	PSI Results	Historical Results	Summary
	One surface water sample from Dry Creek (MW5), exceeded the recreational water quality criteria of 0.7 µg/L (FSANZ, 2017) and 5 µg/L (enHealth, 2016).		One investigated location (Dry Creek, during the PSI) reported an exceedance of adopted criteria.
TPH / TRH	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for the single sample.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Surface Water</u> Concentrations were within adopted criteria for all samples.
BTEXN	<u>Surface Water</u> The single sample was not tested for BTEXN.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Surface Water</u> Where tested, concentrations were within adopted criteria for all samples.
PAH	<u>Surface Water</u> The single sample was not tested for PAH.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria for all samples.	<u>Surface Water</u> Where tested, concentrations were within adopted criteria for all samples.
GROUNDWATER			
PFOS	Groundwater sampling was not conducted during the PSI.	Two locations (MW-2 and MW-3) have exceeded the human health recreational water quality criteria of 0.7 µg/L (FSANZ, 2017) and 5 µg/L (enHealth, 2016). One location (MW-2) also exceeded the ecological criterion of 6.66 µg/L (GHD, June 2015).	Two investigated locations (historically) at the CFTG reported exceedances of the adopted criterion.
PFOA	Groundwater sampling was not conducted during the PSI.	One location (MW-2) exceeded the human health recreational water quality criteria of 5.6 µg/L (FSANZ, 2017) and 50 µg/L (enHealth, 2016).	One investigated location (historically) at the CFTG reported exceedances of the adopted criterion.
6:2FtS	Groundwater sampling was not conducted during the PSI.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.
8:2FtS	Groundwater sampling was not conducted during the PSI.	Concentrations were within applicable human health and ecological criteria for all samples.	Concentrations were within adopted criteria for all samples.



Analyte	PSI Results	Historical Results	Summary
PFHxS	Groundwater sampling was not conducted during the PSI.	Samples have not been tested PFHxS.	Historical samples have not been tested PFHxS.
TPH / TRH	Groundwater sampling was not conducted during the PSI.	One location (MW-2) exceeded the fresh water ecological criterion of 600 µg/L (AEPR, 1997) for TPH C ₁₀ -C ₃₆ fraction.	One investigated location (historically) at the CFTG reported exceedances of the adopted criterion for TPH C ₁₀ -C ₃₆ .
BTEXN	Groundwater sampling was not conducted during the PSI.	Concentrations were within applicable human health and ecological criteria for all samples.	Where tested, concentrations were within adopted criteria for all samples.
PAH	Groundwater sampling was not conducted during the PSI.	Concentrations were within applicable human health and ecological criteria for all samples.	Where tested, concentrations were within adopted criteria for all samples.



8.5 SITE E (SMOKE HUT)

The Airservices lease boundary and investigated areas at and around the Smoke hut (both during the PSI and historically) are shown on Figures 3a-3e (Appendix A). Hydrocarbon exceedances in samples tested for PFAS have also been shown.

8.5.1 Soil

Soil results at and in the vicinity of Site E (Smoke Hut), presented in the summary table in Appendix G, include results from:

- Hand augered soils from this PSI (MS16-MS21) – Figures 4a and 4d.
- Soil samples from the investigation done at the OneSKY equipment room (GHD, 2016a)⁵² (TP01-TP17), In the vicinity of Site E – Figures 4e and 4f.
- Soil samples from the investigation done at the LAHFTG (TP21, TP25 and TP30) (Figures 4e and 4f) and the Smoke Hut (SB01-SB12 and MW01) (AECOM, 2010)⁵³ – Figures 4e and 4f.

The data are believed to represent the extent of soil PFAS testing for Airservices at and in the vicinity of Site E. Other sampling may have been conducted by other Stakeholders.

Comments on the soil analytical results are provided in Table 12.

Most of the soil samples collected during this PSI were taken from near-surface and down to 0.5m depth. Whereas, many past samples from the OneSKY Equipment Room (in the vicinity of the Smoke Hut) and the Smoke Hut, were taken from greater depths of up to 1m and 2.7m respectively. Soils sampled when attempting to drill a groundwater well at the Smoke Hut were sampled at 6m, 12m and 30m (AECOM, 2010). Reference should be made to the depth the sample was collected when interpreting the results. An acceptable concentration at one depth does not infer acceptable concentrations at all depths at the specified location. At some locations PFAS concentrations were more elevated at 0.5m than at 0.1m.

All samples collected from or in the vicinity of the Smoke Hut were collected from an active ARFFS operational area of low ecological biodiversity management priority. These areas are not considered ecologically sensitive areas and do not warrant application of the 95% species protection criterion.

⁵² OneSKY Equipment Room Contamination Investigation and Risk Assessment (GHD, June 2016).

⁵³ Contamination Risk Assessment, Learning Academy Hot Fire Training Ground, Air Services Australia, Tullamarine (AECOM, 29 November 2010).



8.5.2 Surface Water

Surface water results at and in the vicinity of Site E (Smoke Hut), presented in the summary table in Appendix G include results from:

- Surface water samples from this PSI (Arundel Creek, MW3-MW4) – Figures 4a-4d.
- Stormwater pit sample from this PSI (MW2) – Figures 4a-4f.
- Samples taken from the Smoke Hut triple interceptor outlet, LAHFTG trade waste sampling point and the B120 triple interceptor outlet during annual trade waste sampling (BECA, 2015)⁵⁴ and (BECA, 2016)⁵⁵ – Figures 4a-4f.
- Water samples from the investigation done at the LAHFTG (AECOM, 2010)⁵⁶ (LAHFTG, north-western perimeter; Arundel Creek, SW1 and SW2); and Site E east-west aligned stormwater drain) – Figures 4a-4f.

The data are believed to represent the extent of surface water PFAS testing for Airservices at and in the vicinity of Site E. Other sampling may have been conducted by other Stakeholders.

Comments on the surface water analytical results are provided in Table 12.

None of the surface water locations are being used or likely to be used for drinking water supply so the results have not been compared to drinking water criteria. It should be noted that the TRH LORs are higher than the drinking water criteria (WHO, 2008)⁵⁷.

The human health fish consumption water quality criterion is not relevant to samples obtained from, or in the vicinity of Arundel Creek, and consequently any such exceedances have not been discussed.

Trade waste concentrations are included in the surface water summary table (Appendix G), however they are not discussed in the following sections in terms on guideline exceedances.

8.5.3 Groundwater

No groundwater sampling was conducted as a component of the PSI and none has been conducted historically.

Groundwater conditions at the Smoke Hut are not understood and similarly hydrogeology has not been investigated and consequently the interactions between groundwater and surface water are unknown.

⁵⁴ Melbourne Airport Site Visit Report 2015 (BECA, 9 November 2015).

⁵⁵ Melbourne ARFF Site Sampling Report 2016 (BECA, 13 October 2016).

⁵⁶ Contamination Risk Assessment, Learning Academy Hot Fire Training Ground, Air Services Australia, Tullamarine (AECOM, 29 November 2010).

⁵⁷ SEMF enquired with ALS laboratories who noted that they are not typically requested to drop the LOR and would check whether this was feasible.



Table 12: Summary of Analytical Findings – Site E (Smoke Hut)

Analyte	PSI Results	Historical Results	Summary
SOIL			
PFOS	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within adopted criteria for all samples.
PFOA	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within adopted criteria for all samples.
6:2FtS & 8:2FtS	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within adopted criteria for all samples.
PFHxS+ PFOS	Concentrations were within applicable human health and ecological criteria in all samples.	Samples were not analysed for PFHxS historically.	Concentrations were within adopted criteria for all samples.
TPH / TRH:	Concentrations were within applicable human health and ecological criteria in all samples.	One location (SB06_2-2.2) exceeded the general airport ecological TPH C ₆ -C ₉ criterion of 800 mg/kg (AEPR, 1997).	One investigated location (historically) exceeded the adopted criteria.
BTEXN	Soil samples collected during the PSI were not analysed for BTEXN as none reported concentrations for TPH/TRH above the LORs.	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within adopted criteria for all samples.
PAH	Soil samples collected during the PSI were not analysed for PAH as none reported concentrations for TPH/TRH above the LORs.	Concentrations were within applicable human health and ecological criteria in all samples.	Concentrations were within adopted criteria for all samples.
SURFACE WATER			
PFOS	<u>Surface Water</u> Two surface water samples from Arundel Creek, to the west of the Smoke Hut (MW3 and MW4), exceeded the recreational water quality criterion of 0.7 µg/L (FSANZ, 2017). One sample (MW3) also exceeded the recreational	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Two samples from Arundel Creek (during the PSI) exceeded adopted criteria.



Analyte	PSI Results	Historical Results	Summary
	water quality criterion of 5 µg/L (enHealth, 2016) and the ecological criterion of 6.6 µg/L (GHD, June 2015). <u>Stormwater Drainage</u> Two stormwater samples exceeded the recreational water quality criteria of 0.7 µg/L (FSANZ, 2017) and 5 µg/L (enHealth, 2016) and the ecological criterion of 6.6 µg/L (GHD, June 2015). - SW3 – outlet to the paddock to the west of the Smoke Hut. - MW2 – Smoke Hut stormwater pit.	<u>Stormwater Drainage</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Stormwater Drainage</u> Two samples at or in the vicinity of the Smoke Hut (during the PSI) exceeded adopted criteria.
PFOA	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> One stormwater sample (MW2) exceeded the recreational water quality criterion of 5.6 µg/L (FSANZ, 2017).	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Concentrations were within adopted criteria in all samples. <u>Stormwater</u> One stormwater sample from the Smoke Hut (during the PSI) exceeded adopted criteria.
6:2FtS	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Concentrations were within adopted criteria in all samples. <u>Stormwater</u> Concentrations were within adopted criteria in all samples.
8:2FtS	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Historical samples were not tested for 8:2 FtS.	<u>Surface Water</u> Where tested, concentrations were within adopted criteria in all samples.

Analyte	PSI Results	Historical Results	Summary
	<u>Stormwater</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Stormwater</u> Historical samples were not tested for 8:2 FtS .	<u>Stormwater</u> Where tested, concentrations were within adopted criteria in all samples.
PFHxS	<u>Surface Water</u> One Surface water sample from Arundel Creek (MW3) exceeded the recreational water quality criterion of 0.7 µg/L (FSANZ, 2017). <u>Stormwater</u> Two stormwater samples at or in the vicinity of the Smoke Hut (SW3 and MW2) exceeded the recreational water quality criterion of 0.7 µg/L (FSANZ, 2017). The concentration in MW2 also exceeded the recreational water quality criterion of 5 µg/L (enHelath, 2016).	<u>Surface Water</u> Historical samples were not tested for PFHxS <u>Stormwater</u> Historical samples were not tested for PFHxS	<u>Surface Water</u> One surface water sample from Arundel Creek (during the PSI) exceeded adopted criteria. <u>Stormwater</u> Two stormwater samples from or in the vicinity of the Smoke Hut (during the PSI) exceeded adopted criteria.
TPH / TRH	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> One sample in the vicinity of the Smoke Hut (SW3) exceeded the ecological criterion of 600 µg/L (AEPR, 1997) for TPH C ₁₀ -C ₃₆ fraction.	<u>Surface Water</u> Concentrations were within adopted criteria in all samples. <u>Stormwater</u> One stormwater sample in the vicinity of the Smoke Hut (historically) exceeded adopted criteria
BTEXN	<u>Surface Water</u> Where tested, concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Where tested, concentrations were within adopted criteria in all samples.



Analyte	PSI Results	Historical Results	Summary
	<u>Stormwater</u> Concentrations were within applicable human health and ecological criteria in all samples.	<u>Stormwater</u> Concentrations were within applicable c human health and ecological criteria in all samples.	<u>Stormwater</u> Concentrations were within adopted criteria in all samples.
PAH	<u>Surface Water</u> Not tested for PAH during the PSI <u>Stormwater</u> Where tested, concentrations were within applicable human health and ecological criteria in all samples.	<u>Surface Water</u> Where tested, concentrations were within applicable human health and ecological criteria in all samples. <u>Stormwater</u> Where tested, concentrations were within applicable criteria human health and ecological in all samples.	<u>Surface Water</u> Where tested, concentrations were within adopted criteria in all samples. <u>Stormwater</u> Concentrations were within adopted criteria in all samples.

9. PRELIMINARY CONCEPTUAL SITE MODELS

9.1 OVERVIEW

The information captured in this PSI has been used to develop preliminary Conceptual Site Models (CSMs) for each Site managed by Airservices, where AFFF has historically been used. A CSM is a representation of an environmental system defining the possible contaminants, their source(s) and the possible pathways of exposure to potential human and environmental receptors. A CSM is typically revised as additional information and data are obtained to fill information gaps.

9.2 CONCEPTUAL SITE MODELS

The input elements of a preliminary CSM include consideration of the following:

- Sources of potential contamination and CoPC;
- Sensitive human and ecological receptors;
- Subsurface characteristics (geology, hydrogeology, soil);
- Underground services, buildings;
- Migration pathways – for a source of contamination to be of concern, there must be a mechanism for release into environmental media; and
- Exposure routes – for a risk to human health and / or the environment to exist, there must be a source of contamination, a release mechanism, a receptor and a complete migration pathway, which allow the contaminant to move from the source to the point of contact with a sensitive receptor (exposure route).

Based on a review of the information and data collected during the PSI (past and/or present), preliminary CSMs for each Site managed by Airservices, where AFFF has historically been used are summarised in Table 13. The table shows that, based on the PSI results, including review of past investigations, the following Sites (managed by Airservices) and media (including down gradient water bodies) have concentrations of PFAS or hydrocarbons in excess of adopted criteria (trade waste results have not been considered):

- Site A (MFS) – PFAS in shallow soils (BH10_0.5, SKM, 2011) and stormwater drainage (MW1, MW7 and MW8, SEMF, 2018). Note that this soil is now stored in the lined containment cell at the CFTG;
- Site D (CFTG) – PFAS in shallow soils [(MRR-11, EDGE, 2013), (BH2_0.1 and BH3_0.1, GHD, 2008)], sediment (Evaporation Pond, SED2-SED4, GHD, 2008)) and groundwater [(MW-2 and MW3, Connolly, 2013) and (MW2, SEMF, 2014) and TPH in sediment (Evaporation Pond, SED4, GHD, 2008) and groundwater (MW2, SEMF, 2014);
- Site E (Smoke Hut) – PFAS in stormwater drainage [(SW3 and MW2, SEMF, 2018) and (SW3, AECOM, 2010) and TPH in soils at depth (SB06_2-2.2, AECOM, 2010) and stormwater drainage (SW3, AECOM, 2010);
- Dry Creek (to the west of Site D) – PFAS in sediments (MS11-02_0.5, SEMF, 2018) and surface water (MW5, SEMF, 2018);



- Deep Creek (to the west of Site D) – PFAS in surface water (USS1, DSS1 and DSS2, SEMF, 2014-2017); and
- Arundel Creek – PFAS in surface water [(SW2, MW3 and MW4, SEMF, 2018) and (SW1 and SW2, AECOM, 2010)].

The delineation between Site C (FFTG) and Site D (CFTG) is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).

The detection of PFAS in shallow soils within the proposed GBAS area (east of the MFS) may be indicative of broader PFAS concentrations in soils at the Airport.

If trade waste (which discharges to sewer and is therefore not a complete source-pathway-receptor linkage) is not considered, sensitive receptors for which a potential complete pathway exists from a known and confirmed PFAS and/or TPH contamination source include:

- Workers who may come into contact with:
 - o Site A (MFS) – shallow soils, and stormwater;
 - o Site D (CFTG) – shallow soils, sediments (Evaporation Pond) and groundwater;
 - o Site E (Smoke Hut) – soils at depth and stormwater;
 - o Dry Creek – sediments and surface water;
 - o Deep Creek – Surface water; and
 - o Arundel Creek – surface water.
- Recreational users of Deep Creek and Arundel Creek; and
- Aquatic and terrestrial biota using Dry Creek, Deep Creek and Arundel Creek.

The potential for contamination from off-Airport impacting on the Airport and from the wider Airport impacting on identified Sites managed by Airservices, where AFFF is likely to have been used, has not been investigated as a component of the PSI. Current surrounding Airport uses include a mix of non-urban land (agriculture and low-density activities) and urban development (industrial and residential). Agricultural practices can use a range of products (e.g. pesticides and fertilisers) which can be spread broadly. Associated contamination is possible but has not been accounted for in the PSI. Similarly, the potential for PFAS contamination from the greater Airport (i.e. the hangars, previous ARFFS providers etc.) impacting on Airservices managed Sites has not been quantified.

9.3 DATA GAPS

In creating the preliminary CSMs (Table 13) the following data gaps were identified:

- Limited soil investigations have been undertaken at the Airservices' managed Sites. Investigations as a component of the PSI were limited to shallow soil bores drilled by hand.
- Limited surface water investigations have been undertaken at the Airservices' managed Sites.

- Limited groundwater investigations have been undertaken at the Airservices' managed Sites.
- Site A (MFS):
 - o Soil PFAS concentrations at depth are not known;
 - o Very limited groundwater data exists (no current data); and
 - o Hydrogeological understanding of groundwater is poor and migration distances of any PFAS and TRH contamination in groundwater are not known;
 - o Potential connectivity between groundwater at Site A and Arundel Creek is not known.
- Site D (CFTG):
 - o Soil PFAS concentrations at depth are not known;
 - o Hydrogeological understanding of groundwater is poor and migration distances of any PFAS and TRH contamination in groundwater are not known; and
 - o Potential connectivity between groundwater at Site D and Dry Creek and Deep Creek is not known.
- Site E (Smoke Hut):
 - o Groundwater PFAS concentrations are not known.
 - o Hydrogeological understanding of groundwater is poor and migration distances of any PFAS and TRH contamination in groundwater are not known;
 - o Potential connectivity between groundwater at Site E and Arundel Creek is not known.
- Arundel Creek:
 - o Sediment PFAS concentrations are not known.
 - o Potential impacts from other areas of the Airport (i.e. the hangars) are not known.
- General Airport – soil, surface water and groundwater PFAS concentrations across the remainder of the Airport are not known.
- The delineation between Site C (FFTG) and Site D (CFTG) is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).
- Coordination of groundwater and surface water monitoring at the Airport (by other Stakeholders) and Airservices is unclear.
- No groundwater modelling or assessment of the hydrogeological regime, water levels and movement direction(s) and water quality across the whole Airport has been undertaken.
- No intrusive investigations were undertaken at Site B (SFS), managed by Airservices and where AFFF impacts are possible as this site was determined during the desktop PSI to be a lower risk.

Table 13: Preliminary Conceptual Site Models



Table 13 Melbourne Airport - Preliminary Conceptual Site Model (CSM) (June 2018, SEMF Pty Ltd)

Sites	Soil Criteria							Surface Water Criteria						Groundwater Criteria						Receptors	Pathways to Receptors		
	PFAS - Ecological	PFAS - Human Health	TRH - HSL A	TPH - Ecological	BTEXN - Ecological	Naphthalene - HSL A	PAH - Ecological	PFAS - Human Health (Consumption of Fish)	PFAS - Human Health (Recreational)	PFAS - Ecological	TPH - Ecological	BTEXN - Ecological	PAH - Ecological	PFAS - Human Health (Recreational)	PFAS - Ecological	TPH - Ecological	BTEXN - Ecological	PAH - Ecological	Soil		Surface Water	Groundwater	
A - MFS	shallow soils	shallow soils	✓	✓	Δ	Δ	✓	stormwater	stormwater	stormwater	stormwater	stormwater	Δ	(SKM, 2011)	(SKM, 2011)	(SKM, 2011)	(SKM, 2011)	(SKM, 2011)	Workers A	no provided PPE is worn	yes (PPE may not be worn)	no	
	soils at depth	soils at depth																	Workers B	no provided PPE is worn	no provided PPE is worn	very limited data	
																			Biota	no	stormwater discharge to paddock	very limited data	
																			Arundel Creek	no sediment data	stormwater discharge to paddock then Arundel Creek	connectivity unknown	
D - CFTG	shallow soils (EDGE, 2011 & GHD, 2008) & sediment (GHD, 2008)	shallow soils	shallow soils & sediment (evap pond)	shallow soils	shallow soils & sediment (evap pond)	shallow soils & sediment (evap pond)	shallow soils & sediment (evap pond)	Stormwater and training water directed to a 10kL underground tank which is pumped out as required. Refer to Dry Creek & Deep Creek below for details of surface water concentrations in these water bodies.						(Connolly, 2013) & (SEMF, 2014)	(Connolly, 2013) & (SEMF, 2014)	(SEMF, 2014)	✓	✓	Workers A	no provided PPE is worn	no provided wastewater continues to be removed from 10kL tank	no	
	soils at depth	soils at depth	soils at depth	sediment (evap pond)	soils at depth	soils at depth	soils at depth												Workers B	yes	no provided PPE is worn	yes	
																			Biota	yes	based on end of pipe samples if 10kL underground tank was to overflow	yes	
				Dry Creek															sediment	yes	connectivity unknown		
				Deep Creek															sediment	yes	connectivity unknown		
				Grey Box Woodland															no biota data	no surface water flow up-gradient	no data		
E - Smoke Hut	✓	shallow soils	shallow soils	shallow soils	shallow soils	shallow soils	shallow soils	stormwater	stormwater	stormwater	stormwater (AECOM, 2010)	stormwater	stormwater	No groundwater wells installed				Workers A	no provided PPE is worn	yes (PPE may not be worn)	no		
		soils at depth	soils at depth	soils at depth (AECOM, 2010)	soils at depth	soils at depth	soils at depth											Workers B	based on 1 result at depth (AECOM, 2010)	no provided PPE is worn	no data		
	Biota																	yes	stormwater discharge to paddock	no data			
	Arundel Creek																	no sediment data	stormwater discharges to paddock then Arundel Creek	connectivity unknown			
Dry Creek	X	sediment	✓	✓	Δ	Δ	Δ	X	X	X	✓	Δ	Δ	Groundwater connectivity between the CFTG and Dry Creek is unknown				Workers A	no	no			
																		Workers B	yes	yes			
																		Biota	yes	yes			
Deep Creek	✓	based on PFOS only	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	Groundwater connectivity between the CFTG and Deep Creek is unknown				Workers A	no provided PPE is worn	no provided PPE is worn			
																		Workers B	no provided PPE is worn	no provided PPE is worn			
																		Consumption of Fish		yes	connectivity unknown		
																		Recreational Users	no	no	connectivity unknown		
																		Biota	no	yes			
Arundel Creek	sediment							X	X	X	✓	✓	Δ	Groundwater connectivity between the MFS & Smoke Hut and Arundel Creek is unknown				Workers A	sediments	yes (PPE may not be worn)			
																		Workers B	sediments	no provided PPE is worn			
																		Consumption of Fish		yes	connectivity unknown		
																		Recreational Users	sediments	yes	connectivity unknown		
																		Biota	sediments	yes			
General Airport Soils	Δ	Δ	Δ	Δ	Δ	Δ	Δ	O	O	O	O	O	O	O	O	O	O	Workers A	no data provided				
																		Workers B	no data provided				
																		Surface Water Bodies	no data provided				
																		Biota	no data provided				
General Airport Surface Water (excluding Dry Creek, Deep Creek & Arundel Creek)	O	O	O	O	O	O	O	Investigations conducted by others and data not provided						O	O	O	O	O	Workers A		no data provided		
																			Workers B		no data provided		
																			Surface Water Bodies		no data provided		
																			Biota		no data provided		

10. CONCLUSIONS

10.1 GENERAL

Some areas of the Airport land are known to have been impacted by AFFF as a result of past fire-fighting activities (by Airservices and others). Furthermore, due to the ongoing requirements of fire-fighting training and operational responses at the Airport, some equipment and infrastructure are a potential source of environmental contamination if impacted by PFAS and not appropriately managed.

The PSI has enabled an investigation of the Sites managed by Airservices, where AFFF has historically been used (since their establishment in 1995) through the collection of data from limited intrusive investigations, a review of historical data collected over a nine year period (2010-2018) and conducting interviews. Associated hydrocarbon use has also been considered.

The intrusive investigations were limited to soil and surface water sampling in the vicinity of the following three sites, which were selected based on the sites being managed by Airservices and the likelihood of AFFF usage from 1995 to 2010:

- Site A –MFS;
- Site D –CFTG; and
- Site E – Smoke Hut.

Although managed by Airservices, no intrusive investigations were undertaken at Site B (Satellite Fire Station) as a component of the PSI and none have been undertaken historically. Site B was determined during the desktop component of the PSI to be lower risk.

Some common findings and data gaps include:

- Low level PFOS and PFOA impact (i.e. above LORs but within adopted guideline criteria) is pervasive throughout the soils tested (during this PSI and historically).
- At some locations PFAS concentrations in soil were more elevated at 0.5m than at 0.1m.
- PFAS and TPH concentrations in wastewater samples have not been discussed as the waters are removed and pumped to a licensed waste water treatment facility.
- No groundwater sampling was conducted as a component of the PSI.
- Groundwater conditions at Sites managed by Airservices are not well understood and rely on historical results from one well at Site A (MFS) and two wells at Site D (CFTG). Similarly hydrogeology has not been investigated and consequently the interactions between groundwater and surface water are unknown.
- The potential for contamination from off-Airport impacting on the Airport and from the wider Airport impacting on identified Sites managed by Airservices, where AFFF is likely to have been used, has not been investigated as a component of the PSI. Similarly, the potential for PFAS contamination from the greater Airport (i.e. the hangars, previous ARFFS providers etc.) impacting on Airservices managed Sites has not been quantified.
- Limited data exists and the source/s of the identified PFAS contamination cannot be determined without significant additional investigations.

Findings from the limited intrusive investigations conducted during the PSI are discussed below by Site. Based on the findings of the PSI, there is currently insufficient information to determine the likelihood of an unacceptable risk to receptors from the historical use of AFFF. A detailed site investigation (DSI) is required to allow collection of sufficient information to devise a risk-based management strategy for PFAS contamination.

10.2 SITE A (MFS)

The Airservices lease boundary and investigated areas at and around the MFS (both during the PSI and historically) are shown on Figures 2a-2e (Appendix A).

Soil – one investigated location [BH10-0.5 (SKM, 2011)] reported exceedances of the adopted ecological criterion for PFOS (this soil is now stored in the lined containment cell at the CFTG). All locations were within the adopted human health criteria for PFAS and TPH. Six locations from the proposed GBAS area (east of the MFS) also reported exceedances of the adopted ecological criterion for PFOS.

Stormwater – three investigated location [MW1, MW7 and MW8 (SEMF, 2018)] reported exceedances of the adopted human health criteria for PFOS and one location (MW7) also reported exceedances of the adopted human health criteria PFOA, PFHxS, 6:2FtS and 8:2 FtS and the ecological criteria for PFOS. All locations were within the adopted human health and ecological criteria for TPH.

Groundwater – the single investigated location [MW01 (SKM, 2011)] was within adopted human health and ecological criteria for PFAS and TPH.

10.3 SITE D (CFTG)

The Airservices lease boundary and investigated areas at and around the CFTG (both during the PSI and historically) are shown on Figures 3a-3e (Appendix A). The delineation between Site C (FFTG) and Site D (CFTG) is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a).

Soil – three investigated locations [MRR-11 (EDGE, 2013); BH3_0.1 and BH3_0.1 (GHD, 2008)] reported exceedances of the adopted ecological criterion for PFOS. All locations were within the adopted human health criteria for PFAS and TPH.

Sediment – three investigated locations from the Evaporation Pond [SED2-4 (GHD, 2008)] reported exceedances of the adopted ecological criterion for PFOS and one location [SED4 (GHD, 2008)] reported exceedances of the ecological criterion for TPH (C₁₀-C₃₆). All locations were within the adopted human health criteria for PFAS and TPH.

Groundwater – two investigated location [MW-2 and MW-3 (Connolly, 2013) and MW-3 (SEMF, 2014)] reported exceedances of the adopted human health and ecological criteria for PFOS and one location [MW2 (Connolly, 2013) and (SEMF, 2014)] also reported exceedances of the adopted human health criteria PFOA. One location [MW-2 (SEMF, 2014)] reported exceedances of the ecological criterion for TPH (C₁₀-C₃₆).

10.4 SITE E (SMOKE HUT)

The Airservices lease boundary and investigated areas at and around the Smoke Hut (both during the PSI and historically) are shown on Figures 4a-4f (Appendix A).

Soil – one investigated location [SB06_2-2.5 (AECOM, 2010)] reported exceedances of the ecological criterion for TPH (C₆-C₉). All locations were within the adopted human health and ecological criteria for PFAS and TPH.

Stormwater – two investigated location [SW3 and MW2 (SEMF, 2018)] reported exceedances of the adopted human health criteria for PFOS and PFHxS and the ecological criteria for PFOS. One location [MW2 (SEMF, 2018)] also reported exceedances of the adopted human health criteria for PFOA. One location [SW3, (AECOM, 2010)] reported exceedances of the adopted ecological criteria for TPH (C₁₀-C₃₆).

10.5 DOWN GRADIENT RECEIVING WATERS

The delineation between Site C (FFTG) and Site D (CFTG) is not clear and it is likely that the FFTG encompassed the CFTG (Figure 3a), any PFAS impact to down gradient receiving waters therefore cannot be solely attributed to Airservices management of Site D.

10.5.1 Dry Creek

Dry Creek is located to the west of the CFTG and feeds into Deep Creek. Dry Creek is predominantly dry and the surface water sample collected during the PSI was from a stagnant pool of water. Airservices' management of the CFTG is not the only source of PFAS contamination in this area, with other potentially PFAS-impacted sites located nearby (i.e. Site C).

Sediment – the single investigated location [MS11-02_0.5 (SEMF, 2018)] reported exceedances of the adopted ecological criteria for PFOS at 0.5m. The 0.1m sample at this location was within relevant investigation criteria. Both samples were within the adopted human health criteria for PFAS and TPH.

Surface Water – the single investigated location [MW5 (SEMF, 2018)] reported exceedances of the adopted human health and ecological criteria for PFOS and the adopted human health criteria for PFOA and PFHxS. Reported concentrations were within the adopted human health and ecological criteria for TPH.

10.5.2 Deep Creek

Deep Creek is located to the west of the CFTG. Deep Creek was not sampled as a component of the PSI. Airservices' management of the CFTG is not the only source of PFAS contamination in this area, with other potentially PFAS-impacted sites located nearby (i.e. Site C).

Surface Water – three investigated locations [USS1, DSS1 and DSS2 (SEMF, 2014-2017)] reported exceedances of the adopted human health criterion for PFOS. All locations were within the adopted human health and ecological criteria for TPH.

10.5.3 *Arundel Creek*

Arundel Creek is located to the west of the Smoke Hut. Airservices' management of the Smoke Hut is not the only source of PFAS contamination in this area, with other potentially PFAS-impacted sites located nearby (i.e. Site F and Site J). .

Surface Water – two investigated locations [MW3 and MW4 (SEMF, 2018)] reported exceedances of the adopted human health criteria for PFOS. One location [MW3 (SEMF, 2018)] also reported exceedances of the adopted ecological criterion for PFOS and the human health criterion for PFHxS. All locations were within the adopted human health and ecological criteria for TPH.

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Sampling Event, Melbourne International Airport Fire Training Ground (OTEK, November 2008).

Sampling Event, Melbourne International Airport Fire Training Ground (OTEK, May 2009).

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Appendix A - Figures

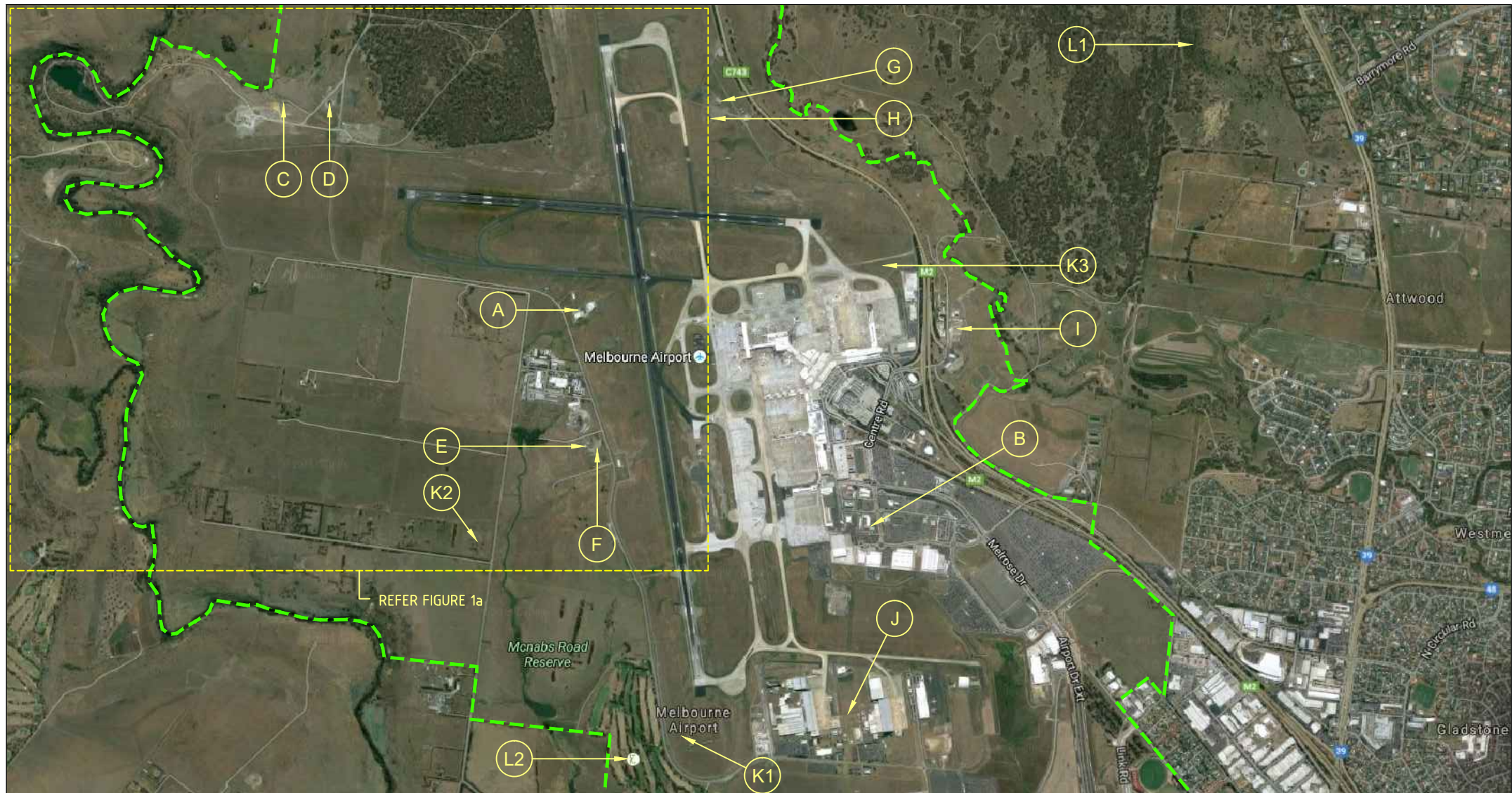


Appendix A

Melbourne Airport (Tullamarine) ARFF Services – PSI

Project #: 2105.022

FINAL (REDACTED)



SITE ID LEGEND

A	MAIN FIRE STATION (MFS)	D	CURRENT FIRE TRAINING GROUND (CFTG)	G	F28 TRAINING AREA	J	AIRCRAFT HANGARS	K3	TRUCK ROLLOVER	L3	NORTH OF SUNBURY ROAD (OUTSIDE MAP AREA)
B	SATELLITE FIRE STATION (SFS)	E	SMOKE HUT	H	BILLY'S BUNKER	K1	AIRPORT EMERGENCY PROCEDURE	L1	GELLIBRAND HILL		
C	FORMER FIRE TRAINING GROUND (FFTG)	F	OLD ARFFTE SCHOOL	I	JOINT USER HYDRANT INSTALLATION (JUHI)	K2	HOUSE FIRE	L2	GOLF COURSE		

LEGEND

	PROPERTY BOUNDARY
	SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 1 AIRPORT AND SITE LOCATIONS



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SITE ID LEGEND

A

MAIN FIRE STATION (MFS)

B

SATELLITE FIRE STATION (SFS)

D

CURRENT FIRE TRAINING GROUND (CFTG)

E

SMOKE HUT

FFTG

FORMER FIRE TRAINING GROUND

NOTE: AIRSERVICES WAS ESTABLISHED 6th JULY 1995 AND ACQUIRED THE FUNCTION OF PROVIDING ARFFS SERVICES.

LEGEND

PROPERTY BOUNDARY

E

SITE LOCATION ID

LAHFTG

LEARNING ACADEMY HOT FIRE TRAINING GROUND

MELBOURNE AIRPORT PSI

FIGURE 1a

AIRSERVICES CURRENT LEASE BOUNDARIES AND SURROUNDING LAND USES

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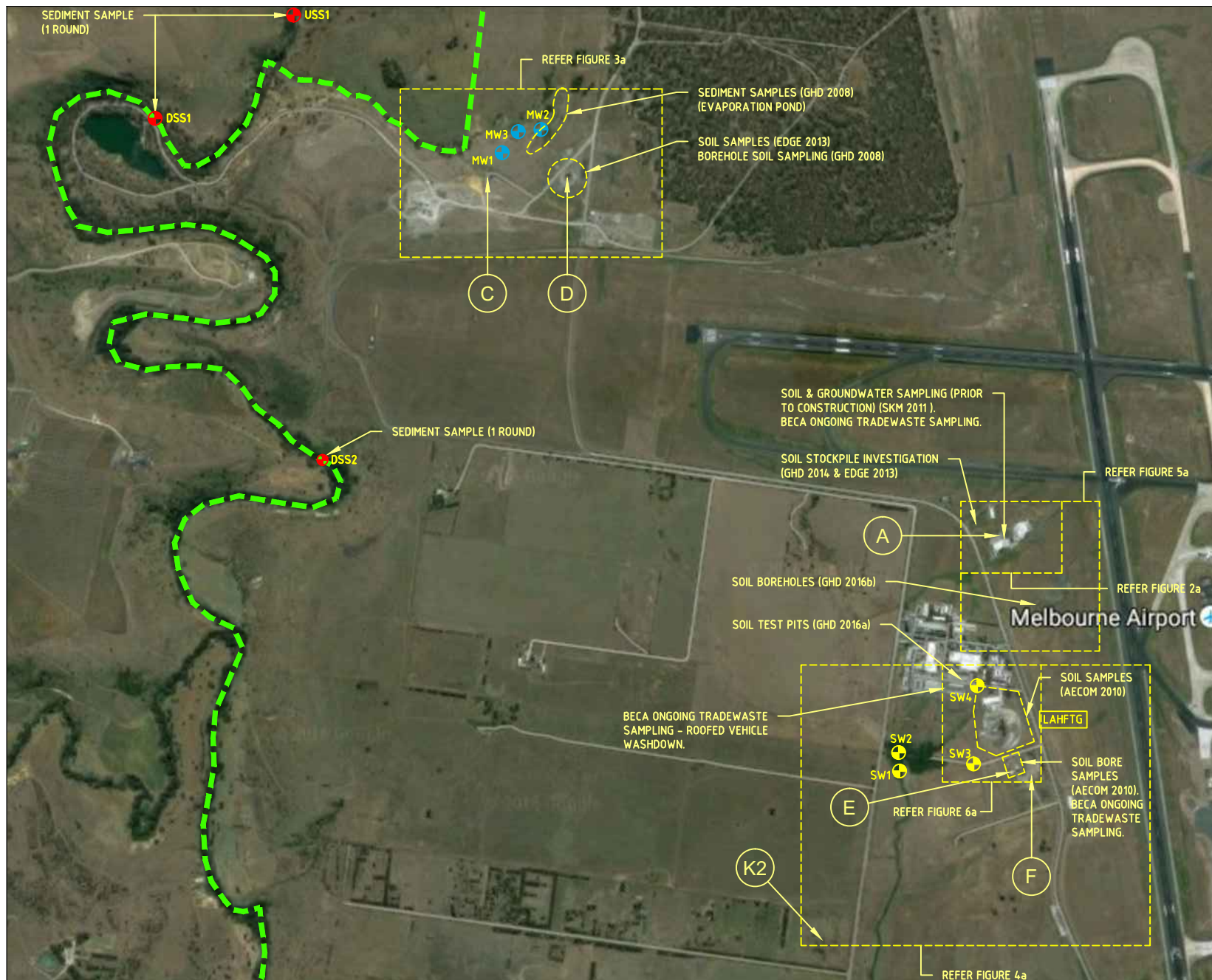
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N



SITE ID LEGEND

A	MAIN FIRE STATION (MFS)
C	FORMER FIRE TRAINING GROUND (FFTG)
D	CURRENT FIRE TRAINING GROUND (CFTG)
E	SMOKE HUT
F	OLD ARFFTE SCHOOL
K2	HOUSE FIRE

LEGEND

	PROPERTY BOUNDARY		SURFACE WATER MONITORING LOCATIONS
	SITE LOCATION ID		STORMWATER SAMPLING LOCATION (AECOM 2010)
	GROUNDWATER MONITORING LOCATIONS		LAHFTG LEARNING ACADEMY HOT FIRE TRAINING GROUND

MELBOURNE AIRPORT PSI
FIGURE 1b
AIRPORT PFAS SOIL/WATER SAMPLING LOCATIONS
IN VICINITY OF AIRSERVICES MANAGED SITES



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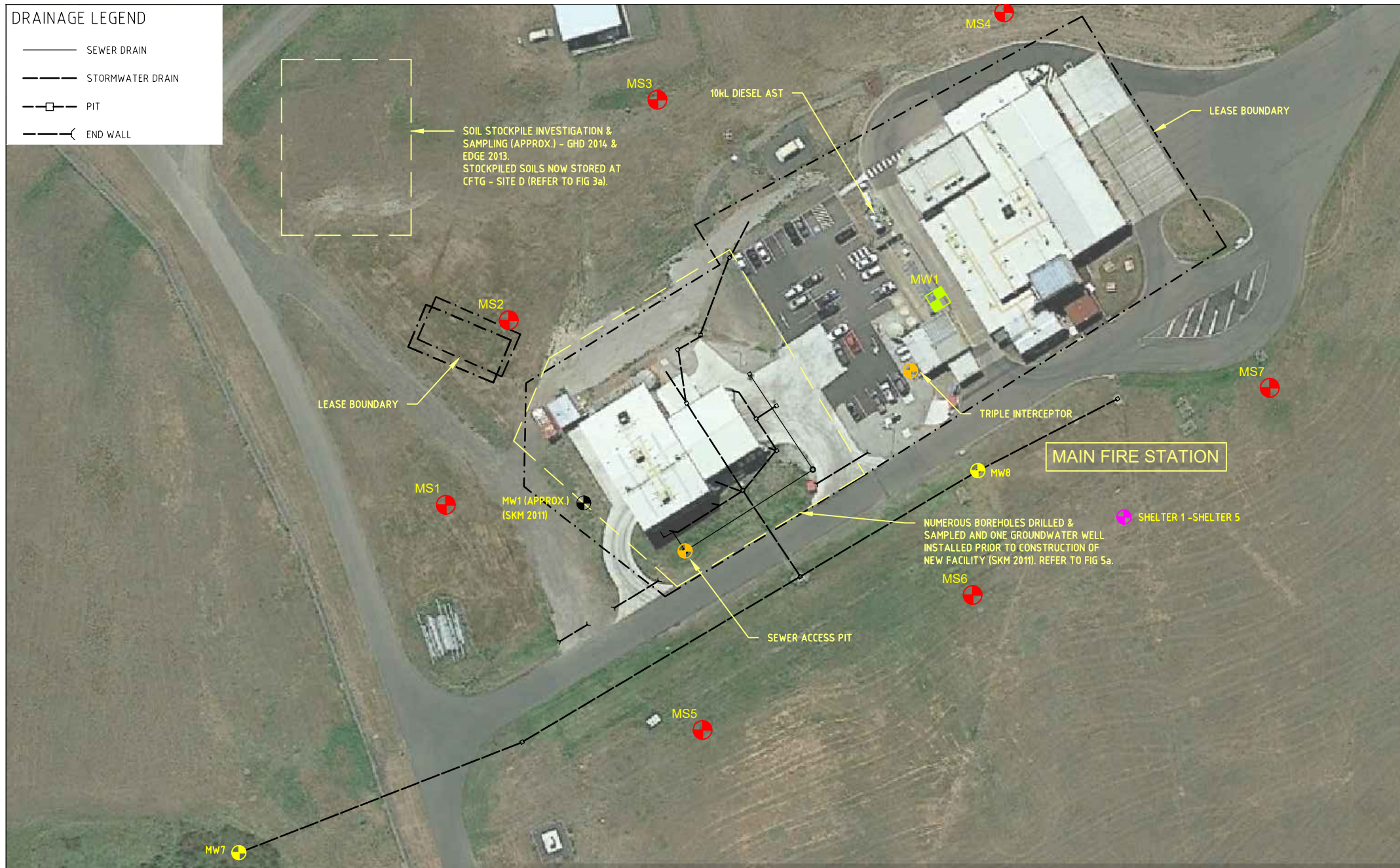
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DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL



LEGEND

- | | | | | |
|----|--|--|--|--|
| MW | | INTERCEPTOR PIT SAMPLE (SEMF 2017) | | GROUNDWATER MONITORING LOCATION (SKM 2011) |
| MS | | SOIL SAMPLE LOCATION (SEMF 2017) | | BECA ONGOING TRADEWASTE SAMPLING LOCATION |
| | | DRAINAGE WATER SAMPLE LOCATION (SEMF 2018) | | BOREHOLE SOIL SAMPLING (GHD 2016b) |

MELBOURNE AIRPORT PSI FIGURE 2a SITE A - MAIN FIRE STATION (MFS) PFAS TESTING LOCATIONS



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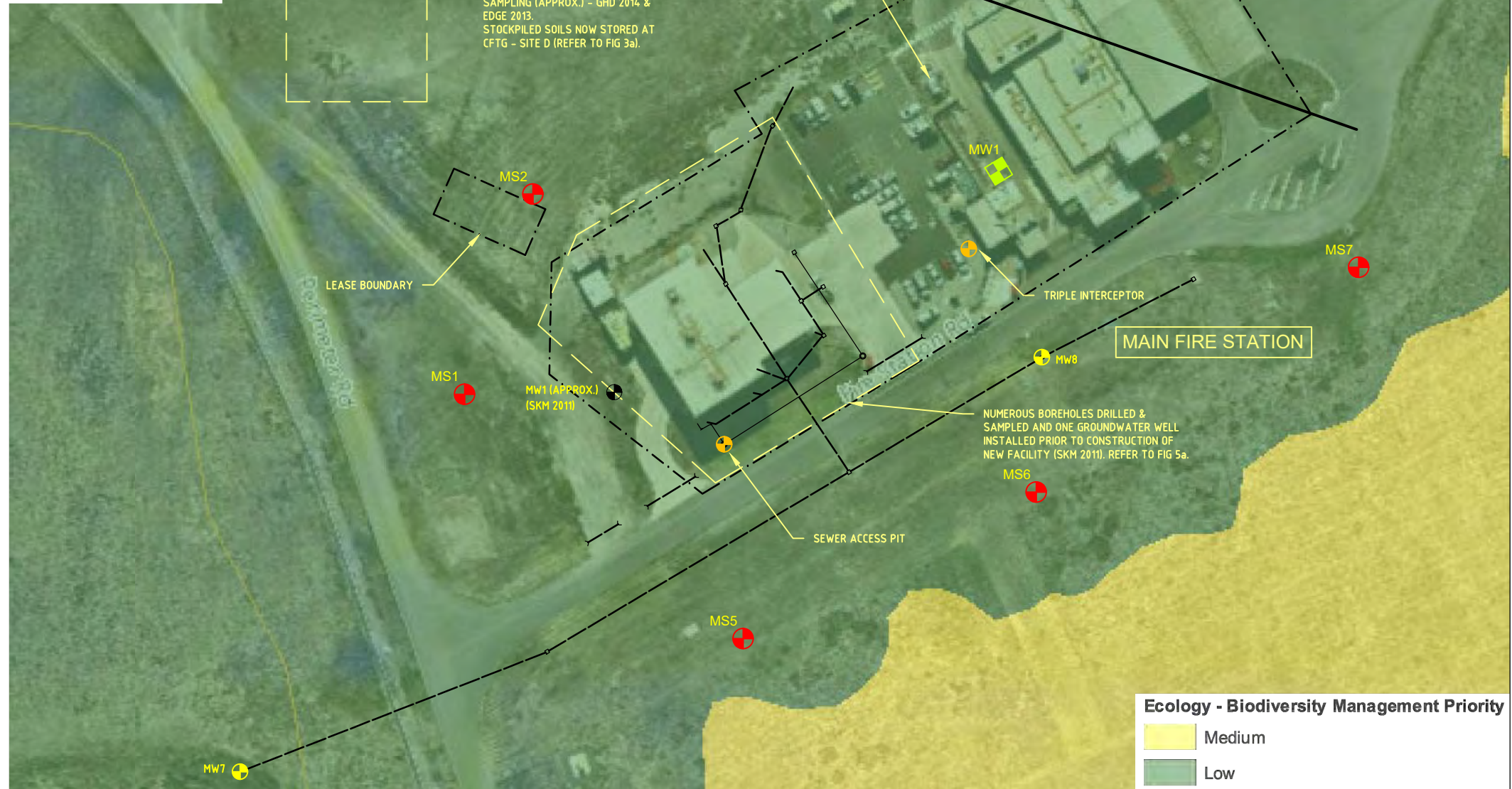
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DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL



LEGEND

- | | | | | |
|----|--|--|--|--|
| MW | | INTERCEPTOR PIT SAMPLE (SEMF 2017) | | GROUNDWATER MONITORING LOCATION (SKM 2011) |
| MS | | SOIL SAMPLE LOCATION (SEMF 2017) | | BECA ONGOING TRADEWASTE SAMPLING LOCATION |
| | | DRAINAGE WATER SAMPLE LOCATION (SEMF 2018) | | |

MELBOURNE AIRPORT PSI

FIGURE 2b (ECOLOGY)

SITE A - MAIN FIRE STATION (MFS)

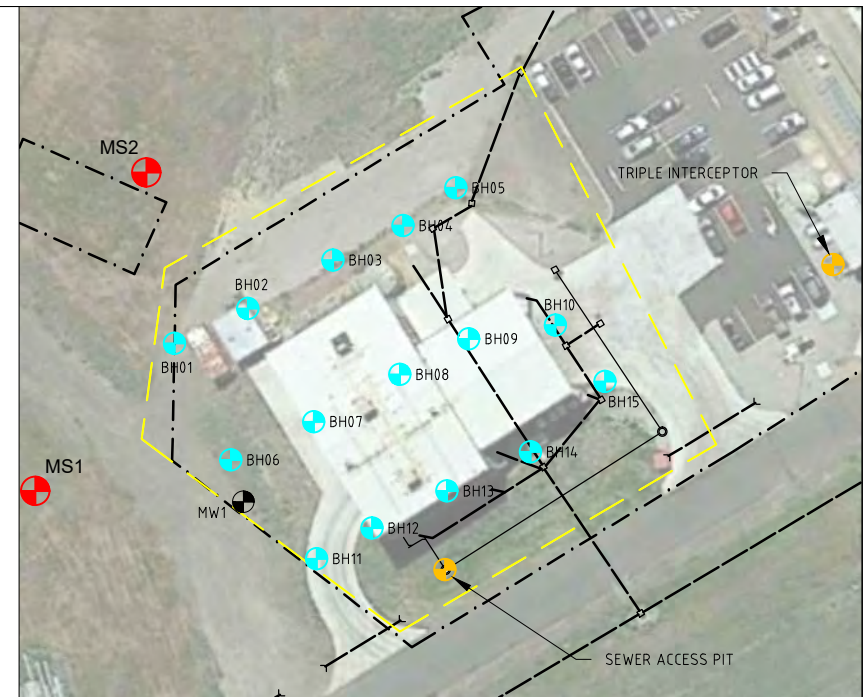


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SITE 1A
NOT TO SCALE

DRAINAGE LEGEND

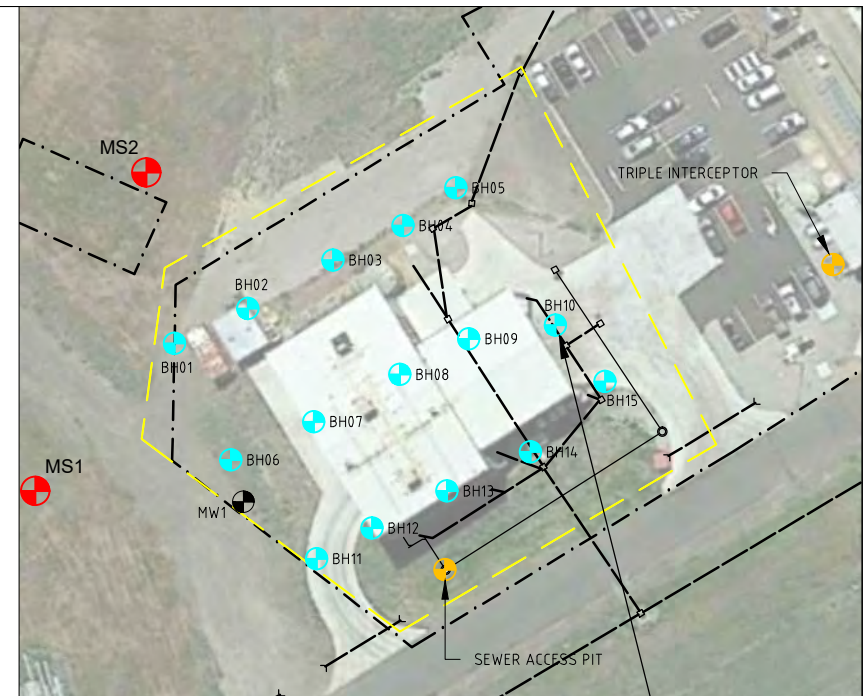
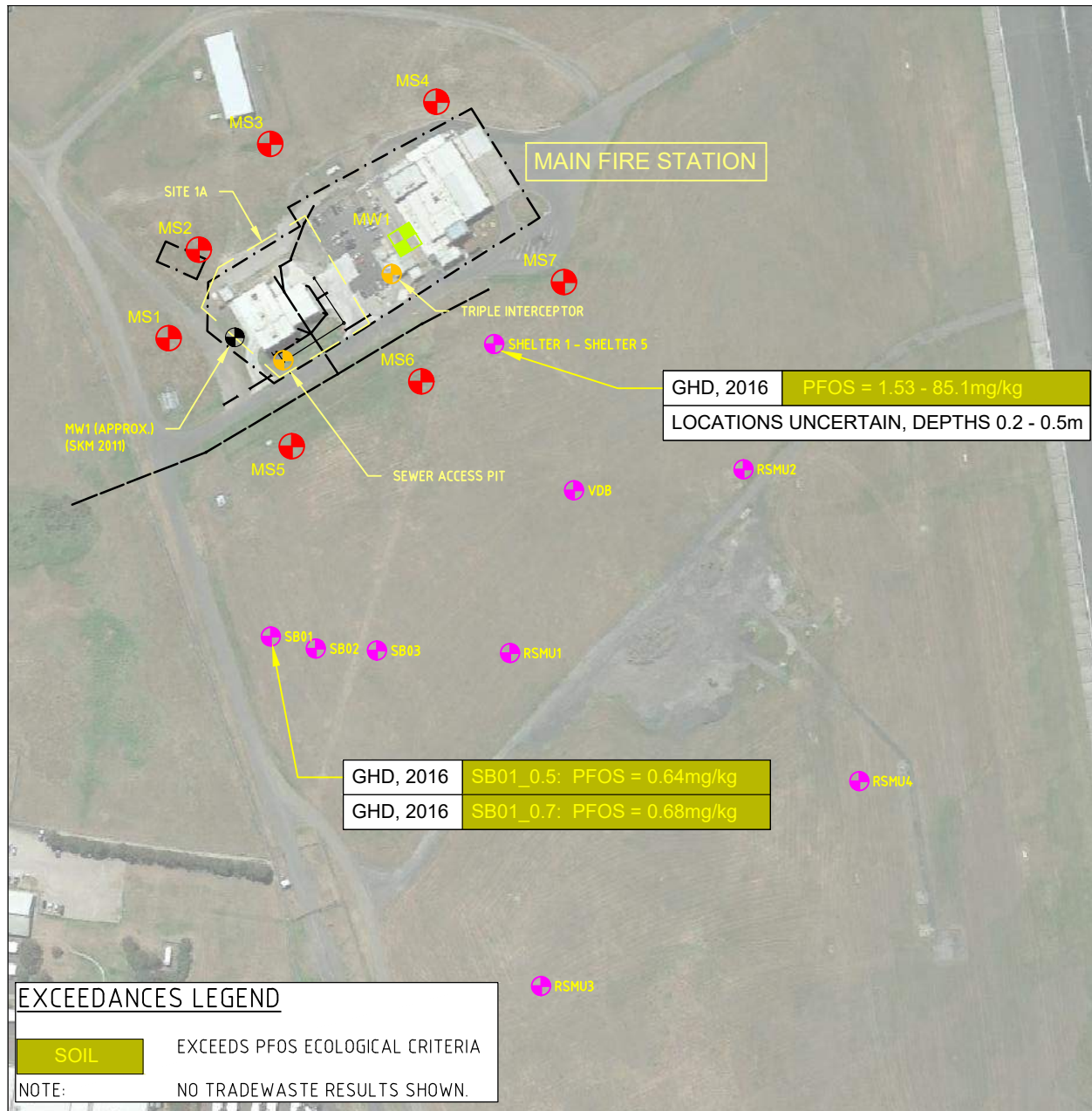
- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- ┐ END WALL

LEGEND

- | | | | | |
|--------------------------|--|--|--|--|
| MW | | INTERCEPTOR PIT SAMPLE (SEMF 2017) | | DRAINAGE WATER SAMPLE LOCATION (SEMF 2018) |
| MS | | SOIL SAMPLE LOCATION (SEMF 2017) | | BECA ONGOING TRADEWASTE SAMPLING LOCATION |
| | | GROUNDWATER MONITORING LOCATIONS (SEMF 2017) | | BOREHOLE SOIL SAMPLING (SKM 2011) |
| | | BOREHOLE SOIL SAMPLING (GHD 2016b) | | |
| - - - - - LEASE BOUNDARY | | | | |

MELBOURNE AIRPORT PSI
FIGURE 2d
SITE A - MAIN FIRE STATION (MFS)
HISTORICAL PFAS TESTING LOCATIONS AND SURROUNDS





DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL

LEGEND

- MW INTERCEPTOR PIT SAMPLE (SEMF 2017)
- MS SOIL SAMPLE LOCATION (SEMF 2017)
- GROUNDWATER MONITORING LOCATIONS (SEMF 2017)
- LEASE BOUNDARY
- BECA ONGOING TRADEWASTE SAMPLING LOCATION
- BOREHOLE SOIL SAMPLING (SKM 2011)
- BOREHOLE SOIL SAMPLING (GHD 2016b)

MELBOURNE AIRPORT PSI

FIGURE 2e

SITE A - MAIN FIRE STATION (MFS)

HISTORICAL PFAS TESTING EXCEEDANCES AND SURROUNDS

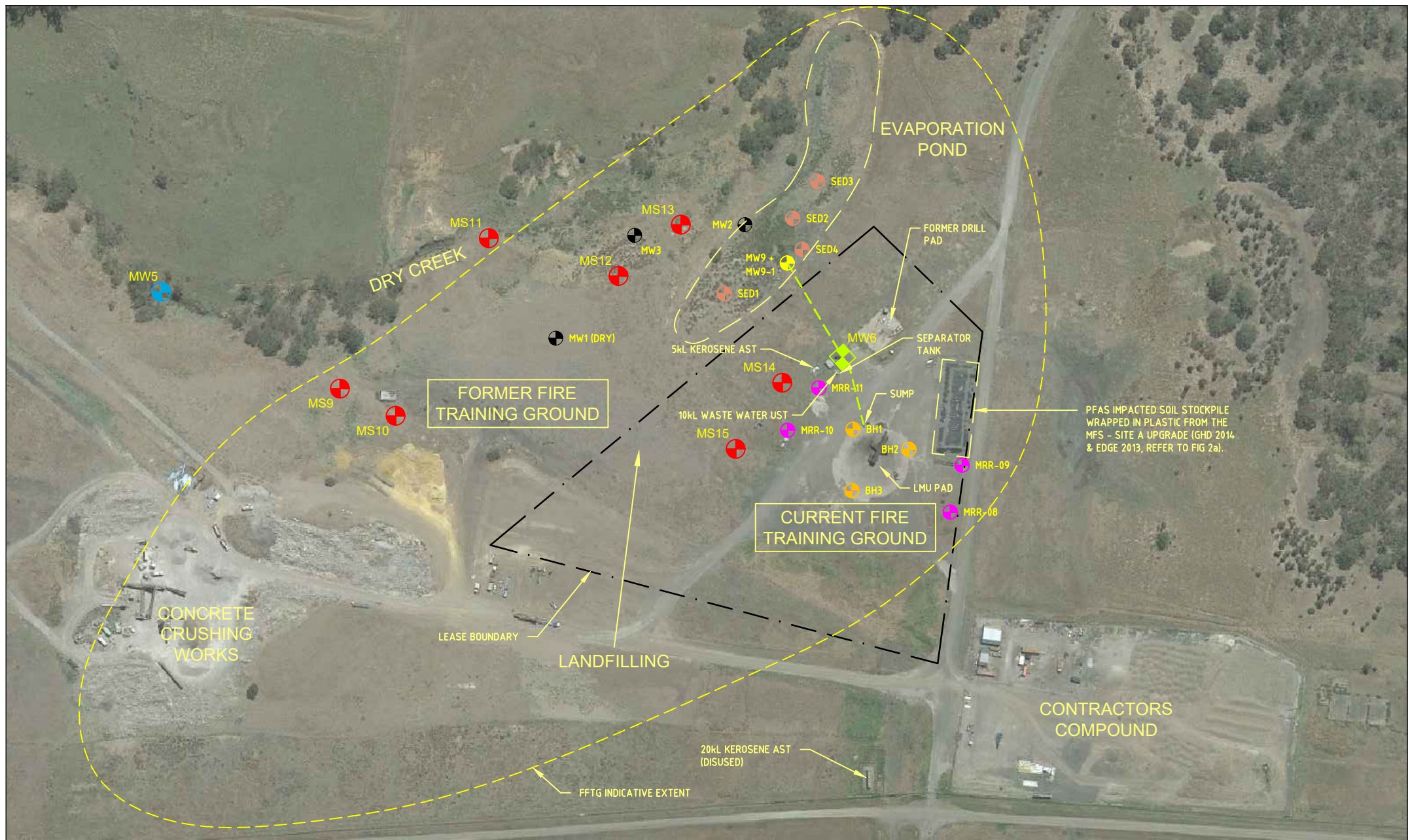


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LEGEND



INTERCEPT PIT
SAMPLE (SEMF 2017)



SURFACE WATER
SAMPLING (SEMF 2017)



SOIL SAMPLE
LOCATION (SEMF 2017)

DISCHARGE PIPING



DRAINAGE WATER SAMPLE
LOCATION (SEMF 2018)



GROUNDWATER
MONITORING LOCATIONS



SEDIMENT SAMPLING
LOCATION (GHD 2008)



BOREHOLE SOIL SAMPLING
(GHD 2008)



EDGE SAMPLING 2013
(SOILS)

MELBOURNE AIRPORT PSI

FIGURE 3a

SITES C & D - FORMER & CURRENT FIRE TRAINING GROUNDS (FFTG & CFTG)
PFAS TESTING LOCATIONS



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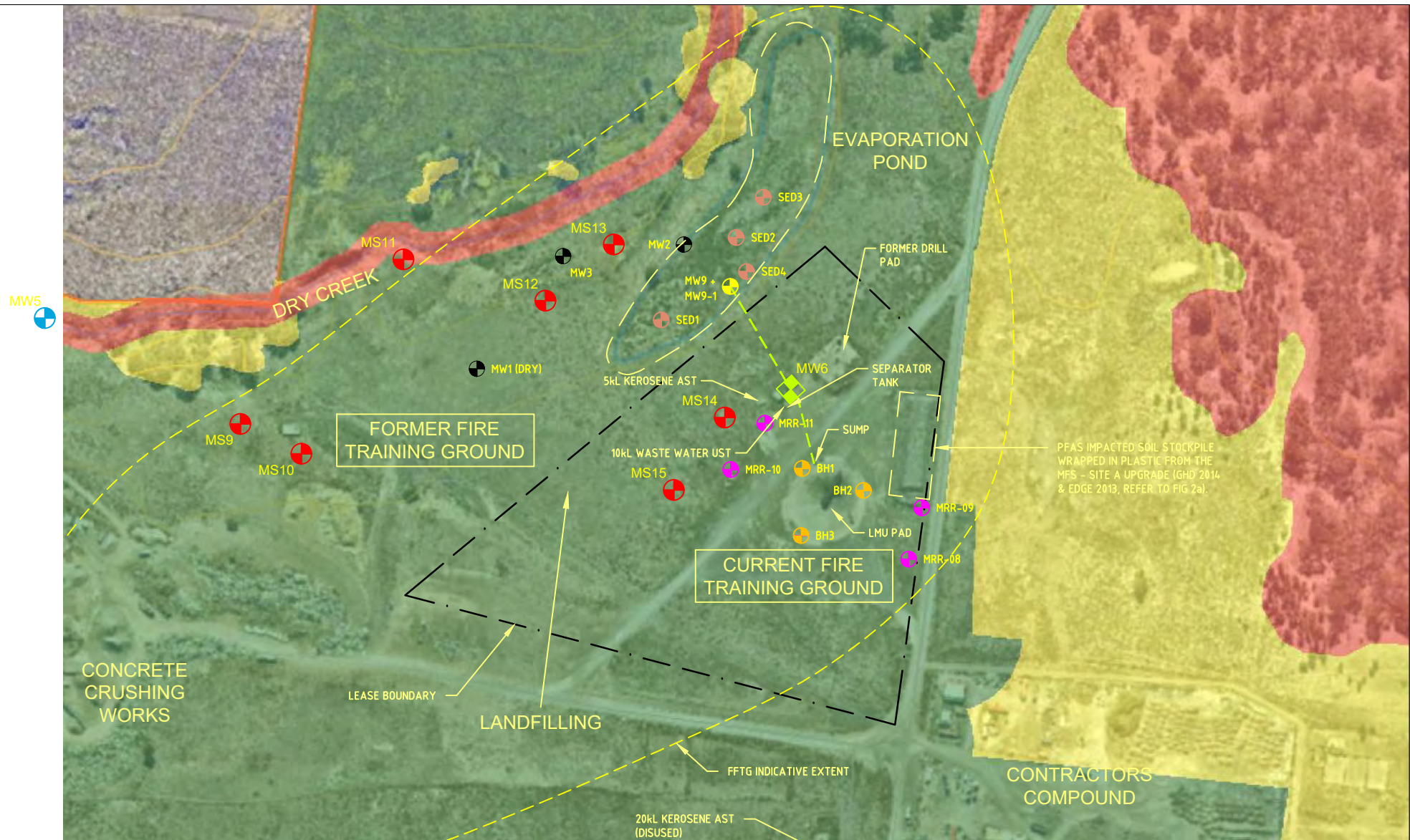
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Ecology - Biodiversity Management Priority



LEGEND

MW		INTERCEPTOR PIT SAMPLE (SEMF 2017)		GROUNDWATER MONITORING LOCATIONS
MW		SURFACE WATER SAMPLING (SEMF 2017)		SEDIMENT SAMPLING LOCATION (GHD 2008)
MS		SOIL SAMPLE LOCATION (SEMF 2017)		BOREHOLE SOIL SAMPLING (GHD 2008)
		DISCHARGE PIPING		EDGE SAMPLING 2013 (SOILS)
		DRAINAGE WATER SAMPLE LOCATION (SEMF 2018)		

MELBOURNE AIRPORT PSI

FIGURE 3b (ECOLOGY)

SITES C & D - FORMER & CURRENT FIRE TRAINING GROUNDS (FFTG & CFTG)

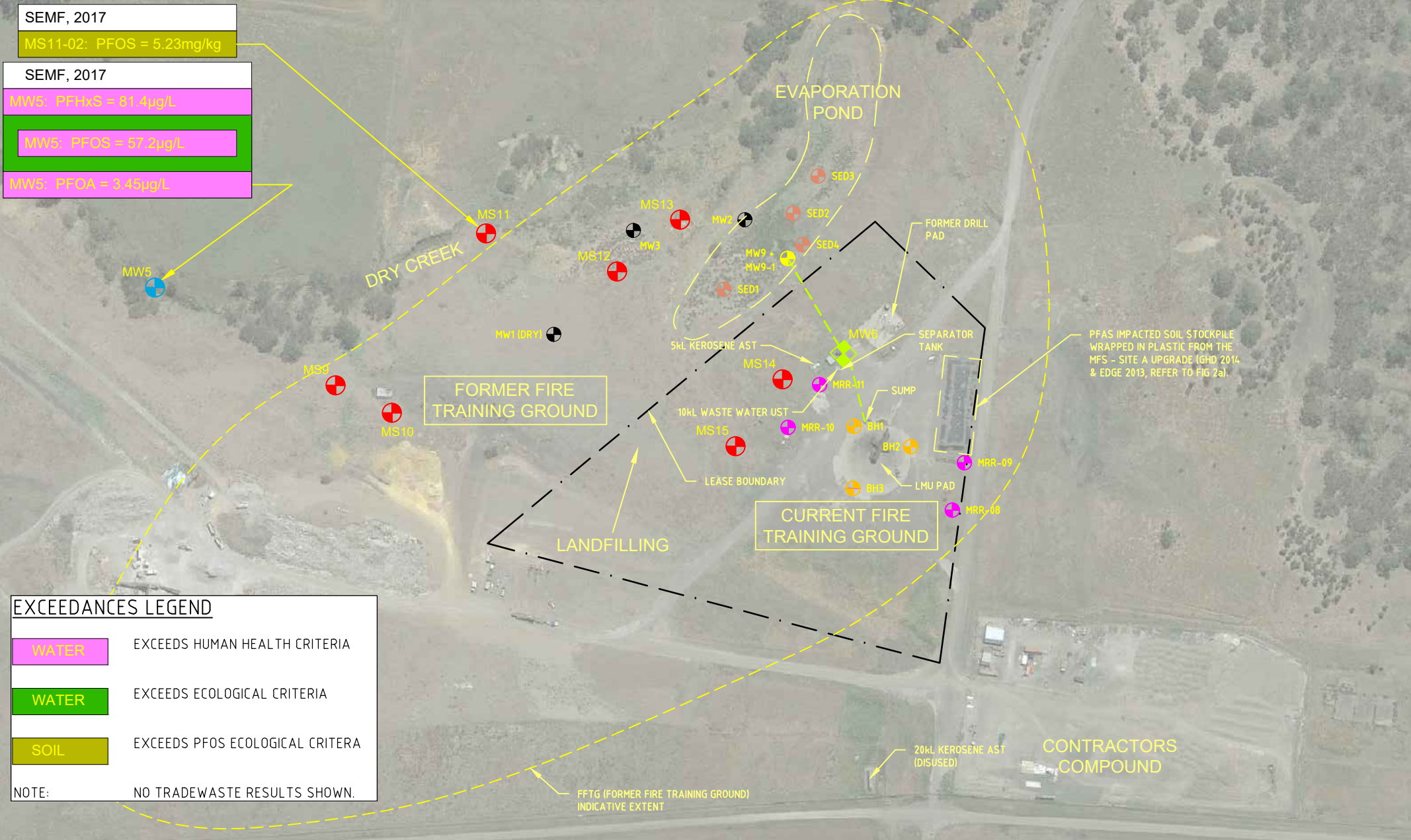


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SEMF, 2017

MS11-02: PFOS = 5.23mg/kg

SEMF, 2017

MW5: PFHxS = 81.4µg/L

MW5: PFOS = 57.2µg/L

MW5: PFOA = 3.45µg/L

EXCEEDANCES LEGEND

WATER

EXCEEDS HUMAN HEALTH CRITERIA

WATER

EXCEEDS ECOLOGICAL CRITERIA

SOIL

EXCEEDS PFOS ECOLOGICAL CRITERIA

NOTE: NO TRADEWASTE RESULTS SHOWN.

LEGEND



INTERCEPT PIT
SAMPLE (SEMF 2017)



SURFACE WATER
SAMPLING (SEMF 2017)



SOIL SAMPLE
LOCATION (SEMF 2017)



DISCHARGE PIPING



DRAINAGE WATER SAMPLE
LOCATION (SEMF 2018)



GROUNDWATER
MONITORING LOCATIONS



SEDIMENT SAMPLING
LOCATION (GHD 2008)



BOREHOLE SOIL SAMPLING
(GHD 2008)



EDGE SAMPLING 2013
(SOILS)

MELBOURNE AIRPORT PSI

FIGURE 3d

SITE D - CURRENT FIRE TRAINING GROUNDS (CFTG)
PSI PFAS TESTING EXCEEDANCES



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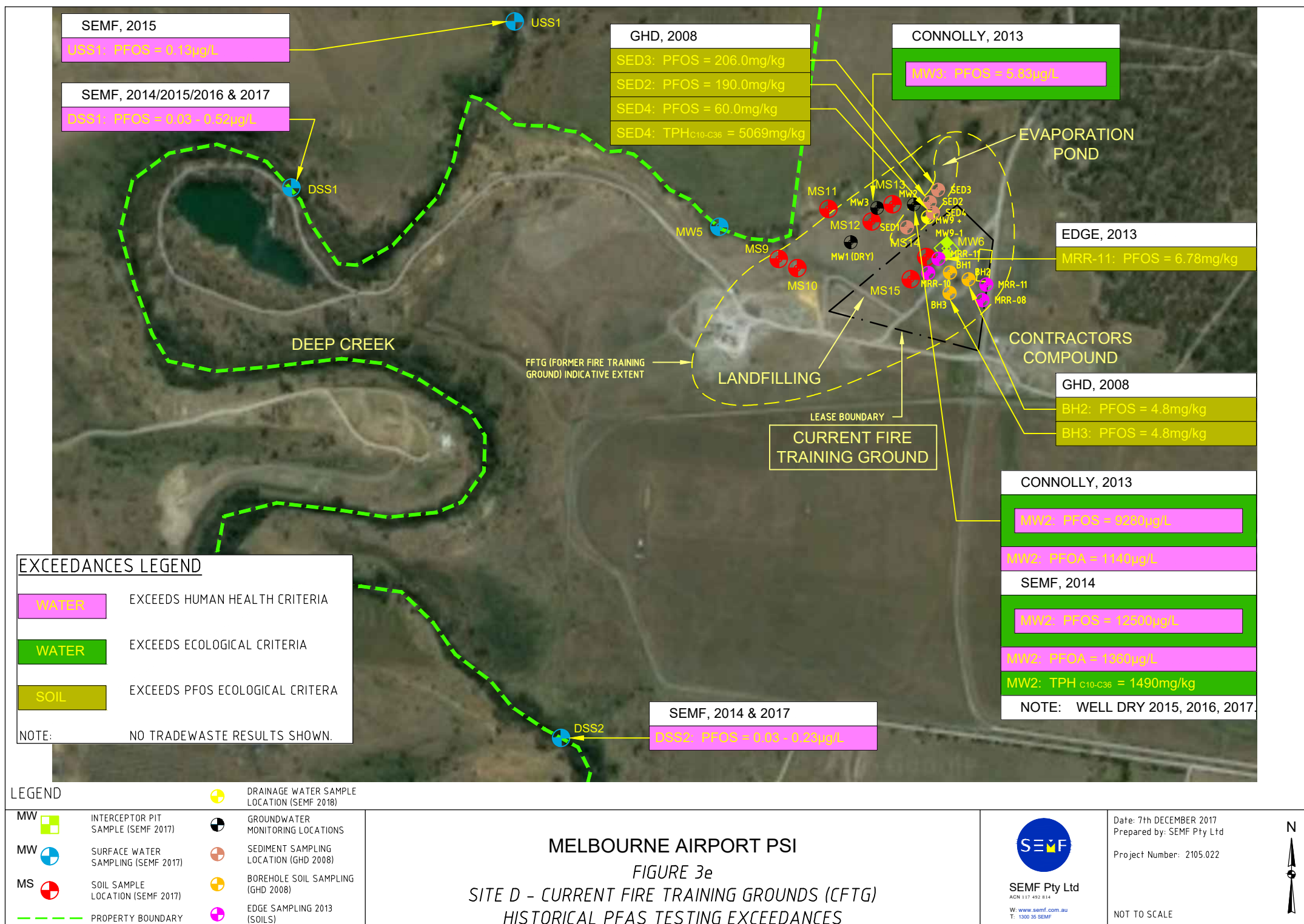
W: www.semf.com.au
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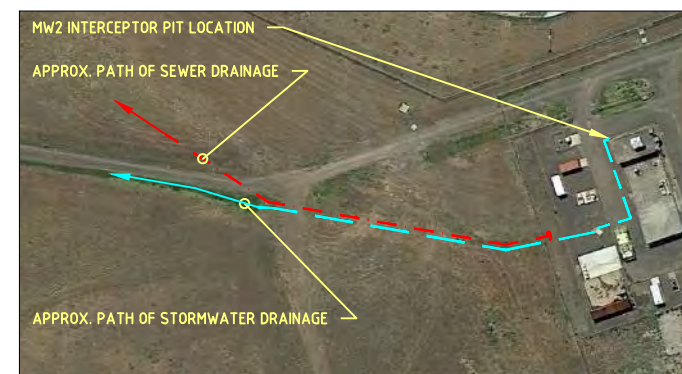
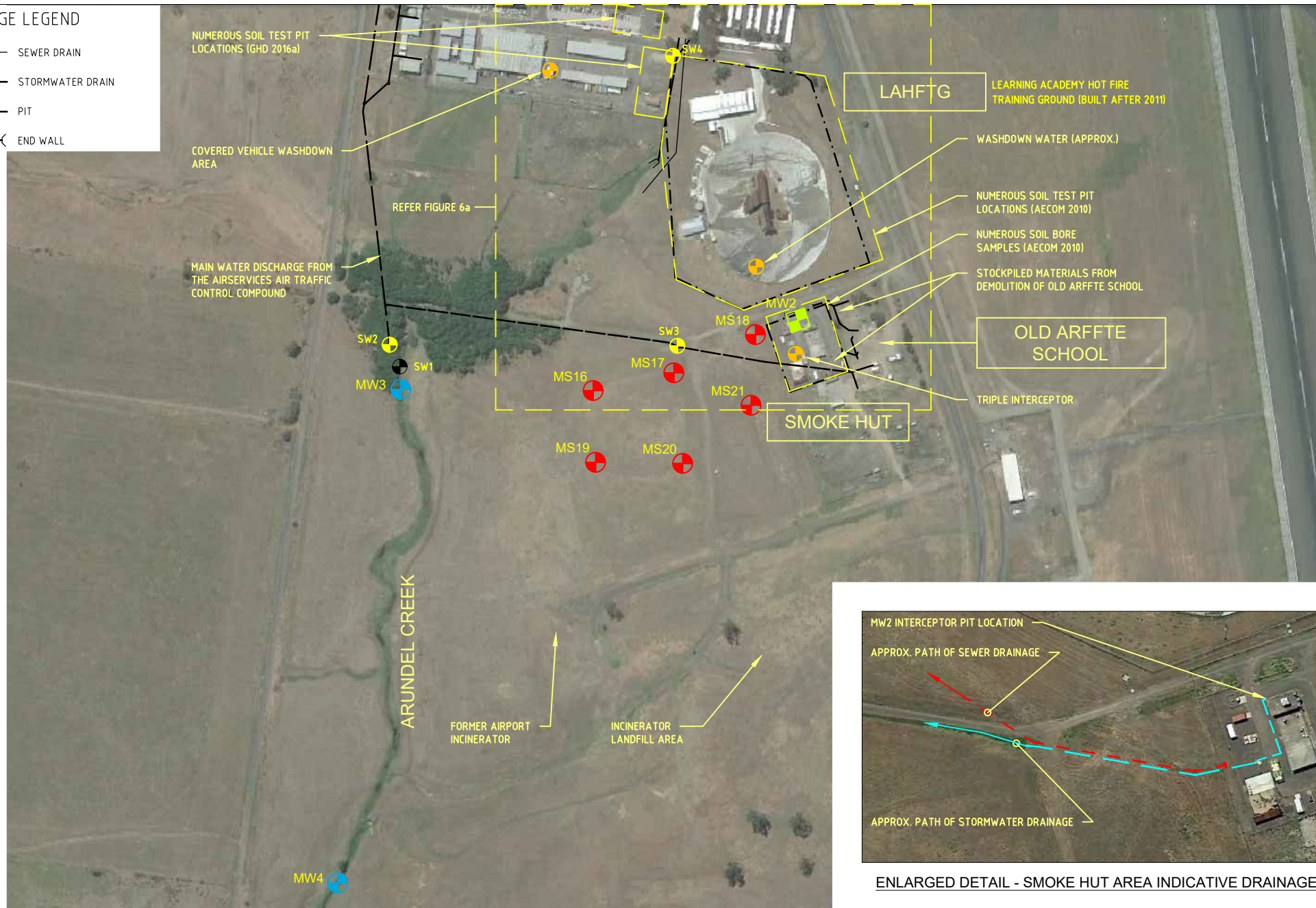
NOT TO SCALE





DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL



ENLARGED DETAIL - SMOKE HUT AREA INDICATIVE DRAINAGE

LEGEND

- MW
- MS
- MW

- INTERCEPTOR PIT SAMPLE (SEMF 2017)
- SOIL SAMPLE LOCATION (SEMF 2017)
- SURFACE WATER SAMPLING (SEMF 2017)

- ☉
- ☉
- ☉

- DRAINAGE WATER SAMPLE LOCATION (SEMF 2018)
- STORMWATER SAMPLING LOCATION (AECOM 2010)
- BECA TRADEWASTE ONGOING SAMPLING LOCATION

--- LEASE BOUNDARY

MELBOURNE AIRPORT PSI FIGURE 4a SITE E - SMOKE HUT PFAS TESTING LOCATIONS



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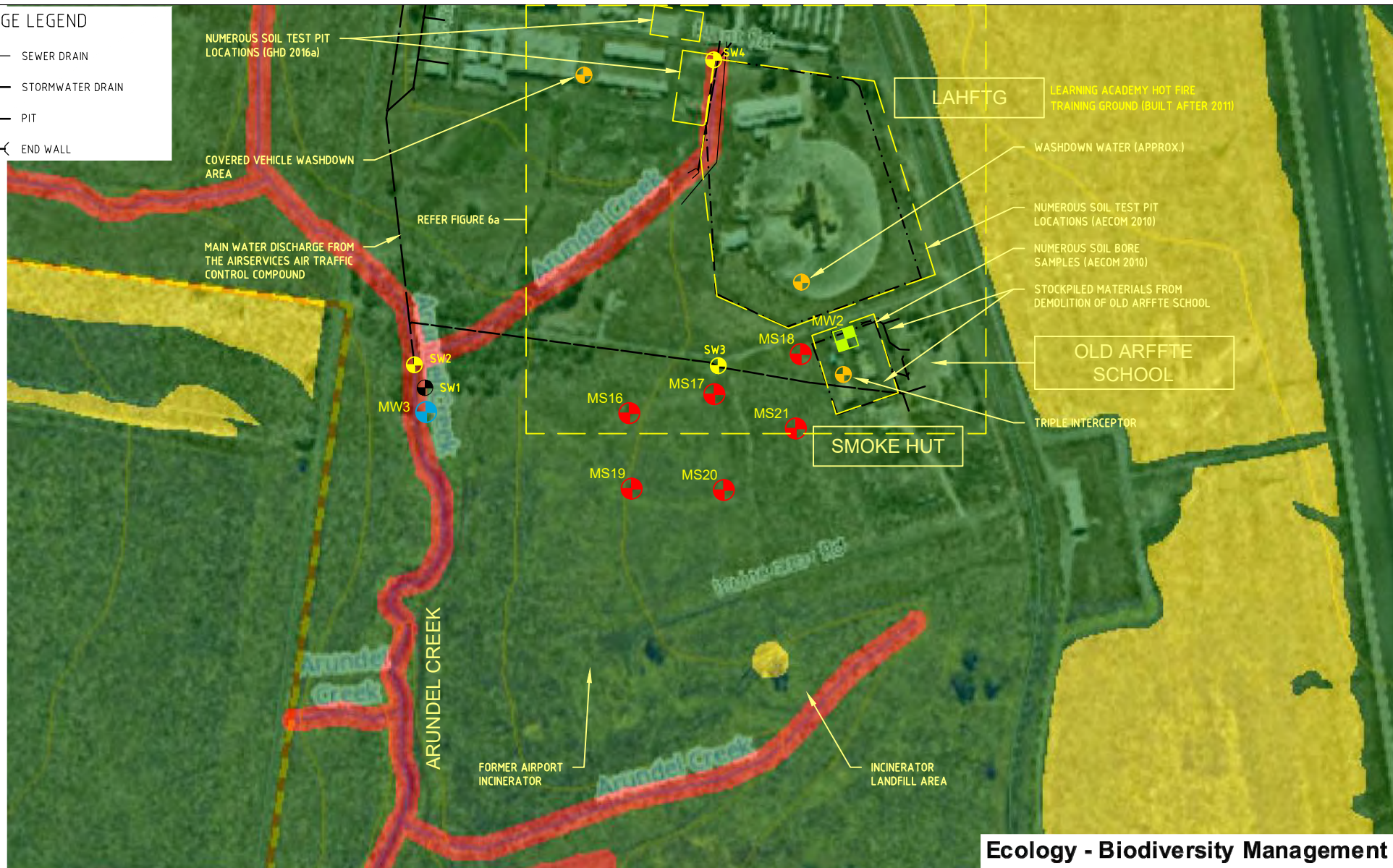
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DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL



Ecology - Biodiversity Management Priority

- High
- Medium
- Low

MW4

LEGEND

- INTERCEPTOR PIT SAMPLE (SEMF 2017)
- SOIL SAMPLE LOCATION (SEMF 2017)
- SURFACE WATER SAMPLING (SEMF 2017)
- DRAINAGE WATER SAMPLE LOCATION (SEMF 2018)
- STORMWATER SAMPLING LOCATION (AECOM 2010)
- BECA TRADEWASTE ONGOING SAMPLING LOCATION
- LEASE BOUNDARY

MELBOURNE AIRPORT PSI

FIGURE 4b (ECOLOGY)
SITE E - SMOKE HUT



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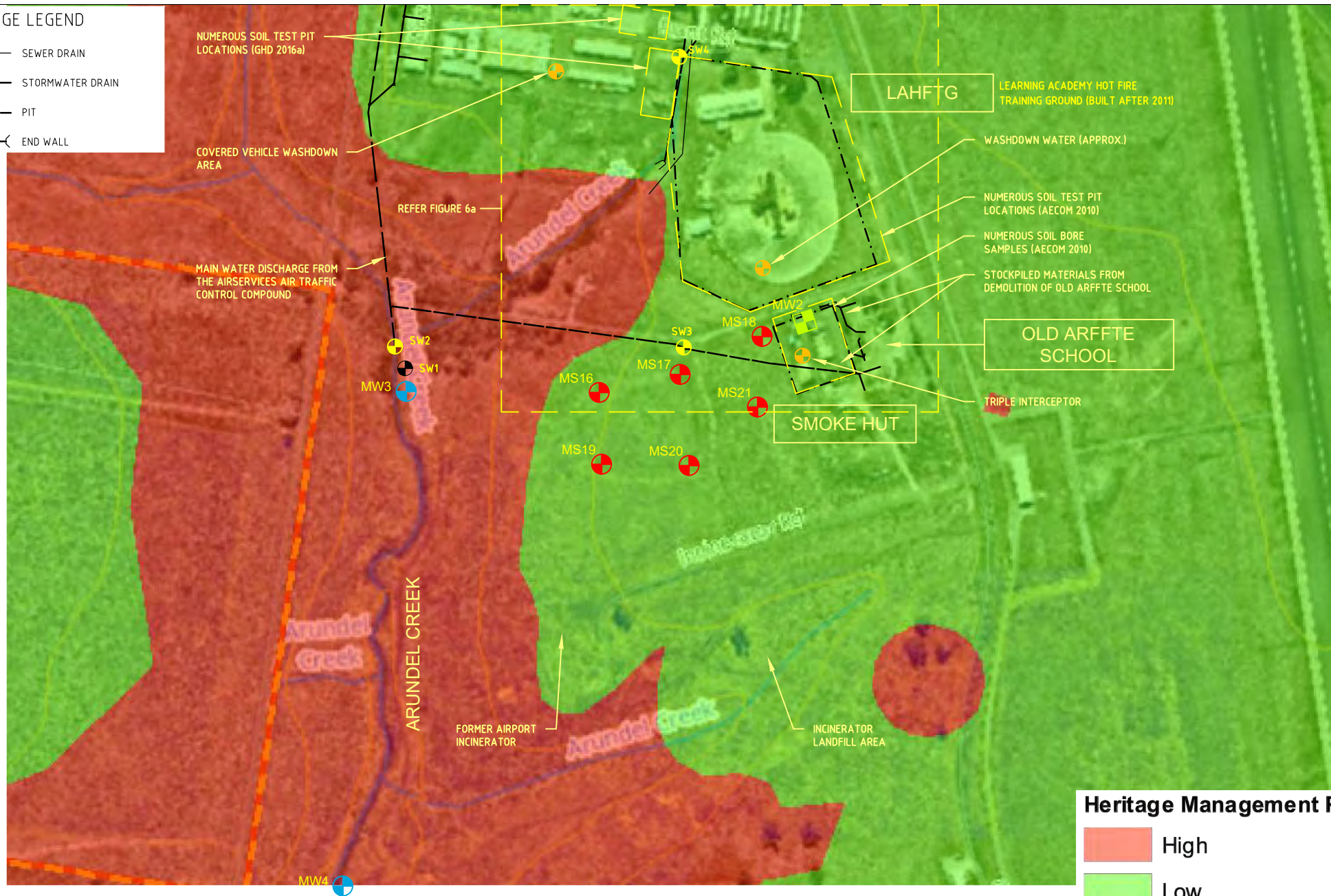
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DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL



Heritage Management Priority

- High
- Low

LEGEND

- MW INTERCEPTOR PIT SAMPLE (SEMF 2017)
- MS SOIL SAMPLE LOCATION (SEMF 2017)
- MW SURFACE WATER SAMPLING (SEMF 2017)
- DRAINAGE WATER SAMPLE LOCATION (SEMF 2018)
- STORMWATER SAMPLING LOCATION (AECOM 2010)
- BECA TRADEWASTE ONGOING SAMPLING LOCATION
- LEASE BOUNDARY

MELBOURNE AIRPORT PSI

FIGURE 4c (HERITAGE)
SITES E - SMOKE HUT



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Prepared by: SEMF Pty Ltd
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DRAINAGE LEGEND

- SEWER DRAIN
- STORMWATER DRAIN
- PIT
- END WALL

SEMF, 2018

SW3: PFOS = 36.7µg/L

SW3: PFOA = 0.4µg/L

SW3: PFHxS = 03.37µg/L

SW3: 6.2FtS = 0.05µg/L

SW3: 8.2FtS = 0.43µg/L

SEMF, 2018

SW2: PFOS = 0.25µg/L

SEMF, 2017

MW3: PFHxS = 4.28µg/L

MW3: PFOS = 8.64µg/L

EXCEEDANCES LEGEND

WATER EXCEEDS PFOS HUMAN HEALTH CRITERIA

WATER EXCEEDS PFOS ECOLOGICAL CRITERION

NOTE: NO TRADEWASTE RESULTS SHOWN.

ARUNDEL CREEK

FORMER AIRPORT INCINERATOR

INCINERATOR LANDFILL AREA

SEMF, 2017

MW4: PFOS = 0.95µg/L

LAHFTG

LEARNING ACADEMY HOT FIRE TRAINING GROUND (BUILT AFTER 2011)

WASHDOWN WATER (APPROX.)

NUMEROUS SOIL TEST PIT LOCATIONS (AECOM 2010)

NUMEROUS SOIL BORE SAMPLES (AECOM 2010)

STOCKPILED MATERIALS FROM DEMOLITION OF OLD ARFFTE SCHOOL

OLD ARFFTE SCHOOL

TRIPLE INTERCEPTOR

SMOKE HUT

SEMF, 2017

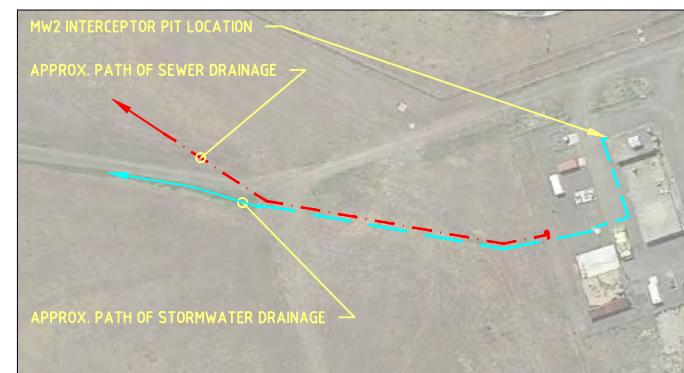
MW2: PFHxS = 80 µg/L

MW2: PFOS = 367µg/L

MW2: PFOA = 10.8µg/L

MW2: 6.2FtS = 0.51µg/L

MW2: 8.2FtS = 1.33µg/L



ENLARGED DETAIL - SMOKE HUT AREA INDICATIVE DRAINAGE

LEGEND

- MW
- MS
- MW

INTERCEPTOR PIT SAMPLE (SEMF 2017)

SOIL SAMPLE LOCATION (SEMF 2017)

SURFACE WATER SAMPLING (SEMF 2017)



DRAINAGE WATER SAMPLE LOCATION (SEMF 2018)



STORMWATER SAMPLING LOCATION (AECOM 2010)



BECA TRADEWASTE ONGOING SAMPLING LOCATION

— · — · — LEASE BOUNDARY

MELBOURNE AIRPORT PSI

FIGURE 4d

SITES E - SMOKE HUT

PSI PFAS TESTING EXCEEDANCES



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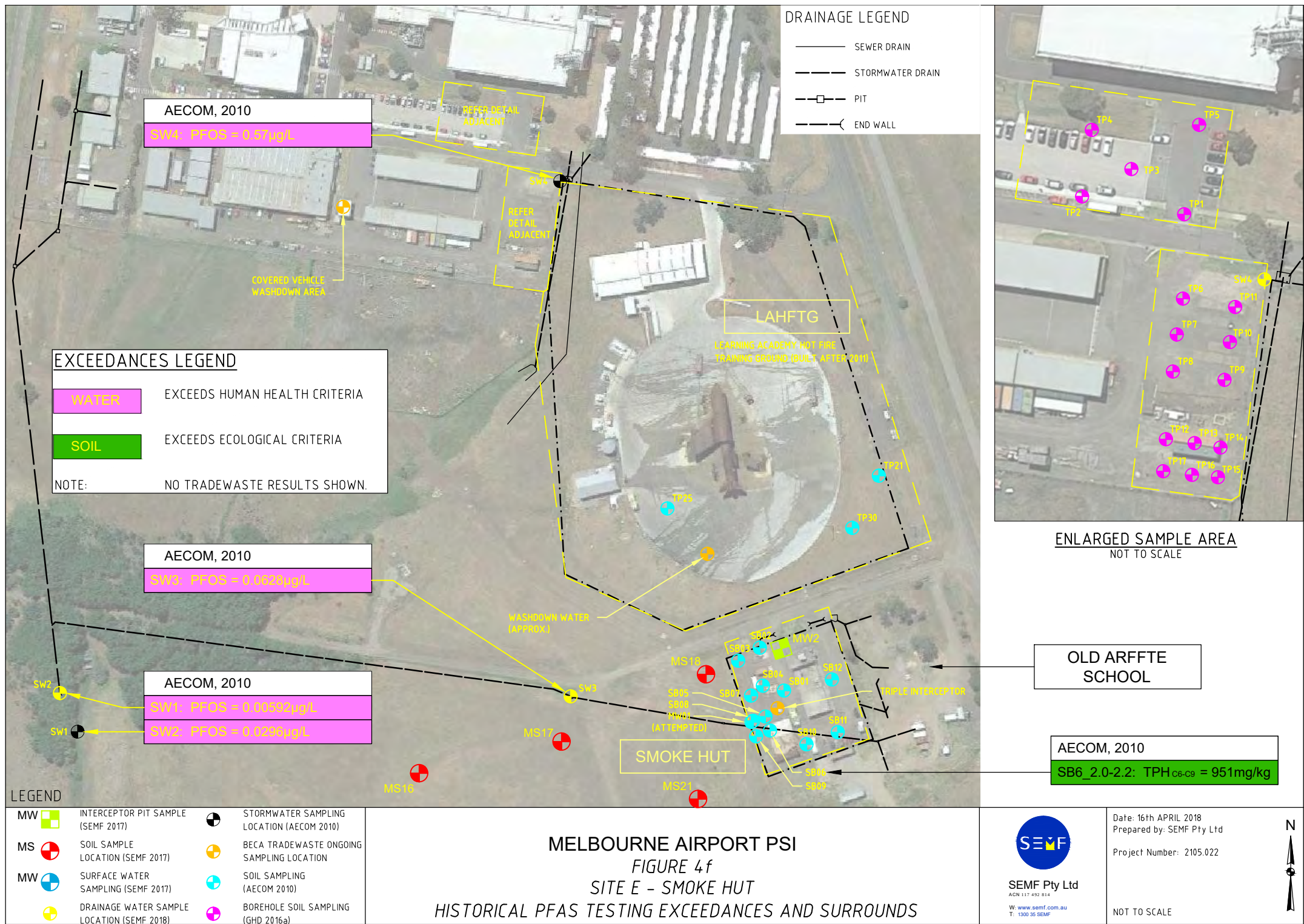
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NOT TO SCALE





AECOM, 2010
SW4: PFOS = 0.57µg/L

REFER DETAIL ADJACENT

REFER DETAIL ADJACENT

LAHFTG
LEARNING ACADEMY HOT FIRE
TRAINING GROUND (BUILT AFTER 2010)

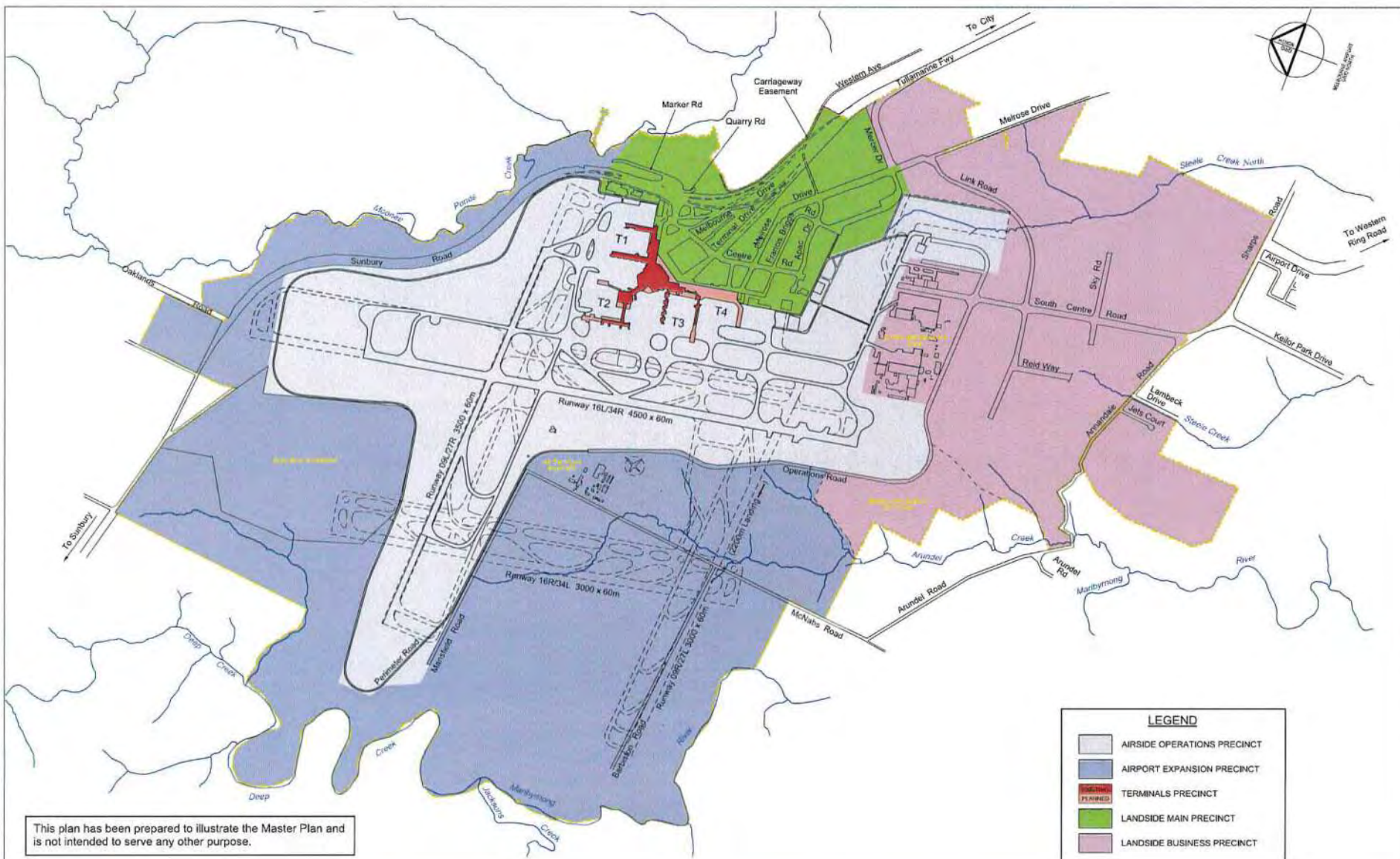
AECOM, 2010
SW3: PFOS = 0.0628µg/L

AECOM, 2010
SW1: PFOS = 0.00592µg/L
SW2: PFOS = 0.0296µg/L

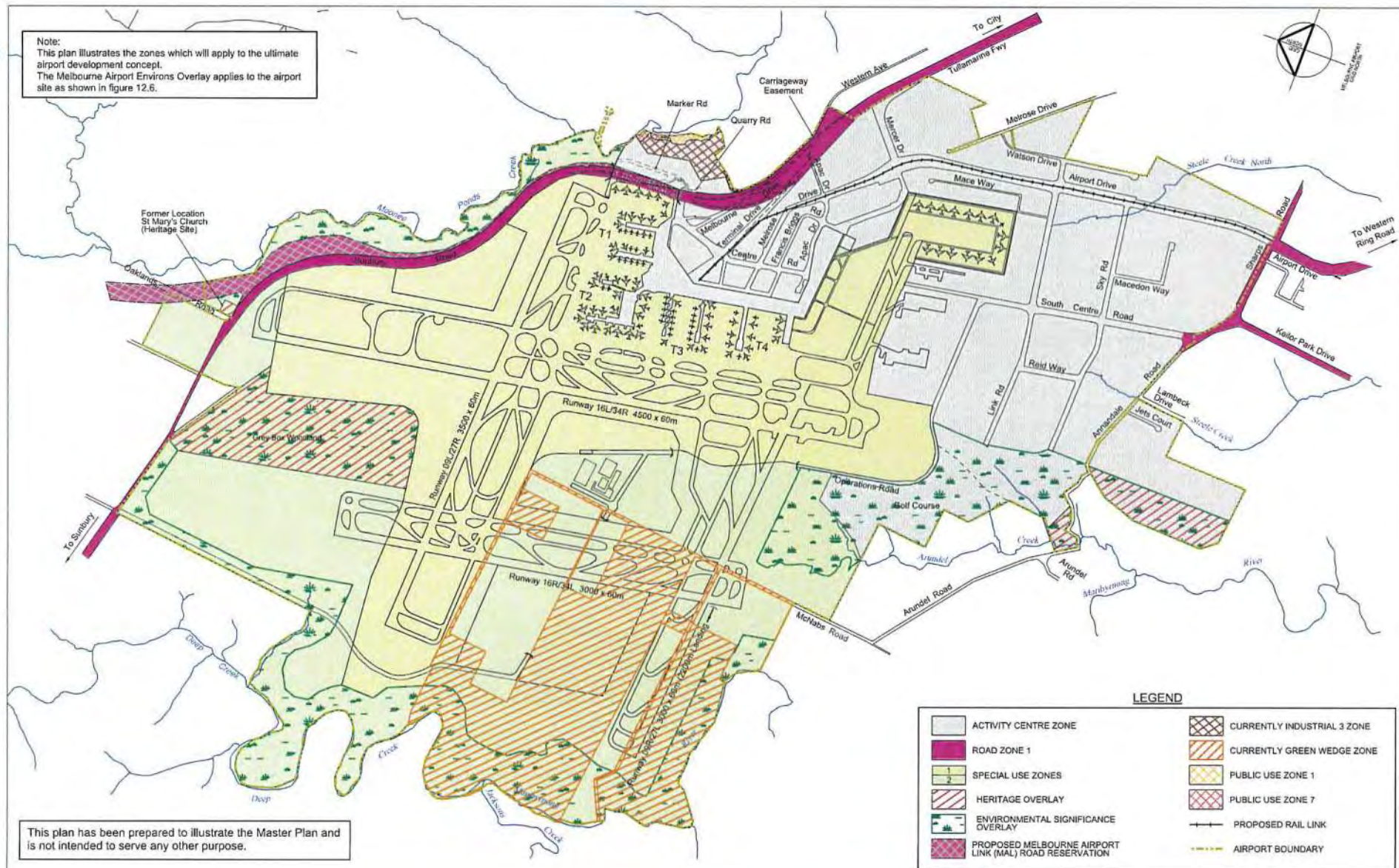
ENLARGED SAMPLE AREA
NOT TO SCALE

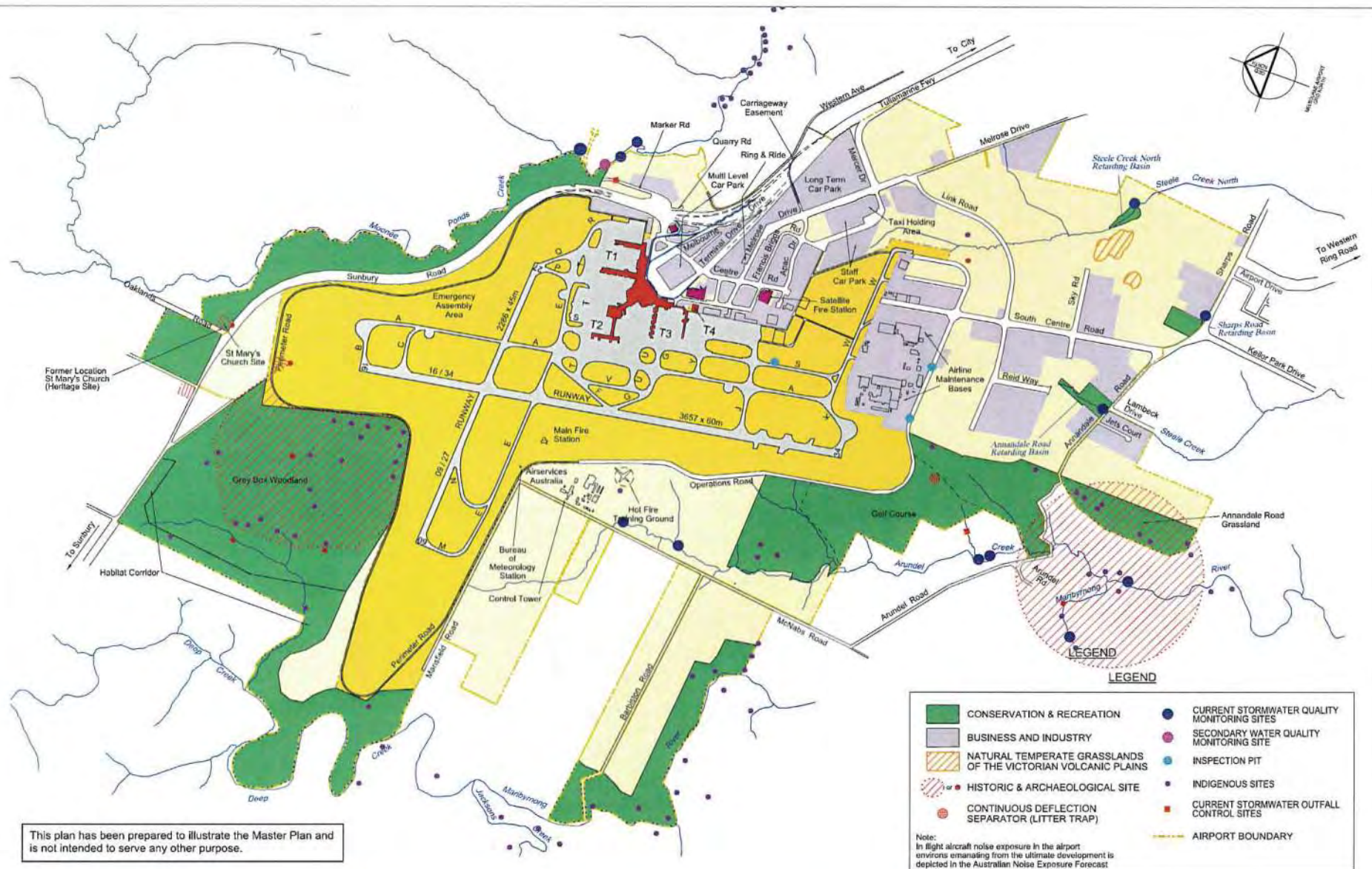
OLD ARFFTE
SCHOOL

AECOM, 2010
SB6_2.0-2.2: TPH_{C6-C9} = 951mg/kg



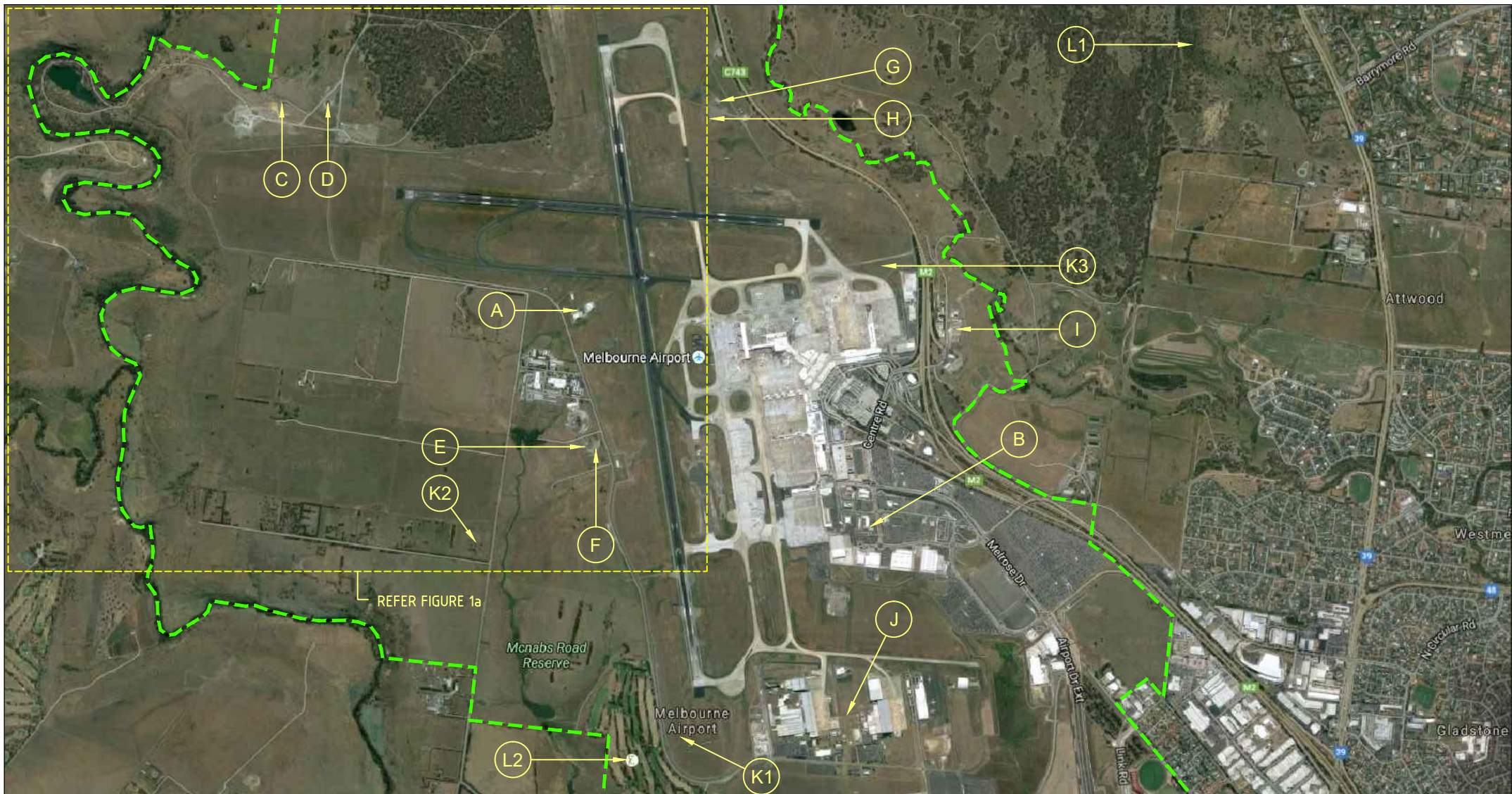
Note:
This plan illustrates the zones which will apply to the ultimate airport development concept.
The Melbourne Airport Environs Overlay applies to the airport site as shown in figure 12.6.





Appendix B – Aerial Photographs and Summary of Observations





SITE ID LEGEND

A	MAIN FIRE STATION (MFS)	D	CURRENT FIRE TRAINING GROUND (CFTG)	G	F28 TRAINING AREA	J	AIRCRAFT HANGARS	K3	TRUCK ROLLOVER	L3	NORTH OF SUNBURY ROAD (OUTSIDE MAP AREA)
B	SATELLITE FIRE STATION (SFS)	E	SMOKE HUT	H	BILLY'S BUNKER	K1	AIRPORT EMERGENCY PROCEDURE	L1	GELLIBRAND HILL		
C	FORMER FIRE TRAINING GROUND (FFTG)	F	OLD ARFFTE SCHOOL	I	JOINT USER HYDRANT INSTALLATION (JUHI)	K2	HOUSE FIRE	L2	GOLF COURSE		

LEGEND

	PROPERTY BOUNDARY
	SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 1 AIRPORT AND SITE LOCATIONS



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T: 1300 36 SEMF

Date: 16th APRIL 2018
Prepared by: SEMF Pty Ltd

Project Number: 2105.022

NOT TO SCALE



SITE ID LEGEND

- B SATELLITE FIRE STATION (SFS)
- I JOINT USER HYDRANT INSTALLATION (JUHI)
- K3 TRUCK ROLLOVER
- L1 GELLIBRAND HILL



LEGEND

--- PROPERTY BOUNDARY

(E) SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 2

HISTORICAL AERIAL IMAGE 1931


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Date: 4th AUGUST 2016
Prepared by: SEMF Pty Ltd
Project Number: 2105.022

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SITE ID LEGEND

- B SATELLITE FIRE STATION (SFS)
- I JOINT USER HYDRANT INSTALLATION (JUHI)
- K3 TRUCK ROLLOVER



LEGEND

- PROPERTY BOUNDARY
- (E) SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 3
HISTORICAL AERIAL IMAGE 1960



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SITE ID LEGEND

- A MAIN FIRE STATION (MFS)
- B SATELLITE FIRE STATION (SFS)
- C FORMER FIRE TRAINING GROUND (FFTG)
- D CURRENT FIRE TRAINING GROUND (CFTG)
- E SMOKE HUT
- F OLD ARFFTE SCHOOL
- G F28 TRAINING AREA
- H BILLY'S BUNKER
- I JOINT USER HYDRANT INSTALLATION (JUHI)
- J AIRCRAFT HANGARS
- K1 AIRPORT EMERGENCY PROCEDURE
- K2 HOUSE FIRE
- K3 TRUCK ROLLOVER
- L1 GELLIBRAND HILL
- L2 GOLF COURSE
- L3 NORTH OF SUNBURY ROAD



LEGEND

- PROPERTY BOUNDARY
- E SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 4
HISTORICAL AERIAL IMAGE 1969



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SITE ID LEGEND

- I JOINT USER HYDRANT INSTALLATION (JUHI)
- L1 GELLIBRAND HILL



LEGEND

--- PROPERTY BOUNDARY

(E) SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 5

HISTORICAL AERIAL IMAGE 1979 (a)


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SITE ID LEGEND

- A MAIN FIRE STATION (MFS)
- E SMOKE HUT
- F OLD ARFFTE SCHOOL
- K3 TRUCK ROLLOVER



LEGEND

- PROPERTY BOUNDARY
- (E) SITE LOCATION ID

MELBOURNE AIRPORT PSI
FIGURE 6
HISTORICAL AERIAL IMAGE 1979 (b)



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SITE ID LEGEND

- A MAIN FIRE STATION (MFS)
- B SATELLITE FIRE STATION (SFS)
- E SMOKE HUT
- F OLD ARFFTE SCHOOL
- G F28 TRAINING AREA
- H BILLY'S BUNKER
- I JOINT USER HYDRANT INSTALLATION (JUHI)
- K2 HOUSE FIRE
- K3 TRUCK ROLLOVER
- L1 GELLIBRAND HILL
- L3 NORTH OF SUNBURY ROAD



LEGEND

--- PROPERTY BOUNDARY

(E) SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 7

HISTORICAL AERIAL IMAGE 1980


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T: 1900 26 SEMF

Date: 4th AUGUST 2016
Prepared by: SEMF Pty Ltd
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SITE ID LEGEND

- B SATELLITE FIRE STATION (SFS)
- I JOINT USER HYDRANT INSTALLATION (JUHI)
- K3 TRUCK ROLLOVER
- L1 GELLIBRAND HILL



LEGEND

--- PROPERTY BOUNDARY

(E) SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 8

HISTORICAL AERIAL IMAGE 1985 (a)


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T: 1900 26 SEMF

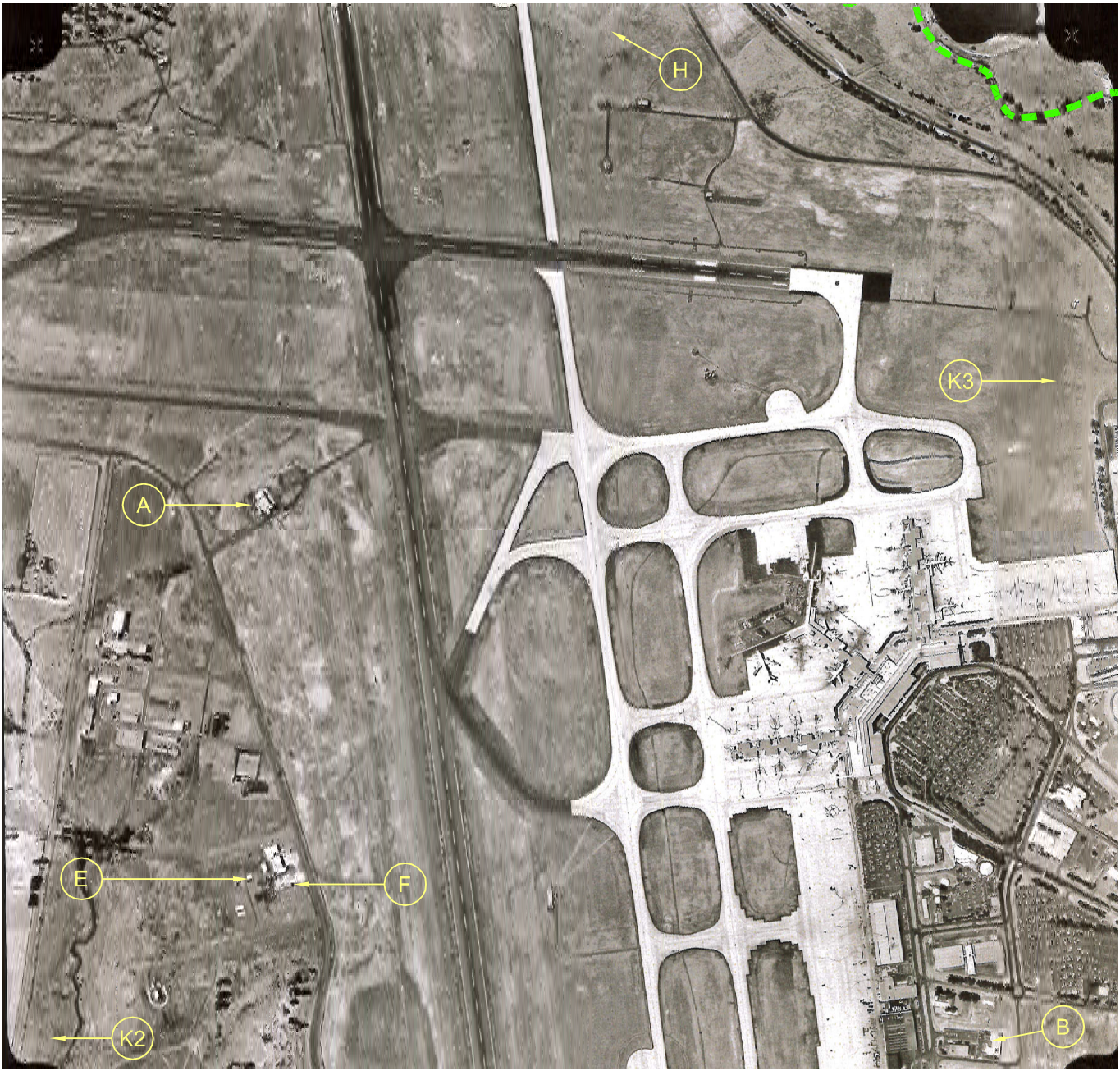
Date: 4th AUGUST 2016
Prepared by: SEMF Pty Ltd
Project Number: 2105.022

NOT TO SCALE



SITE ID LEGEND

- A MAIN FIRE STATION (MFS)
- B SATELLITE FIRE STATION (SFS)
- E SMOKE HUT
- F OLD ARFFTE SCHOOL
- H BILLY'S BUNKER
- K2 HOUSE FIRE
- K3 TRUCK ROLLOVER



LEGEND

- PROPERTY BOUNDARY
- (E) SITE LOCATION ID

MELBOURNE AIRPORT PSI
FIGURE 9
HISTORICAL AERIAL IMAGE 1985 (b)



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Date: 4th AUGUST 2016
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SITE ID LEGEND

- C FORMER FIRE TRAINING GROUND (FFTG)
- D CURRENT FIRE TRAINING GROUND (CFTG)



LEGEND

- PROPERTY BOUNDARY
- (E) SITE LOCATION ID

MELBOURNE AIRPORT PSI
FIGURE 10
HISTORICAL AERIAL IMAGE 1991 (a)


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SITE ID LEGEND

- B SATELLITE FIRE STATION (SFS)
- I JOINT USER HYDRANT INSTALLATION (JUHI)
- K3 TRUCK ROLLOVER
- L1 GELLIBRAND HILL



LEGEND

- PROPERTY BOUNDARY
- (E) SITE LOCATION ID

MELBOURNE AIRPORT PSI
FIGURE 11
HISTORICAL AERIAL IMAGE 1991 (b)



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SITE ID LEGEND

- A MAIN FIRE STATION (MFS)
- B SATELLITE FIRE STATION (SFS)
- E SMOKE HUT
- F OLD ARFFTE SCHOOL
- J AIRCRAFT HANGARS
- K1 AIRPORT EMERGENCY PROCEDURE
- K2 HOUSE FIRE
- K3 TRUCK ROLLOVER
- L2 GOLF COURSE



LEGEND

- PROPERTY BOUNDARY
- E SITE LOCATION ID

MELBOURNE AIRPORT PSI
 FIGURE 12
 HISTORICAL AERIAL IMAGE 1991 (c)



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SITE ID LEGEND

- A MAIN FIRE STATION (MFS)
- C FORMER FIRE TRAINING GROUND (FFTG)
- D CURRENT FIRE TRAINING GROUND (CFTG)
- E SMOKE HUT
- F OLD ARFFTE SCHOOL
- K2 HOUSE FIRE



LEGEND

- PROPERTY BOUNDARY
- E SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 13

HISTORICAL AERIAL IMAGE 1991 (d)



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SITE ID LEGEND

A	MAIN FIRE STATION (MFS)	D	CURRENT FIRE TRAINING GROUND (CFTG)	G	F28 TRAINING AREA	J	AIRCRAFT HANGARS	K3	TRUCK ROLLOVER	L3	NORTH OF SUNBURY ROAD (OUTSIDE MAP AREA)
B	SATELLITE FIRE STATION (SFS)	E	SMOKE HUT	H	BILLY'S BUNKER	K1	AIRPORT EMERGENCY PROCEDURE	L1	GELLIBRAND HILL		
C	FORMER FIRE TRAINING GROUND (FFTG)	F	OLD ARFFTE SCHOOL	I	JOINT USER HYDRANT INSTALLATION (JUHI)	K2	HOUSE FIRE	L2	GOLF COURSE		

LEGEND

	PROPERTY BOUNDARY
	SITE LOCATION ID

MELBOURNE AIRPORT PSI
FIGURE 14
HISTORICAL AERIAL IMAGERY 2004



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ACN 517 492 814

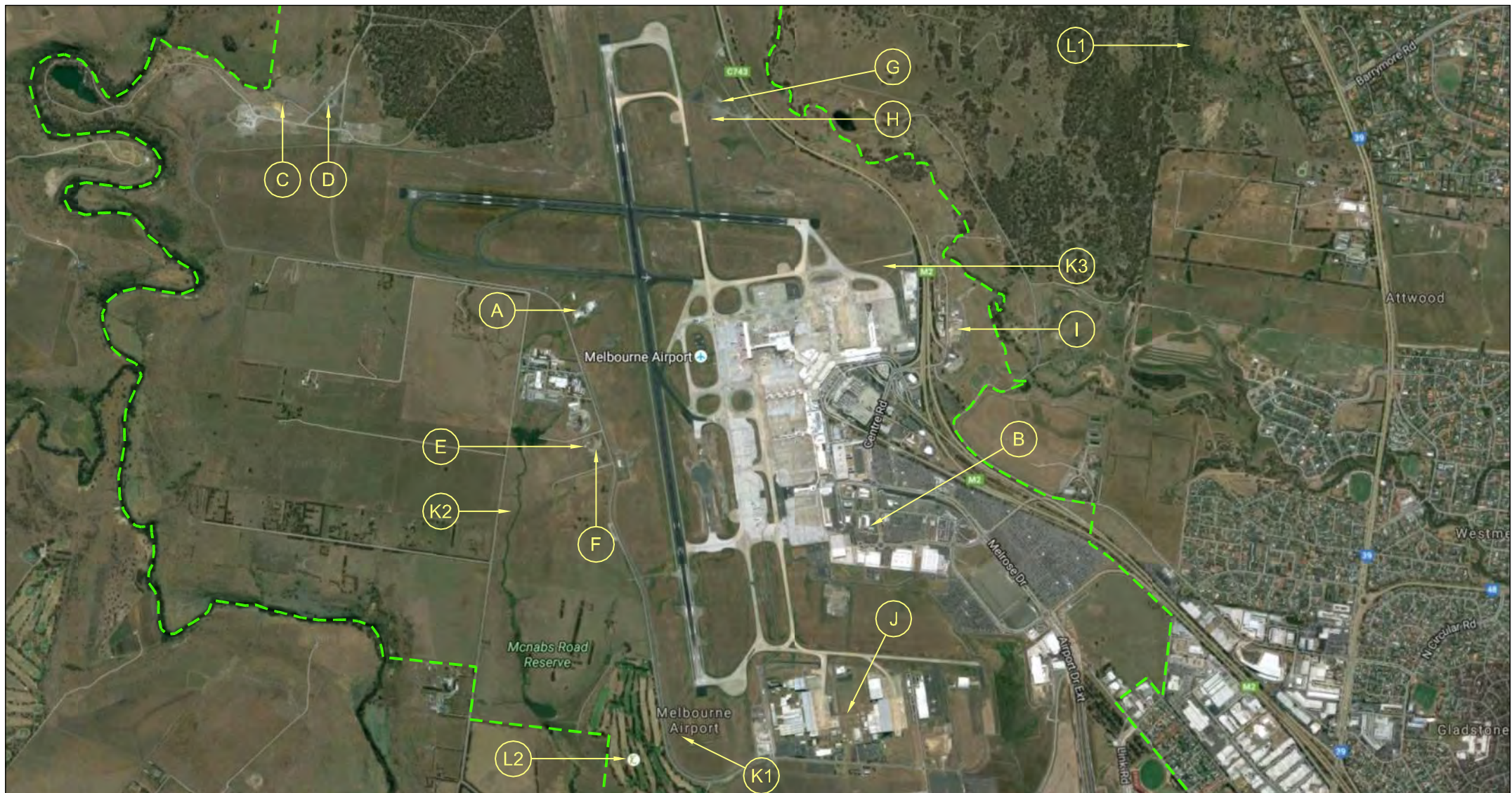
W: www.semf.com.au
T: 1900 26 SEMF

Date: 4th AUGUST 2016
Prepared by: SEMF Pty Ltd

Project Number: 2105.022

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SITE ID LEGEND

A	MAIN FIRE STATION (MFS)	D	CURRENT FIRE TRAINING GROUND (CFTG)	G	F28 TRAINING AREA	J	AIRCRAFT HANGARS	K3	TRUCK ROLLOVER	L3	NORTH OF SUNBURY ROAD (OUTSIDE MAP AREA)
B	SATELLITE FIRE STATION (SFS)	E	SMOKE HUT	H	BILLY'S BUNKER	K1	AIRPORT EMERGENCY PROCEDURE	L1	GELLIBRAND HILL		
C	FORMER FIRE TRAINING GROUND (FFTG)	F	OLD ARFFTE SCHOOL	I	JOINT USER HYDRANT INSTALLATION (JUHI)	K2	HOUSE FIRE	L2	GOLF COURSE		

LEGEND

	PROPERTY BOUNDARY
	SITE LOCATION ID

MELBOURNE AIRPORT PSI

FIGURE 15

HISTORICAL AERIAL IMAGERY 2015



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T: 1900 26 SEMF

Date: 4th AUGUST 2016
Prepared by: SEMF Pty Ltd
Project Number: 2105.022

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Table B1: Observations from Review of Aerial Photographs

Date	Observation
Site A – Main Fire Station (MFS)	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the north and east. - MFS visible in its current location. - Vacant land to the west, buildings to the south (where current Airservices offices are) and runways to the north and east.
1979 (b)	- Airport terminals and two runways visible to the north and east. - MFS visible in its current location. - Buildings to the south (current Airservices offices) and runways to the north and east.
1980	No change since 1979 (b).
1985 (b)	No change since 1980.
1991 (c)	No change since 1985 (b).
2004	Workshop visible to the west of the MFS.
2015	No change since 2004.
Site B – Satellite Fire Station (SFS)	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the north and west. - Building activities visible in the vicinity of the SFS. - Airport development to the north, east, south and west.
1979	Not visible on 1979 (a) or 1979 (b).
1980	No change since 1979 (b).
1985 (a)	No change since 1980.
1991 (b) and (c)	No change since 1985 (a).
2004	No change since 1991 (b) and 1991 (c).
2015	No change since 2004.

Date	Observation
Site C– Former Fire Training Ground (FFTG)	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the south-east. - Ground disturbance visible in the vicinity of the FFTG. - Vacant land to the west, building to the south-east and woodland to the north-east.
1979	Not visible on 1979 (a) or 1979 (b).
1980, 1985	Not visible.
1991 (a) and (d)	- Airport east-west runway to the south-east. - Large Mock-up (LMU) from CFTG visible and evaporation pond visible (1991 (a)). - Grey Box Woodland to the east, ground disturbance activities to the west and Deep Creek further to the west.
2004	No change since 1991 (a) and 1991 (d).
2015	No change since 2004.
Site D – Current Fire Training Ground (CFTG)	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the south-east. - No ground disturbance visible in the vicinity of the CFTG. - Vacant land to the west, building to the south-east and woodland to the north-east.
1979	Not visible on 1979 (a) or 1979 (b).
1980, 1985	Not visible.
1991 (a) and (d)	- Airport east-west runway to the south-east. - Large Mock-up (LMU) visible and evaporation pond potentially visible (1991 (a)). - Grey Box Woodland to the east, ground disturbance activities to the west and Deep Creek further to the west.
2004	No change since 1991 (a) and 1991 (d).
2015	No change since 2004.

Date	Observation
Site E – Smoke Hut	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the north and east. - Land disturbance in the vicinity of the Smoke Hut. - Vacant land to the west and south, buildings to the north (where current Airservices offices are) and runway to the east.
1979 (b)	- Airport terminals and two runways visible to the north and east. - Land disturbance in the vicinity of the Smoke Hut. - Potential land disturbance to the west, vacant land to the south and buildings to the east (likely to be the ARFFTE School).
1980	- Airport terminals and two runways visible to the north and east. - Smoke Hut potentially visible, with land disturbance in the vicinity. - Ground disturbance to the west and south and buildings to the east (likely to be the ARFFTE School).
1985 (b)	- Airport terminals and two runways visible to the north and east. - Smoke Hut visible. - Ground disturbance to the west and south and buildings to the east (ARFFTE School).
1991 (c)	No change since 1985 (b).
2004	- ARFFTE School to the east potentially demolished. - Google Earth image from 2005 shows a structure to the south-west of the Smoke Hut (only visible in 2005 and 2006).
2015	No change since 2004.
Site F – Old ARFFTE School	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the north and east. - ARFFTE School not visible. - Vacant land to the west and south, buildings to the north (where current Airservices offices are) and runway to the east.

Date	Observation
1979 (b)	▪ Airport terminals and two runways visible to the north and east. ▪ ARFFTE School visible. ▪ Potential land disturbance to the west (Smoke Hut?), vacant land to the south, buildings to the north (where current Airservices offices are) and runway to the east.
1980	▪ Airport terminals and two runways visible to the north and east. ▪ ARFFTE School visible. ▪ Ground disturbance to the west (Smoke Hut?) and south, buildings to the north (where current Airservices offices are) and runway to the east.
1985 (b)	▪ No change since 1980.
1991 (c)	▪ No change since 1985 (b).
2004	▪ ARFFTE School no longer visible.
2015	▪ No change since 2004.
Site G– F28 Training Area	
1931	▪ Predominantly vacant land, likely to be agricultural.
1960	▪ Development at the Airport visible. ▪ Surrounding land predominantly vacant paddocks.
1969	▪ Airport terminals and two runways visible to the south and west. ▪ Ground disturbance visible in the vicinity of the F28 training area. ▪ Vacant land to the north and east, Airport development to the south and west.
1979	▪ Not visible on 1979 (a) or 1979 (b).
1980	▪ Airport terminals and two runways visible to the south and west. ▪ Ground disturbance visible in the vicinity of the F28 training area. ▪ Vacant land and dams to the north and east, Airport development to the south and west.
1985	▪ Not visible.
1991	▪ Not visible on 1991 (a-d).
2004	▪ No change since 1980.
2015	▪ No change since 2004.
Site H– Billy’s Bunker	
1931	▪ Predominantly vacant land, likely to be agricultural.
1960	▪ Development at the Airport visible. ▪ Surrounding land predominantly vacant paddocks.

Date	Observation
1969	▪ Airport terminals and two runways visible to the north and east. ▪ Ground disturbance visible in the vicinity of Billy's Bunker. ▪ Vacant land to the north, the F28 training area to the east and Airport development to the south and west.
1979	▪ Not visible on 1979 (a) or 1979 (b).
1980	▪ Airport terminals and two runways visible to the south and west. ▪ Ground disturbance visible in the vicinity of Bully's Bunker. ▪ Vacant land to the north, the F28 training area to the east and Airport development to the south and west.
1985	▪ Not visible.
1991	▪ Not visible on 1991 (a-d).
2004	▪ No change since 1980.
2015	▪ No change since 2004.
Site I– Joint User Hydrant Installation (JUHI)	
1931	▪ Predominantly vacant land, likely to be agricultural.
1960	▪ Development at the Airport visible. ▪ Surrounding land predominantly vacant paddocks.
1969	▪ Airport terminals and two runways visible to the west. ▪ JUHI visible. ▪ Vacant land to the north and east (potential quarrying activities to the east) and Airport development to the south and west.
1979 (a)	▪ JUHI visible. ▪ Vacant land to the north and east, lagoons to the south-east and Airport development to the west.
1980	▪ No change since 1979 (a).
1985 (a)	▪ Potential expansion of the JUHI to the north. ▪ Vacant land to the north and east, lagoons to the south-east and Airport to the west.
1991 (b)	▪ Vacant land to the north and east, ground disturbance and no lagoons to the south-east and Airport to the west.
2004	▪ Vacant land to the north and east, less ground disturbance to the south.
2015	▪ No change since 2004.

Date	Observation
Site J– Aircraft Hangars	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the north. - Building activities visible in the vicinity of the aircraft hangars. - Vacant land to the east, south and west and Airport development to the north.
1979	Not visible on 1979 (a) or 1979 (b).
1980	Not visible.
1985	Not visible.
1991 (c)	- Hangars visible in current location. - Golf course to the west and Airport to the north.
2004	No changes since 1991 (c).
2015	No change since 2004.
Site K– General Airport	
N/A	No observations in relation to general Airport areas were made.
Site L– Off Airport (L1 - Gellibrand Hill, L2 - Golf Course and L3 – AEP North of Sunbury Road)	
1931	Predominantly vacant land, likely to be agricultural.
1960	- Development at the Airport visible. - Surrounding land predominantly vacant paddocks.
1969	- Airport terminals and two runways visible to the south-west. - L1 – vacant land, with Airport development to the south-west and potential residential to the north and east. - L2 – vacant land, with Airport development to the north-east. - L3 – not visible.
1979 (a)	- L1 – vacant land to the north, east, south and west, lagoons and JUHI further to the south-west. - L2 – not visible. - L3 – not visible.

Date	Observation
1980	▪ L1 – vacant land to the east, south and west, possible ground disturbance to the north, dams and JUHI further to the south-west. ▪ L2 – not visible. ▪ L3 – vacant land.
1985 (a)	▪ L1 – vacant land to the north, east, south and west. ▪ L2 – not visible. ▪ L3 – not visible.
1991 (b) and (c)	▪ L1 – potentially visible on 1991 (b), residential? Development to the east and south, vacant land to the west. ▪ L2 – visible on 1991 (c), hangars to the east, vacant land to the north and west and Airport to the north-east. ▪ L3 – not visible on 1991 (a-d).
2004	▪ L1 – residential? Development to the east, vacant land to the south and west. ▪ L2 – no change since 1991 (c). ▪ L3 – not visible.
2015	▪ No change since 2004.

Appendix C – Summary of Provided Documentation



Table C1: Findings from Provided Documentation

Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
Provided Documentation			
22/03/98	<i>ARFF Incident Detail Report – Aircraft Crash (#595)</i>	Incident Report	▪ Melbourne Runway 27: ○ Foam used – 20 L ○ Water used – 300 L ○ Vehicles involved – ULFV5 and ULFV6
05/03/04	<i>ARFF Incident Detail Report – Fire Non-Aircraft (#5683)</i>	Incident Report	▪ APAM land, Melrose Drive: ○ Foam used – 173 L ○ Water used – 21,000 L ○ Vehicles involved – ULFV5, ULFV7, MFB, CFA, police and Airport safety
02/03/07	<i>ARFF Incident Detail Report – Fire Non-Aircraft (#8685)</i>	Incident Report	▪ ALPHA taxiway, south of Runway 27/09: ○ Foam used – 270 L ○ Water used – 4,000 L ○ Vehicles involved – ULFV6, ULFV7, RIV and Airport safety
05/05/16	<i>ARFF Site Manifest – Melbourne Satellite Fire Station Complex</i>	SFS Manifest	▪ SFS: ○ PFAS contamination may be present. ○ Storage/use of diesel – wastewater to sewer and stormwater. ○ Storage/use of kerosene – site contamination. ○ Storage/use of firefighting foam – prescribed waste.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
05/05/16	ARFF Site Manifest – Melbourne Fire Training Ground	CFTG Manifest	▪ CFTG: - o PFAS contamination may be present. - o Storage/use of kerosene – site contamination. - o Storage/use of firefighting foam – prescribed waste.
05/05/16	ARFF Site Manifest – Main Fire Station Complex	MFS Manifest	▪ MFS: - o PFAS contamination may be present. - o Storage/use of diesel – wastewater to sewer and stormwater. - o Storage/use of kerosene – site contamination. - o Storage/use of firefighting foam – prescribed waste.
Previous Investigations			
26/02/97	Melbourne Airport Groundwater Contamination Investigation Report – Extract, pages 10-14 (CH2M Hill, February 1997)	Unknown	▪ FFTG / CFTG Landfill Sites: - o Three landfills were established at the FTG by the FAC and generally received inert wastes. - o The history of the landfill operations in the FTG area have not been documented. - o Landfill 4 (3,000 m²) – located adjacent to the southern end of the fire-water sump bund wall and occupying a portion of the southern bank of the Deep Creek tributary. - o Landfill 5 (20,000 m²) – located on the crest of the fill about 500 m west of Landfill 4. - o Landfill 6 (5,000 m²) – located between Landfill 4 and Landfill 5.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
			- o Main water table would most likely be positioned in the Bulla Granodiorite. Groundwater could move along the interface between the Newer Volcanics and the Bulla Granodiorite. - o It is likely groundwater flow would be to the south-west, towards Deep Creek. - o Groundwater flow rates would be very slow through the low permeability rocks. - o The presence of thick unsaturated zone and high clay content underlying the landfills are favourable to contaminant attenuation. ▪ FFTG / CFTG Run-off Sump: - o Located to the north-east of the FTG area. - o Firefighting training has been conducted at the FTG since ~1977 by CAA. - o On average ~120,000 L of kerosene and ~20,000 L of foam are used for training each year. - o Run-off drains to the north, is collected in an underground drain from the large mock-up (LMU) area, discharges into a large sump on the banks of the valley leading into Deep Creek. - o Run-off from some of the FTG areas discharges directly into Deep Creek tributary. - o Regional groundwater is not readily susceptible to contamination because of the clayey and impermeable nature of the weathered basalt, the depth to the regional water table, the low permeability of the aquifers (Newer Volcanic basalt and Bulla Granodiorite) and the local absence of porous media type aquifers (Werribee Formation and/or Brighton Group sediments). - o Likely that perched groundwater discharges to Deep Creek.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
22/10/03	<i>Final Environmental Audit Report, Victoria Airport Services – ARFF</i> (Airservices, October 2003)	Desktop environmental audit of ARFF assets at Melbourne Airport	▪ CFTG: - o 12,000 L UST decommissioned by removing fuel and filling tank with cement slurry – contaminated soil identified in the surrounding area. - o 30,000 L AST decommissioned after all kerosene used. - o Wastewater and unburnt fuel passes through a triple interceptor. - o Possible overspray of fuel during training activities. - o AFFF passes through a triple interceptor – spillage noted as ok as AFFF is biodegradable (this is not the case). - o Lagoon inspected to ensure foam water solution held. ▪ MFS: - o Separators at the mechanical workshop and extinguisher training pad. - o Mechanical workshop is bunded and the separator discharges to sewer. There is a valve to the sewer system for vehicle wash. - o 10,000 L UST, decommissioned. - o Vehicle refuelling on hardstand and area drains to separator. - o Waste oil and batteries stored in bunded area. - o ARFF spills go to interceptor with spill retrieval facility prior to sewer discharge. - o AFFF bulk storage and drums within bunded area. - o AFFF drainage from washed hoses drains to interceptor. - o 10,000 L kerosene AST, pumped to fuel trailer via bowser. - o Spillage of 800 L of kerosene from trailer (MFS to CFTG).



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
14/01/05	<i>Monitoring of Water Quality in Fuel Separators and Groundwater Investigation Wells, Main Fire Station, Operations Road, Melbourne Airport</i> (GeoPollution Management, January 2005)	Asses the quality of wastewater being disposed to sewer via three fuel separators and sample existing groundwater wells.	▪ MFS: - o Operated from its current location since to opening of the Airport. - o Three fuel separators were installed in ~1998: - o Fuel Separator 1 – located adjacent to the MFS, a bunded area outside the workshop captures all run-off produced during cleaning of the workshop and vehicles. - o Fuel Separator 2 – located adjacent to a concrete pad used for minor fire drills, diesel, kerosene, powder and foam are separated off and the process water disposed via sewer. - o Impact (TPH) was identified in Fuel Separator 2. - o PFAS sampling was not conducted. ▪ CFTG: - o Fuel Separator 3 – located adjacent to the airplane mock-up, kerosene and foam are separated from the water, pumped to a tank and re-used at the CFTG, process water is diverted to the settling pond. - o Prior to construction of Fuel Separator 3, all wastewater was disposed via an outlet pipe to the settling pond. - o Fire retardant foam was visually observed in Fuel Separator 3. - o Groundwater well MW-1 was dry and not sampled, MW-2 was sampled. - o Impact (BTEX and TPH) was identified in MW-2. - o PFAS sampling was not conducted.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
15/08/06	<i>Groundwater Quality Assessment, Melbourne Airport (OTEK, August 2006)</i>	Review available information and evaluate groundwater quality and hydrogeologic conditions in the vicinity of the CFTG	▪ CFTG: - o Periodic sampling between 1994 and 2005 has detected TPH and surfactants (associated with AFFF) in MW-2, adjacent to the settling pond. - o Depth to perched water table is 6.7 mbgs. - o Depth to bedrock groundwater is between 25 and 40 mbgs. - o Estimated low permeability of soils between the perched water table aquifer and the bedrock aquifer groundwater with flow being in the order of 3×10^{-5} m/year. - o Estimated hydraulic conductivity of the aquifer is 350 m/year. - o Initially, all wastewater run-off was diverted directly to the settling pond. - o In 1998, a fuel separator was installed to remove kerosene from the wastewater prior to discharge to the settling pond. - o No engineering controls are in place to remove AFFF from the wastewater. - o Rainwater is also diverted from the CFTG to the settling pond via an outlet pipe that bypasses the separator. - o 3M Light Water was used until 2000. - o Ansulite is currently (2006) used. ▪ MFS: - o Two fuel separators installed to treat wastewater before discharging it to the sanitary sewer.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
19/09/07	<i>Groundwater Monitoring Well Installation, Melbourne International Airport Fire Training Ground (OTEK, September 2007).</i>	Assess the extent of dissolved kerosene and surfactant impacts identified in perched groundwater during December 2004 and August 2005 sampling events.	▪ CFTG: - o Infrastructure includes an airplane mock-up on a concrete pad, an oil-water separator and a settling pond. - o Surrounding area to the north and west is predominantly undeveloped land. - o Operated as a fire training ground since 1970, with ~15 drills/year conducted. - o Groundwater well MW-3 was installed to intersect regional groundwater for the purpose of assessing site activities. - o Groundwater well MW-3 was installed down-gradient of the CFTG with no soil impacts detected and minor groundwater impacts (kerosene and surfactants). - o PFAS sampling was not conducted.
03/04/08	<i>Sampling Event, Melbourne International Airport Fire Training Ground (OTEK, April 2008)</i>	Groundwater and surface water monitoring at the CFTG (February 2008)	▪ CFTG: - o Groundwater well MW-1 was dry and not sampled, MW-2 and MW-3 were sampled. - o The fuel interceptor discharge point was sampled. - o Impact (TPH and/or MBAS) were detected in the effluent, perched water and groundwater samples. - o Interceptor is not fully effective in removing TPH and MBAS contaminants. - o MBAS impacts may have migrated to Deep Creek. - o PFAS sampling was not conducted.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
11/11/08	<i>Sampling Event, Melbourne International Airport Fire Training Ground (OTEK, November 2008)</i>	Groundwater and surface water monitoring at the CFTG (October 2008)	▪ CFTG: - o Groundwater well MW-1 was dry and not sampled, MW-2 and MW-3 were sampled. - o The fuel interceptor discharge point was sampled. - o Impact (BTEX, TPH and/or MBAS) were detected in the effluent and perched water samples. - o Concentrations of contaminants in the oil/water separator effluent increased since February 2008. - o Interceptor is not fully effective in removing TPH and MBAS contaminants. - o MBAS impacts may have migrated to Deep Creek. - o PFAS sampling was not conducted.
20/05/09	<i>Sampling Event, Melbourne International Airport Fire Training Ground (OTEK, May 2009)</i>	Groundwater and surface water monitoring at the CFTG (March 2009)	▪ CFTG: - o Groundwater wells MW-1 and MW-2 were dry and not sampled, MW-3 was sampled. - o The fuel interceptor discharge point, the interceptor at the former UST and the interceptor at the maintenance shed were sampled. - o Impact (BTEX, TPH and/or MBAS) was detected in the fuel interceptor's effluent and the groundwater sample. - o Interceptor is not fully effective in removing BTEX, TPH and MBAS contaminants. - o No impact (above Trade Waste limits) were detected at the interceptor at the former UST and the interceptor at the maintenance shed. - o PFAS sampling was not conducted.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
14/07/09	<i>Groundwater Monitoring Event, Fire Training Ground, Melbourne International Airport, Tullamarine, Victoria (OTEK, July 2009)</i>	Groundwater monitoring at the CFTG (June 2009)	▪ CFTG: ○ Groundwater wells MW-1 and MW-2 were dry and not sampled, MW-3 was sampled. ○ No impacts (BTEX, TPH or MBAS) were detected in MW-3. ○ PFAS sampling was not conducted.
September 2008	<i>Preliminary Site Contamination Assessment, Melbourne ARFF Drill Ground, Melbourne Airport (GHD, September 2008)</i>	To provide preliminary information regarding potential contamination at the fire training ground as a result of former and current uses as a fire training ground.	▪ CFTG: ○ Site is approximately 22,000 m², 1km north of the east-west runway. ○ Defined by the edge of the gravelled area surrounding the training area to the east and south, groundwater monitoring bore MW3 to the west and the northern edge of the on-site lagoon. ○ The site is currently (2008) used as a firefighting training facility that included lighting kerosene fires and using AFFF to extinguish. ○ Wastewater runoff consisting of water, kerosene and AFFF collected from the surface of the concrete pad area drains through a sump and outflow pipe to an underground separator tank (~50m north-west of the concrete pad). It then passes through the separator system with treated water discharged to the lagoon. ○ Not all kerosene and AFFF used during training is captured on the concrete pad – overspray of up to 10m from the concrete bund area occurs. ○ Relatively flat with the circular concrete pad having a gradual slope toward the sump located at the northern edge of the concrete. The site drops away sharply to the north-west toward the lagoon and an unnamed dry creek. ○ Previously farming and agricultural land.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
			- o 28,768 L of kerosene was used from June 2007 to June 2008 and due to the similar frequency of drills this usage volume was likely to be consistent with the preceding seven years. - o 3M Light Water has not been used at the site since 2000. - o When used, the purchased 3M Light Water (6% concentration) was diluted to 3% for training purposes. - o ARFF switched from 3M Light Water to Ansulite in ~2000. - o Drills occurred on a twice-weekly basis and lasted ~15 minutes. - o A 100L spill of kerosene occurred in ~2003 which was discharged directly to the lagoon. - o Prior to 1970 there were landfilling activities in close proximity to the site – the closest known landfill is beneath groundwater Monitoring Well MW1 (~50m to the west). - o Quarrying activities were carried out around the site. - o Up until 1997, there was no concrete pad or fuel interceptor associated with the training area, with wastewater disposed of via an outlet pipe directly to the lagoon. - o Identified areas of concern included the current drill pad, former drill pad, interceptor and outlet to the lagoon, area around fuel lines and above-ground fuel tank, lagoon and former landfilling area. - o Fill material present. - o Soil, sediment and groundwater impact identified (TPH, BTEX, PAH, PFOS and/or PFOA). - o Potential risks to human health and the environment were identified,



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
August 2010	<i>Aviation Rescue and Fire Fighting (ARFF) Fire Stations Heritage Assessment, Stage 1 Report: Summary and Interim Heritage Assessments</i> (Lovell Chen, August 2010)	Heritage assessment of ARFF fire stations owned or leased by Airservices	▪ MFS (Building 9): - o Built between 1964 and 1970. - o Accessed from Operations Road. - o Located 275m west of the north/south runway and 175m south of the east/west runway. - o Originally consisted of a garage for six fire fighting vehicles, maintenance workshop facilities, an equipment room, an elevated watch room, facilities for vehicle washing, hose whip and trough and foam storage areas. The latter three were located to the west of the main complex. - o Rigid frame construction, with concrete block infill walls, aluminium windows and coloured asbestos spandrel panels. The roof was insulated low pitch metal trough cladding. Floors were reinforced concrete slabs finished in granolithic or vinyl tiles according to use. - o In 1985, a garage was added to the east of the original garage and a mechanics workshop was constructed to the north. These works resulted in interior reconfiguration. - o In 2004, a gym was constructed to the south. - o Not considered to have potential Commonwealth Heritage values. ▪ SFS (Building 110): - o Built between 1972 and 1973 and is used a support facility. - o Located on the corner of Centre Road and Francis Briggs Road, south-west of the airport. - o Single-storey building on a rectangular plan and originally consisted of a garage for four fire fighting vehicles. The eastern most bay has been adapted to a store / workshop. An integrated foam store was located in the



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
			north-west corner of the building. The original hose whip and trough are located to the north of the building. - o Steel frame construction with red brick infill walls. The roof is steel sheeting with steel fascia. - o Not considered to have potential Commonwealth Heritage values.
15/11/10	<i>Due Diligence Report, Proposed Learning Academy Hot Fire Training Ground at Melbourne Airport</i> (AECOM, November 2010)	Desktop assessment of the historical activities undertaken at the site and the potential for them to result in contamination.	▪ LAHFTG: - o Main paddock was largely vacant land consisting of grassy surface cover, a number of internal tracks and Arundel Creek on the western boundary. Remnants of previous structures (i.e. concrete footings) observed in the north-eastern corner. - o From ~1934-1961 the site was owned by farmers and a journalist. - o Since 1961 the site has been owned by federal authorities and has undergone little change from the 1930's, with the exception of construction of a bowling green in the north-eastern part of the site in the 1960's (demolished in the 1990's) and the Smoke Hut. ▪ Smoke Hut: - o Built in the late 1980's. - o Located immediately south of the paddock area, currently (2010) used for fire training activities by the Melbourne Airport Fire Brigade. - o Consisted of a two-storey cinder/brick building with areas of paved and cleared land. - o Contained a number of above and below ground structures identified as areas of potential concern (i.e. stormwater pit, triple interceptor trap, training pad, equipment storage areas and waste storage areas).



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
29/11/10	Contamination Risk Assessment, Learning Academy Hot Fire Training Ground, Air Services Australia, Tullamarine (AECOM, November 2010)	Contamination Risk Assessment at the Learning Academy Hot Fire Training Ground (LAHFTG) prior to construction.	▪ General: ○ Drilling to a maximum of 34 mbgs did not encounter groundwater (groundwater is expected at depths of at least 40-50 mbgs in the area). ○ Silty clay and basalt layers were encountered underlying the site that would potentially act as an aquiclude. ○ Potential for downward percolation of surface water into the aquifer was considered to be low. ▪ LAHFTG: ○ Paddock area (3.7 ha) has been vacant land for ~25 years. ○ Land was previously partly used as a bowling green, farmhouse and agricultural/grazing activities. ○ No ARFF activities have been undertaken in the area. ○ Low concentrations of PFOS/PFOA were detected in the southern portion of the paddock area, adjacent to the Smoke Hut – potential for historical use of AFFF. ○ Potential for up-gradient sources and wash-down activities associated with an adjacent fire engine storage compound / yard on the north-western boundary of the site. ○ Low likelihood of contamination in stormwater associated with the paddock area. ▪ Smoke Hut: ○ Smoke Hut (0.4 ha) was built 25-35 years ago. ○ ARFF activities have been undertaken in this area but AFFF has not been used.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
			- o Historical and current (2010) activities have resulted in contamination (PFOS/PFOA, TPH and PAH) of the soil and adjacent surface / stormwater – potential for historical use of AFFF. - o Contamination (PFOS/PFOA, TPH, PAH and heavy metals) in surface water sample adjacent to the Smoke Hut. - o Fill was identified in the area. - o Potential for contamination along uncontrolled drainage / stormwater channels towards Arundel Creek. - o Likely to pose potential risk to ecological and human receptors.
30/11/10	<i>Environmental Issues Report, Learning Academy – Hot Fire Training Ground – Melbourne Airport</i> (AECOM, November 2010)	Environmental characterisation and impact assessment for the development of the new LAHFTG, including a contamination risk assessment	▪ LAHFTG, identified issues included: - o Potential extent of existing soil and groundwater contamination. - o Identifying and confirming sources of contamination.
01/12/10	<i>ARFF Conceptual Site Model: Risk Assessment and Works Program, Risk Assessment Report</i> (SKM, December 2010)	Desktop based risk assessment of the potential impact from PFOS and/or PFOA, along with other CoPC associated with AFFF use.	▪ Recommended further works at the CFTG, MFS and the Smoke Hut. ▪ CFTG: - o Constructed in the 1970's, ~1 km north of the east-west runway. - o 22,000 m² defined by a gravelled area to the east and south, MW-3 to the west and the lagoon to the north. - o Training activities mainly carried out on the circular concrete pad (~10 m radius), surrounded by an area of bare earth with a sparse covering of gravel.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
			- o 100 m² disused rectangular drill pad to the north. - o Landfilling and quarrying have also occurred in this area. - o Kerosene and AFFF overspray can occur up to 10m from concrete pad during training activities. - o Main area is relatively flat and drops away sharply to the north-west towards the lagoon and an unnamed dry creek. - o Spill of 100 L of kerosene in ~2003 to the lagoon. - o 3M Light Water used until ~2000 and then replaced with Ansulite. - o Wastewater discharge impacted with BTEX, TPH and MBAS. - o Groundwater impacted by hydrocarbons and surfactants. ▪ MFS: - o ~200 m west of the north-south runway, predominantly surrounded by hardstand, with grassed areas further beyond. - o Fuel and chemical storage includes; 2 x 9,000 L AFFF tanks and 2,000 L tank for retrieval of vehicle AFFF, both in a shallow bund. - o Bund overflow to triple interceptor. - o Mechanical testing with 3M Light Water and Ansulite in grassed areas to the north and south. - o Fuel UST, located on the western side of the main building was decommissioned in 2000, with the area remediated and testing revealed no evidence of contamination. ▪ Old ARFFTE School and Smoke Hut: - o ~350 m west of the north-south runway. - o Groundcover is a mixture of grass, bare soil and hardstand. - o Residual contamination from 3M Light Water and Ansulite use.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
			- o Contamination of soil around the interceptor pits at the Smoke Hut. ▪ FFTG: - o Located to the west of the CFTG. - o Groundcover is scrubland and bare soil. - o Area was used by Airservices predecessors and wastewater was uncontained or channelled directly into a dry creek to the north of the CFTG. - o The dry creek is connected to Deep Creek.
1/06/11	Phase 1 and Phase 2 Environmental Site Assessment (ESA), 0245 ARFF Melbourne Fire Station CAT 10 Upgrade (SKM, 2011)	Assessment of background environmental conditions prior to the upgrade to describe risks from historical and current site activities in order to minimise potential environmental liabilities.	▪ MFS: - o Construction of Melbourne Airport began in 1964, with the first domestic flights in 1970. The MFS was operational at this time. - o Contamination risks included: diesel AST; kerosene fire training pad; fire retardant foams. - o AFFF was used until the end of 2009 and in June 2011 was still stored in the large AST and some 1kL IBCs. - o PFAS was detected in soil at the western end of the MFS, hydrocarbons were predominantly below LORs. - o PFAS was detected in groundwater, hydrocarbons were below the LORs. - o Western end of the MFS was deemed suitable for the proposed workshop development.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
13/06/13	<i>Ground Monitoring Event, Melbourne International Airport, Fire Training Ground, Tullamarine Vic (Connolly Environmental, June 2013)</i>	Groundwater monitoring event to assess whether wastewater present within the settling pond at the CFTG was adversely impacting on the regional groundwater aquifer	▪ CFTG: ○ Groundwater wells MW-1 was dry and not sampled, MW-2 and MW-3 were sampled. ○ Impact (MBAS) was detected in MW-2 – decreased (by a factor of 6) since last sampling event. ○ Use of AFFF was discontinued in January 2010. ○ PFAS sampling was conducted – PFOS and/or PFOA impact detected in MW-2 and MW-3. ○ Identification of PFAS contamination in MW-3 indicated contaminated water from the settling pond had entered the aquifer.
7/10/13	<i>Excavation of PFOS/PFOA Contaminated Soil at the Hot Fire Learning Academy, Melbourne Airport (EDGE, 2013)</i>	Soil sampling of (a) 50m ³ stockpiled soil adjacent to the MFS; (b) in-situ area, 1,800 m NW of the MFS (known as the Old Fire Test Ground	▪ Stockpiled soil excavated from the MFS during the upgrade works (now stored at the CFTG): ○ PFAS was detected in stockpiled soil, hydrocarbons were predominantly below the LORs. ▪ CFTG: ○ PFAS was detected in soil around the LMU, hydrocarbons were below the LORs.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
19/02/14	<i>Perfluorinated Compounds (PFC) Speculative Sampling, Deep Creek, Melbourne Airport – Report</i> (SEMF, February 2014)	Sediment and surface water sampling at Deep Creek (January 2014)	▪ CFTG: ○ None of the targeted parameters were present in the upstream sediment and surface water sampling location (USS1). ○ PFOS and 6:2 FtS were present in the downstream sediment sampling locations (DSS1 and DSS2). ○ PFOS was present in the downstream surface water sampling locations (DSS1 and DSS2).
24/10/14	<i>Aviation Rescue and Fire Fighting Services, Melbourne Airport Fire Training Ground, Groundwater Monitoring Event</i> (SEMF, October 2014)	Groundwater sampling at the CFTG	▪ CFTG: ○ Groundwater wells MW-1 was dry and not sampled, MW-2 and MW-3 were sampled. ○ Impact (TPH, PFOS, PFOA, 6:2FtS and MBAS) was detected in MW-2. ○ Impact (MBAS) was detected in MW-3.
24/10/14	<i>Aviation Rescue and Fire Fighting Services, Melbourne Airport Fire Training Ground, Surface Water Event</i> (SEMF, October 2014)	Surface water sampling at Deep Creek, down-gradient of the CFTG	▪ CFTG: ○ Three surface water locations were sampled (DSS1, DSS2 and USS1). ○ Impact (MBAS) was detected in all samples.
01/07/15	<i>Aviation Rescue and Fire Fighting Services, Melbourne Airport Fire Training Ground, Groundwater Monitoring Event</i> (SEMF, June 2016)	Groundwater sampling at the CFTG	▪ CFTG: ○ Groundwater wells MW-1 and MW-2 were dry and not sampled, MW-3 was sampled. ○ Impact (MBAS) was detected in MW-3.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
01/07/15	<i>Aviation Rescue and Fire Fighting Services, Melbourne Airport Fire Training Ground, Surface Water Event (SEMF, June 2014)</i>	Surface water sampling at Deep Creek, down-gradient of the CFTG	▪ CFTG: ○ Location DSS2 was dry and not sampled, locations DSS1 and USS1 were sampled. ○ Samples were collected from pools of stagnant water and may not be representative of the surface water quality of Deep Creek. ○ Impact (FtS and MBAS) was detected in both samples.
16/10/15	<i>Trade Waste Agreement Management (BECA, 2015)</i>	Trade waste equipment inspection and wastewater sampling	▪ Trade waste is generated at a number of facilities operated by Airservices; MFS (main washdown bay and mechanical workshop); LAHFTG; Smoke Hut; kitchen grease trap B212; mechanical workshop grease trap B330; roofed vehicle washdown bay B120; SFS washdown bay. ▪ Trade waste agreements in place for the MFS (including the mechanical workshop), the LAHFTG and the vehicle washdown bay. ▪ No trade waste agreement for the Smoke Hut. ▪ Analytical results were compliant with applicable limits in the Trade Waste Consents with the exception of pH. ▪ PFAS (particularly PFOS) analytical results were high at the MFS washdown bay; the mechanical workshop; and the Smoke Hut. PFAS is not referenced in the Trade Waste Consents.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
June 2016	<i>OneSKY Equipment Room Contamination Investigation and Risk Assessment</i> (GHD, 2016a)	Soil sampling at the OneSKY equipment room construction site located at Plant Road (NW of the LAHFTG) and a proposed stockpile location south of Plant Road	- Equipment room construction site – PFAS was detected in soil, hydrocarbons were below the LORs. - Proposed stockpile area – PFAS was detected in soil, hydrocarbons were below the LORs.
August 2016	<i>Melbourne GBAS Program, Site Contamination Assessment – Additional Sampling Event</i> (GHD, 2016b)	Soil sampling at the proposed location for GBAS installation, SE of the MFS	PFAS was detected in soil, hydrocarbons (where tested) were below the LORs.
24/05/16	<i>Melbourne Airport (Tullamarine) Fire Training Ground, April 2016 Groundwater Monitoring Event</i> (SEMF, May 2016)	Groundwater sampling at the CFTG	- CFTG: - Groundwater wells MW-1 and MW-2 were dry and not sampled, MW-3 was sampled. - Impact (MBAS) was detected in MW-3.
24/05/16	<i>Melbourne Airport (Tullamarine) Deep Creek, April 2016 Surface Water Monitoring Event</i> (SEMF, May 2016)	Surface water sampling at Deep Creek, down-gradient of the CFTG	- CFTG: - Location DSS2 was dry and not sampled, locations DSS1 and USS1 were sampled. - Samples were collected from pools of stagnant water and may not be representative of the surface water quality of Deep Creek. - Impact (PFOS, FtS and MBAS) was detected in DSS1. - Impact (FtS and MBAS) was detected in USS1.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
13/10/16	<i>Melbourne ARFF Site Sampling Report 2016 (BECA, 2016)</i>	Trade waste equipment inspection and wastewater sampling	- Trade waste is generated at a number of facilities operated by Airservices; MFS (main washdown bay and mechanical workshop); LAHFTG; Smoke Hut; kitchen grease trap B212; mechanical workshop grease trap B330; roofed vehicle washdown bay B120; SFS washdown bay; CFTG. - Trade waste agreements in place for the MFS (including the mechanical workshop), the LAHFTG and the vehicle washdown bay. - No trade waste agreement for the Smoke Hut. - Not including the CFTG, analytical results were compliant with applicable limits in the Trade Waste Consents. - Wastewater generated at the CFTG discharges to an evaporation pond and analytical results were not compliant with applicable criteria for discharge to the environment. - PFAS (particularly PFOS) analytical results were high at the MFS washdown bay; the mechanical workshop; Smoke Hut; and the CFTG. PFAS is not referenced in the Trade Waste Consents.
19/09/17	<i>Melbourne Airport (Tullamarine) Fire Training Ground, July 2017 Groundwater Monitoring Event (SEMF, September 2017)</i>	Groundwater sampling at the CFTG	- CFTG: - Groundwater wells MW-1 and MW-2 were dry and not sampled, MW-3 was sampled. - Impact (PFOS and MBAS) was detected in MW-3.



Date	Document / Report	Objective	Key AFFF- (and other CoPC-) Related Findings
28/08/17	Melbourne Airport (Tullamarine) Deep Creek, July 2017 Surface Water Monitoring Event (SEMF, August 2017)	Surface water sampling at Deep Creek, down- gradient of the CFTG	▪ CFTG: - o Samples from two locations (DSS1 and DSS2) were collected from pools of stagnant water and may not be representative of the surface water quality of Deep Creek. - o Location USS1 was sampled from flowing water. - o Impact (PFOS) was detected in DSS1. - o Impact (PFOS) was detected in DSS2. - o Elevated TDS was detected in all samples.



Appendix D – Interview Responses



Appendix D

Melbourne Airport (Tullamarine) ARFF Services – PSI

Project #: 2105.022

FINAL (REDACTED)

Table D1: Interview Responses – ARFF Personnel

No.	Question	Response
<u>ARFF Services Contact:</u> Interviewee (position & period of time working at the airport): Fire Station Manager (1 month); Fire Commander (15 years); Fire Commander (21 years); Station Officer (23 years); Leading Fire Fighter (29 years). Interview Date & Time: 13/07/16, 09:00 – 11:30 (office) & 13:00-14:30 (drive around).		
1	Where has AFFF been used at the airport?	Main Fire Station (MFS): - Monthly foam testing of the monitor on the fire trucks (to see if the correct mixture was being dispensed) along the length of the road to the south of the MFS. - Multiple accidental releases of foam (due to valve being left on) around the MFS. - Annual discharge and refilling of foam fire extinguishers on bare ground behind the MFS where the current car parking area is located. - Former truck wash down on bare ground outside the former mechanical workshop to the north of the MFS (now the gym). Previously no interceptor pit. - Previous testing of foam on the grassed area to the north of the MFS. - Foam storage – initially in 205L drums then 1kL IBCs (both on grassed areas, unbunded) then in a bulk tank (bunded). - Current truck wash bay behind the MFS, where all trucks are washed and filled with foam. The area reports to a triple interceptor pit which doesn't remove foam (potentially ineffective) and discharges to sewer under a Trade Waste Agreement. - Previously a small training drill area (open shed and a couple of steel containers/trays) underneath the new carpark at the rear of the MFS – AFFF was used there prior to any drainage infrastructure with discharge direct to soil. - Hot fire training previously conducted at the MFS. - There has been no AFFF in the new workshop. - Stockpiled soil to the south of the MFS is from the GBAS installation. Satellite Fire Station (SFS): - Trucks washed at the rear of the SFS (where current grass/table area is). - Hoses were washed in this area. - No drainage infrastructure. - Monitor testing conducted – using foam. - Was initially airside and had three trucks – all carried foam. - The SFS has never been used as the MFS. - Used to respond to a lot of first aid incidents given its proximity to the terminals.



No.	Question	Response
		Former Fire Training Ground (FFTG): ▪ Very large area extending from the top of the hill (fenced compound) down to Dry Gully (which drains into Deep Creek) – whole area was used for training. ▪ Conducted remote fire training exercises where 205L drums (containing unknown wastes from the works depot) were ignited, rolled down the hill and fire fighters ran down the hill with hoses to extinguish the fire. Resulted in large quantities of burnt/unburnt fuels as well as foam. ▪ No concrete pad or controlled drainage. ▪ 1 x 6 week recruit course would use ~30,000 L of foam concentrate. ▪ Training drills always used foam. ▪ During a training drill ½ truck load of foam (~500L) could be dispensed. ▪ During a training drill, 6 x 205L drums (fuel?) and/or 1 x 800L trailer (fuel?) could be dispensed. ▪ During a recruit course there could be up to 2 training drills/day. There have been ~51 recruit courses held at Melbourne. ▪ Station training drill at least weekly. ▪ Concrete bunker below FFTG where the remote fire training exercises using 205 L drums were conducted. ▪ Old tunnels (like mine shafts) cut into the hill below the FFTG used for rescue drills involving foam (near remaining concrete bunker). Not used post 1993. ▪ There was a garage near the old tunnels (near remaining concrete bunker). ▪ Jet A1 and kerosene (primarily) were used to light fires. ▪ Above ground kerosene tank still present within the fenced compound (unbunded). Current Fire Training Ground (CFTG): ▪ Used by operations fire fighters for training purposes. ▪ Concrete pad beneath the Large Mock-up (LMU, plane shell) with a centre drain and ring drains. ▪ Drainage reports to a holding tank where it is pumped through a coalescing plate interceptor (doesn't remove foam – potentially ineffective). Output water is gravity fed to the evaporation pond and the holding tank is pumped out by contractors as required. ▪ During a training drill ½ truck load of foam (~500L) could be dispensed. ▪ MFB have used the area (and their foam) for training exercises (early-mid 2000's). ▪ Training drills always use foam. ▪ Station training drill at least weekly. ▪ Smaller concrete pad also used for training. ▪ Adjacent to Grey Box Woodland. ▪ Adjacent stockpile of potentially contaminated soil (containment cell) excavated from the new workshop footings at the MFS.



No.	Question	Response
		Smoke Hut: ▪ Built ~1990. ▪ Adjacent to the old ARFFTE School (demolished). ▪ Hose and branch training. Often presence of residual foam in the lines as a result of training exercises at the FTG (i.e. FTG training of a morning followed by hose and branch training in the afternoon). ▪ CFA have used the area (and their foam) for training exercises (~2001). The CFA may have also used Class A foam for BA training. ▪ MFB and CFA have conducted combined drill exercises. ▪ Stockpiled material is from the demolition of the Old ARFFTE School and associated carpark. ▪ Foam was used in the area prior to construction of the Smoke Hut, there were a number of small concrete pads used for exercises. ▪ Previously burnt tyres and other accelerants in the Smoke Hut, currently burn hay/wood and use a simulated smoke machine. ▪ Perimeter drains report to an interceptor to stormwater and then Arundel Creek. Old ARFFTE School: ▪ Demolished (contained asbestos-containing materials (ACM)), training school moved to Brisbane and then returned to Melbourne when the LAHFTG was built. ▪ Adjacent to Smoke Hut, primarily within fenced compound between the Smoke Hut and Operations Road. ▪ Had a foam testing lab (small quantities). ▪ Had small concrete pad for washing hose whips. ▪ Hose and branch training in the paddock to the south using foam. ▪ Personal training equipment (chin up bars) and a running track to the rear of the Old ARFFTE School. ▪ Incinerator for burning aircraft waste (domestic). ▪ Whole area has been subject to foam. ▪ 3M Light Water was used on the 1987 recruit course. ▪ Gradient towards Arundel Creek. ▪ No drainage infrastructure (completely uncontained). Learning Academy Hot Fire Training Ground (LAHFTG): ▪ New and all recruit training (Australia wide) is conducted here. ▪ Reticulated LPG gas used as the accelerant. ▪ AFFF has never been used at the facility. ▪ Area is adjacent to the Old ARFFTE School and Smoke Hut.



No.	Question	Response
		F28 Training Area: ▪ Fokker (aircraft) frame with gravel pad (inside eastern boundary). ▪ No drainage infrastructure (completely uncontained). ▪ Area is still used for monitor checks. ▪ No foam intentionally used in the area. ▪ Potential for accidental foam release. Billy's Bunker: ▪ Adjacent to the F28 Training Area. ▪ 2 x bunkers used for daily monitor checks – primarily water but potential for residual foam discharge. ▪ No drainage, concrete hardstand. Golf Course (off Airport): ▪ AEP conducted in the paddock (prior to 2006) – may have used foam. North of Sunbury Road (off Airport): ▪ AEP conducted in the paddock (prior to 2006) – foam was used (quantity unknown). Gellibrand Hill (off Airport): ▪ High resolution approach radar – no foam storage / use. ▪ AEP conducted in 2008 – no foam used. ▪ Aircraft crash on the Airport side of Gellibrand Hill in mid-late 1980's – likely that foam was used. ▪ Joint exercises conducted with CFA, MFB, DSE/DELP – foam may have been used. Joint User Hydrant Installation (JUHI) Tank Farm non-ARFF source of PFAS): ▪ Holds 11,000,000L of fuel in above-ground tanks (Jet A1). ▪ Automatic injection suppression with ~1,000L of foam concentrate. ▪ Aircservices are the responding agency but do not maintain or train at the tank farm.



No.	Question	Response
		General Airport: ▪ Grass fires and providing back-up to CFA – only used water but potential for residual foam discharge from lines (highly diluted, ~1L concentrate). ▪ Multi-car fire in the Qantas carpark – foam was used. ▪ Terminal car park fires – foam was used. ▪ McNabs Road car fire – foam was used. ▪ House fire to the west – foam may have been used. ▪ Typically, ~300-400L of foam is used for a car fire. ▪ Truck rollover near Qantas Catering in 1983/84 – could have spilt up to ~1,000L foam (if truck was full), unknown whether foam was spilled. ▪ Drill in 1998 where 15 lengths of hose was run down the hill (to the west of the east-west runway) and foam was used. ▪ Diesel tanks at the main Airservices office buildings for back up gen sets. Hangars (non-ARFF source of PFAS): ▪ Four main hangars – Qantas, Ansett, Melbourne Jet Base and Virgin. ▪ All hangars contain foam suppression (cannons) and have had foam releases over the years. The shut off valves have been closed to prevent foam from discharging to surface water/soil. ▪ The Qantas and Ansett hangars had their own effluent treatment plants. ▪ Electroplating chemicals stored and used – cyanide, acids, TCE. ▪ Majority of maintenance is now conducted offshore. ▪ All hangars have foam fire extinguishers which are discharged and refilled annually (by others).
2	Who has used AFFF at the airport (Airservices & others)?	▪ ARFF ▪ Airlines with hangars (Qantas, Ansett, Virgin and Melbourne Jet Base). ▪ MFB ▪ Defence. ▪ CFA – minimal (20L drums)
3	What types of AFFF have been used at the airport? Quantities?	▪ 3M Light Water (~1978/1980) – quantities unknown. ▪ Ansulite (~2001) – quantities unknown.



No.	Question	Response
4	What infrastructure may be potentially impacted by AFFF use?	- Any above and below-ground infrastructure at the locations identified in question 1 (including concrete slabs, drains and waste water treatment). - Soil underneath the new concrete slab at the rear of the MFS.
5	When was AFFF used at the airport?	- Protein foam initially (from 1970's). - AFFF foam – 3M Light Water (from ~1978/1980). - AFFF foam – Ansulite (from ~2001). - Solberg RF6 (from ~2010).
6	Is there any AFFF still stored at the airport?	- No bulk storage belonging to Airservices remains. The 2 x 20 kL above-ground tanks at the MFS were removed ~6 months ago with contents disposed of at Geocycle). - Potentially still stored by others within the hangars (IBC's and fire extinguishers) and elsewhere.
7	How was AFFF delivered / used / stored / disposed of at the airport?	Delivered: - Plastic lined 205 L drums (3M Light Water). 1 kL IBCs. - Pumped from the 1 kL IBCs into the bulk tanks at the MFS. - Pumped from the bulk tanks to the trucks at the MFS (pipework still present). Used: - Training. - Extinguishing actual fires. - Dispensed from trucks and fire extinguishers. - ARFF fire extinguishers were AFFF based until 2010 when a transition to Solberg RF6 was made. Stored: - Stacked wherever there was space at the MFS. - Stored on bare ground, not bunded. - Foam is now bunded and stored at the workshop. Disposed: - Drums were used for training exercises. - IBC's were rinsed and taken home by ARFF personnel. - An excess built up and were collected and disposed of off-site.



No.	Question	Response
8	Why was AFFF used at the airport? What is now used instead?	- Fire suppression (trucks and fire extinguishers). - Solberg RF6 is now used.
9	When using AFFF, was a Standard Procedure followed?	- There was a SOP for operating the trucks which included dispensing the foam. - There was no requirement around the amount of foam dispensed (operationally if there was a fire, as much foam as necessary was used to extinguish it).
10	Have any environmental assessments been conducted at the airport?	- Yes – not sure by whom/when. - APAM are currently conducting an environmental assessment (PFAS).
11	Are you aware of any PFAS investigations and testing that have been undertaken (within and outside of the ARFF site/s)?	APAM are currently conducting an environmental assessment (PFAS).
12	Site plans showing building locations, services (including underground), stormwater drains and pits, dangerous goods storage etc?	- Underground services plans not available. - Stormwater drains are monitored by APAM. - Airport has dangerous goods storage.



No.	Question	Response
13	How old are the buildings and structures?	▪ MFS – built in 1970 and modified since. ▪ SFS – built in 1970 and modified since. ▪ Workshop at the MFS – built in 2014. The northern part of the MFS was previously the workshop. ▪ FFTG – built in 1975 and destroyed in the late 1990s. ▪ CFTG – with triple interceptor: - o Main pad with large mock-up (LMU) built in 1975. - o Smaller second concrete pad was built in ~2001. ▪ Smoke House – built in the late 1980's. ▪ Old ARFFTE School – built in 1975 and demolished in 1995.
14	Location/s & details of groundwater monitoring wells?	▪ FFTG/CFTG – 3 wells downgradient.
15	Are there any known ecologically sensitive areas (threatened flora, communities and threatened fauna) within the airport?	▪ Grey Box Woodland (to the north-east of the CFTG) – remnant and rare eucalypt woodland ecology. ▪ Gellibrand Hill – Woodlands Park (off Airport to the north-east). ▪ Thistle infestation – major weed at the Airport. ▪ Refer to the Site Manifest and the Melbourne Airport Master Plan (2013).
16	Uses, types, storage locations and quantities of chemicals at the Airport?	▪ AFFF – as above. ▪ DCP – dry chemical powder (potassium bicarbonate): - o 22.5 kg buckets in the shed at the MFS (currently 1,182 kg) - o 225kg/truck. - o Each truck is emptied once/year. - o Mainly used at the FTG and at the back of the MFS. ▪ Diesel – 10 kL above-ground tank (partitioned) at the MFS (bunded). ▪ Kerosene – 5 kL above-ground tank at the FTG (bunded). ▪ Oils, degreasers, coolant etc. – ~1.2kL total stored at the MFS workshop in drums (bunded). ▪ ACM: - o Present in the majority of buildings. - o An audit has been completed and a register developed. - o Unlikely at the FFTG/CFTG. - o Old trucks (used until 1990's) had ACM insulating the engine bay).



No.	Question	Response
17	Details of any environmental incidents (i.e. fires, chemical spills etc.)? Incident log?	▪ Truck rollovers – no foam leaked. ▪ Refer to Incident Reports: - o 595 – Aircraft Crash on the runway (1998), 20L of foam used. - o 5683 – Non-aircraft fire APAM land, Melrose Drive (2004) – 173L of foam used. - o 8685 – Non-aircraft fire ALPHA taxiway, south of runway 27/09 (2007) – 270L of foam used. - o 11266 – Mutual aid call to Whittlesea/Kinglake (2009) – 5L of foam used.
18	Are there any discharges to land and/or water?	▪ Land – historical discharge to soils in the vicinity of MFS, SFS, FFTG, CFTG, Old ARFFTE School, Smoke Hut, F28 Training Area, Billy's Bunker, hangars, any areas where a fire has been extinguished and any areas where AEP's have been conducted. ▪ Surface water – historical discharges to Deep Creek. ▪ Groundwater – potential historical discharge to groundwater.
19	Wastewater collection and treatment details?	▪ MFS – current truck wash bay behind the MFS, where all trucks are washed and filled with foam. The area reports to a triple interceptor pit which doesn't remove foam (potentially ineffective) and discharges to sewer under a Trade Waste Agreement. ▪ CFTG – drainage from the main pad reports to a holding tank where it is pumped through a coalescing plate interceptor (doesn't remove foam – potentially ineffective). Output water is gravity fed to the evaporation pond and the holding tank is pumped out by contractors as required.
20	What wastes are produced and where/how are they disposed of?	▪ Packaging / IBCs / drums – removed by contractors. ▪ Charcoal from fires – placed into a skip bin and removed by contractors.
21	Has PFAS impacted soil been taken away from the airport or moved around within the airport?	▪ During construction of the new workshop at the MFS (2014), soil remained within the footprint. ▪ During extension of the MFS (2014), soil was transported to the CFTG and placed in a designated purpose built containment cell. ▪ During demolition of the ARFFTE training school (in 1995) soil remained within the area.
22	Locations of any stockpiled material / containment areas / drains / waste disposal areas / pits / ponds / lagoons?	▪ Old ARFFTE School – stockpiled material from the demolition of the Old ARFFTE School and associated carpark. ▪ CFTG – containment cell (stockpiled material) excavated from the new workshop footings at the MFS. ▪ CFTG – evaporation pond for output water from the coalescing plate separator. ▪ West of CFTG – old quarry containing rainwater. ▪ Drainage plans not available. ▪ Pits are maintained by Airservices Property Department.



No.	Question	Response
23	Do you have any details of local geology and hydrogeology? Aerial photographs?	None provided, refer to the Melbourne Airport Master Plan (2013).
24	What are the adjacent property uses (in all directions), now and historically?	- North – private property and rural houses (north of Sunbury Road). - East – mixture of Crown and private residential land. Dumping of chemicals at a suspected tip to the East of Sunbury Road (from 1980's/1990's to ~2000). - South – light industry / golf course. - West – farmland owned by the Airport and adjusted to farmers (cows). Storage of carnival rides and houses.
25	Has fire training been undertaken in areas outside of the current fire station and/or firefighting training ground (recently or historically)?	Recently: - Following training, hoses are washed and dried at the rear of the MFS. - Following recruit training, hoses are washed and dried at the LAHFTG. Historically: - Following training, hoses were washed and dried at the old ARFFTE School or at the MFS.



No.	Question	Response
26	When AFFF was used in training, what volumes were used and what was the methodology for wash down of waste and equipment?	Former Fire Training Ground (FFTG): ▪ Training drills always used foam. ▪ During a training drill ½ truck load (~500L) of foam could be dispensed. ▪ During a training drill, 6 x 205L drums (fuel?) and/or 1 x 800L trailer (fuel?) could be dispensed. ▪ During a recruit course there could be up to 2 training drills/day. There have been ~51 recruit courses held at Melbourne. ▪ 1 x 6 week recruit course would use ~30,000 L of foam concentrate. ▪ Firefighting personnel training drill at least weekly. ▪ No concrete pad or controlled drainage. Current Fire Training Ground (CFTG): ▪ Training drills always use foam. ▪ During a training drill ½ truck load (~500L) of foam could be dispensed. ▪ Concrete pad beneath plane shell. ▪ Smaller concrete pad also used for training. ▪ Firefighting personnel training drill is held at least weekly. ▪ Drainage from the main pad reports to a holding tank where it is pumped through a coalescing plate interceptor (doesn't remove foam – potentially ineffective). Output water is gravity fed to the evaporation pond and the holding tank is pumped out by contractors as required.
27	How widely was the AFFF dispersed aerially?	▪ Dependent on the type of truck (all capable of producing a foam/water mix): ○ Large Fire Tender (LFT) – would throw foam 35-40 m (1960's). ○ Ultra Large Fire Vehicle (ULFV) Mark 5/6 50+ m – (1970's/1980's). ○ ULFV Mark 7 – 50+ (mid 1980's). ○ ULFV Mark 8 – 60-80 m (current). ▪ Potentially up to 60-80m longitudinally. ▪ In windy conditions the lateral extent was greater.



No.	Question	Response
28	What are the nearest sensitive receptors (human and environmental)? Downstream receptors for surface water?	Human: ▪ On airport – operational and maintenance staff. ▪ Off-airport – neighbouring farmland/residences. Ecological: ▪ Grey Box Woodland – north-east of the CFTG. ▪ Arundel Creek feeds into the Maribyrnong River. ▪ Jacksons Creek and Deep Creek to the west join to form the Maribyrnong River. ▪ Gellibrand Hill / Woodlands Park – north-east of the Airport (up-gradient).
29	How long have the ARFF locations been used by Airservices (and predecessor/s)?	▪ Airport firefighting services have always been provided by Airservices and its predecessors. ▪ ARFF mechanics previously serviced everything to do with the Airport (from the early 1980's until ~1988/1989). ▪ ARFF services providers have included: - o Pre 1986 – Federal Airports were owned and operated by the Commonwealth and the Department of Aviation provided ARFF services at Federal Airports. - o 16 June 1986 – the Federal Airports Corporation (FAC) was established and certain Airports were vested in the FAC. However, the ARFF function did not vest in the FAC and was undertaken by the Department of Transport and Communications (the successor to the Department of Aviation). - o 15 June 1988 – the Civil Aviation Authority (CAA) was established and had the function of providing ARFF services. - o 6 July 1995 – Airservices was established and acquired the function of providing ARFF services.
30	Who / which operation previously occupied the ARFF locations (going as far back as possible)?	As above for question 29.



Table D2: Interview Responses – Airport Personnel

No.	Question	Response
<u>Airport Contact:</u> Interviewee (position & period of time working at the airport): Melbourne Airport Environment Manager (4 years) Date & Time: 15/07/16, 16:15-16:45 (phone)		
1	Where has AFFF been used at the airport?	- Fire Training Ground (ARFF source of PFAS) – training activities. - Airport maintenance bases / hangars (non-ARFF source of PFAS) – fire suppression systems. - Joint User Hydrant Installation (JUHI) – fire suppression at the bulk fuel storage.
2	Who has used AFFF at the airport?	- Airservices. - Individual Airlines (within the hangars): - Virgin, Qantas & Melbourne Aviation Precinct. - Majority of maintenance is now done offshore. - Exon (at JUHI).
3	What types of AFFF have been used at the airport? Quantities?	3M Light Water – quantities unknown. - Ansulite – quantities unknown.
4	What infrastructure may be potentially impacted by AFFF use?	- Drainage networks. - Stormwater network. - Triple interceptor traps.
5	When was AFFF used at the airport?	Unknown.
6	Is there any AFFF still stored at the airport?	- Airservices may still store AFFF at the airport. - Exon may still store AFFF at JUHI. - AFFF may still be stored in the hangars.
7	How was AFFF delivered / used / stored / disposed of at the airport?	Unknown.
8	Why was AFFF used at the airport? What is now used instead?	- Fire suppression. - Solberg RF6 is now used by Airservices. - Current fire suppression at JUHI and the hangars is unknown.



No.	Question	Response
9	Have any environmental assessments been conducted at the airport?	- Phase 1 Environmental Site Assessment as a component of the runway development (not provided). - Environmental Site Assessments conducted by the Airport within Airservices' lease/s (not provided). - Some smaller assessments (not provided).
10	Location/s & details of groundwater monitoring wells?	- There isn't an extensive network of groundwater wells and monitoring is not regular: - Three at the Fire Training Ground. - Unknown number at the JUHI facility. - Refer to the Melbourne Airport Master Plan 2013 for the location of groundwater wells.
11	Are there any known ecologically sensitive areas (threatened flora, communities and threatened fauna) within the airport?	Refer to the Melbourne Airport Master Plan 2013 for known ecologically sensitive areas.
12	Uses, types, storage locations and quantities of chemicals at the airport?	- Primarily above-ground tanks storing fuel: - JUHI. - Hire car facilities. - Depots. - There are a couple of legacy underground fuel storage tanks – refer to the Melbourne Airport Master Plan 2013.
13	Details of any environmental incidents (i.e. fires, chemical spills etc.)? Incident log?	There have been no major environmental incidents.
14	Are there any discharges to land and/or water?	Refer to the Melbourne Airport Master Plan 2013 for the number and location of catchment areas that the Airport discharges into.
15	Wastewater collection and treatment details?	- There is no dedicated Wastewater Treatment Plant (WWTP) for the Airport. - Each tenant is responsible for their own wastewater treatment and each have their own Trade Waste Agreement.
16	Has PFAS impacted soil been taken away from the airport or moved around within the airport?	- Not to Melbourne Airport Environmental Manager's knowledge. - Airservices would have the most PFAS impacted soil.



No.	Question	Response
17	Locations of any stockpiled material / containment areas / drains / waste disposal areas / pits / ponds / lagoons?	▪ Stockpiled material – at the FTG from Airservices activities. ▪ Containment areas – evaporation pond at the FTG. ▪ Dam – at the Golf Club on Arundel Creek (discharge point for the Airport), no results were provided.
18	Details of local geology and hydrogeology? Aerial photographs?	▪ Unknown – refer to the Melbourne Airport Master Plan 2013 for details pf local geology and hydrogeology.
19	What are the adjacent property uses (in all directions), now and historically?	▪ Refer to the Melbourne Airport Master Plan 2013.
20	What are the nearest sensitive receptors (human and environmental)?	▪ Human health – Airport workers and maintenance personnel. ▪ Ecological – Grey Box Forrest, Arundel Creek, Deep Creek, Growling Grass Frog (area surrounding Moonee Ponds Creek) and natural grasslands. ▪ Refer to the Melbourne Airport Master Plan 2013 for environmentally significant areas.
21	How long has the ARFF location been used by Airservices (and predecessor/s)?	▪ Unknown.
22	Who / which operation previously occupied the ARFF Location (going as far back as possible)?	▪ Unknown.



Appendix E – AFFF Usage Site Inspection Findings



Table E1: AFFF Usage Site Inspections Findings

Inspected Feature	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L
	MFS	SFS	FFTG	CFTG	Smoke Hut	Old ARFFTE School	F28 Training Area	Billy's Bunker	JUHI	Aircraft Hangars	Operational Response Sites within the Airport	Off Airport
Disturbed, coloured or stained soil	None observed	None observed	Highly disturbed area	In places	In places	None observed	None observed	None observed	None observed	Not inspected	Not inspected	Not inspected
Bare soil patches	None observed	None observed	In places	In places	In places	In places	None observed	In places	In places	Not inspected	Not inspected	Not inspected
Disturbed or distressed vegetation	Changes in vegetation noted	None observed	None observed	None observed	Changes in vegetation noted	None observed	None observed	None observed	None observed	Not inspected	Not inspected	Not inspected
Unusual odour	None observed	None observed	None observed	None observed	None observed	None observed	None observed	None observed	None observed	Not inspected	Not inspected	Not inspected
Quality of surface water, sheens	None observed	None observed	Foam observed on a surface puddle	None observed	None observed	None observed	None observed	None observed	None observed	Not inspected	Not inspected	Not inspected
Topography and surface water drainage	Relatively flat, EVT drainage is to interceptor and then to sewer, stormwater drainage to adjacent paddock	Relatively flat, drainage to stormwater	Relatively flat, no drainage infrastructure with drainage towards Deep Creek	Relatively flat then drops off sharply towards Deep Creek	Relatively flat, drainage to interceptor, stormwater drainage to adjacent paddock	Relatively flat, drainage was uncontained	Relatively flat, drainage uncontained	Relatively flat, drainage uncontained	Relatively flat, drainage is to interceptor and then to sewer	Not inspected	Not inspected	Not inspected
Groundwater bores	One well	None observed	None observed	Three wells down-gradient	None observed	None observed	None observed	None observed	None observed	Not inspected	Not inspected	Not inspected
Buildings and roads	Building condition in line with age, roads in good condition	Building condition in line with age, roads in good condition	No buildings, roads are unsealed gravel	No buildings, roads are unsealed gravel	Structure condition in line with age, roads are bitumen	Buildings demolished, roads are unsealed gravel	Structure condition in line with age, roads are bitumen and unsealed gravel	No buildings, roads are bitumen	Building and structure condition in line with age, roads in good condition	Not inspected	Not inspected	Not inspected

Inspected Feature	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L
	MFS	SFS	FFTG	CFTG	Smoke Hut	Old ARFFTE School	F28 Training Area	Billy's Bunker	JUHI	Aircraft Hangars	Operational Response Sites within the Airport	Off Airport
Presence of stockpiles, fill, containment areas, sumps, drains and waste disposal areas	No fill, waste disposal or containment areas observed, two interceptors with drainage to sewer Stockpile from GBAS installation to the south	No stockpiles, fill, waste disposal, sumps or containment areas observed, drainage to stormwater	No stockpiles, fill, waste disposal, sumps or containment areas observed	Soil stockpile from MFS upgrade, previous landfill activities, drainage is to a holding tank, interceptor and ultimately the evaporation pond	Soil stockpile from demolition of Old ARFFTE School and associated car park, drainage interceptor then stormwater	Soil stockpile from demolition of Old ARFFTE School and associated car park, drainage was uncontained	Adjacent soil stockpiles (origin unknown), drainage uncontained	Adjacent soil stockpiles (origin unknown), drainage uncontained	Potential vegetated soil stockpiles adjacent, drainage is to interceptor and then to sewer	Not inspected	Not inspected	Not inspected
Evidence of cut and fill activities	None observed	None observed	None observed	Potentially as area has been used for quarry and landfill activities	None observed	None observed	None observed	None observed	Potentially	Not inspected	Not inspected	Not inspected
Presence of pits, ponds and lagoons	No ponds / lagoons observed, stormwater and triple interceptor pits present	No ponds / lagoons / pits	No ponds / lagoons / pits	Evaporation pond, interceptor pit	No ponds / lagoons / pits	No ponds / lagoons / pits	No ponds / lagoons / pits	No ponds / lagoons / pits	No ponds / lagoons observed, stormwater and interceptor pits present	Not inspected	Not inspected	Not inspected
Chemical storage tanks and infrastructure	10kL diesel AST (bunded), packaged oils / degreasers / coolants at the workshop (bunded)	None observed	Disused 20kL? kerosene AST (unbunded) within fenced compound	5kL kerosene AST (bunded)	LPG cylinder	None observed	None observed	None observed	11,000,000 L of fuel in above-ground tanks (bunded)	Not inspected	Not inspected	Not inspected
Underground infrastructure	Drainage network	Drainage network	None observed	Drainage is to a holding tank, interceptor and ultimately the evaporation pond	Drainage to interceptor then stormwater	Drainage was uncontained	Drainage uncontained	Drainage uncontained	Drainage network	Not inspected	Not inspected	Not inspected

Inspected Feature	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L
	MFS	SFS	FFTG	CFTG	Smoke Hut	Old ARFFTE School	F28 Training Area	Billy's Bunker	JUHI	Aircraft Hangars	Operational Response Sites within the Airport	Off Airport
Condition of chemical storage facilities	Good	None observed	Poor	Good	None observed	None observed	None observed	None observed	Average	Not inspected	Not inspected	Not inspected
Evidence of chemical spillage	None observed	None observed	Staining in places	Staining in places	Staining in places	Staining in places	Staining in places	None observed	None observed	Not inspected	Not inspected	Not inspected



Appendix F – Interim Assessment Criteria



Table F1: Guideline Criteria – Commonwealth Airports – Interim Soil Assessment Criteria

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
Full PFAS Suite (as commercially available from ALS)	PFOS	Human Health	Residential – 6 mg/kg	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			Low / High density residential - 22 mg/kg / 90 mg/kg (PFOS + PFHxS)	GHD, 2016 ²
			Recreational Public Open Space - 45 mg/kg (PFOS + PFHxS)	GHD, 2016 ²
			Commercial / Industrial - 640 mg/kg (PFOS + PFHxS)	GHD, 2016 ²
		Ecological	0.373 mg/kg (95% protection) 0.91 mg/kg (80% protection) 4.71 mg/kg (commercial/industrial 60% protection)	UK Environmental Agency 2009: Refer GHD Guide June 2015 ¹ .
	PFOA	Human Health	Residential - 16 mg/kg	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			Low / High density residential - 220 mg/kg / 900 mg/kg	GHD, 2016 ²
			Recreational Public Open Space - 450 mg/kg	GHD, 2016 ²
			Commercial / Industrial - 6400 mg/kg	GHD, 2016 ²
		Ecological	3.73 mg/kg	Refer GHD Guide June 2015 ¹ .
	8:2FtS	Human Health	16 mg/kg (Residential)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
		Ecological	3.73 mg/kg	Refer GHD Guide June 2015 ¹ .
	6:2FtS	Human Health	60 mg/kg (Residential)	Refer GHD Guide June 2015 ¹ .
		Ecological	3.73 mg/kg	As for 8:2FtS (based on being a sulphonate and not known to break down readily) - Refer GHD Guide June 2015 ¹ .
Hydrocarbons (TRH / TPH)#	TRH C ₆ -C ₁₀	Human Health	82,000 mg/kg	CRC CARE ³ HSL A Direct Contact – Intrusive / Maintenance Worker.
	TRH C ₁₀ -C ₁₆		62,000 mg/kg	
	TRH C ₁₆ -C ₃₄		85,000 mg/kg	
	TRH C ₃₄ -C ₄₀		120,000 mg/kg	
	TPH (C ₆ -C ₉)#	Ecological	800 mg/kg (Airport generally)	Commonwealth Airports (Environment Protection) Regulations 1997
			100 mg/kg (areas of Env. Significance)	
	TPH (>C ₉)#		5,000 mg/kg (Airport generally)	
			1,000 mg/kg (areas of Env. Significance)	
Volatile Monocyclic Aromatic Hydrocarbons (BTEXN)	Benzene	Human Health	1 mg/kg	Commonwealth Airports (Environment Protection) Regulations 1997
	Toluene		130 mg/kg	
	Ethyl-benzene		50 mg/kg	

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
	(o-, m-&p-)-xylenes		25 mg/kg	
	Naphthalene		-	
	Benzene	Ecological	0.5 mg/kg	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
	Toluene		3 mg/kg	
	Ethyl-benzene		5 mg/kg	
	(o-, m-&p-)-xylenes		5 mg/kg	
	Naphthalene		-	
Polycyclic Aromatic Hydrocarbons (PAHs)	Benzo(a)pyrene	Human Health	5 mg/kg	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
		Ecological	0.7 mg/kg~	National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013
	Total PAH	Human Health	100 mg/kg	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
		Ecological	5 mg/kg	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>

Notes:

- # There are no TRH criteria given in the referenced guidelines, hence only TPH criteria are provided in the above table.
- ‘-‘ not given in guideline.
- ~ level is for areas of ecological significance, urban residential and public open space and commercial and industrial.
- PFAS and TPH / TRH criteria were adopted from Preliminary Site Investigations (PSI) Screening Levels, Draft, Airservices 4 October 2016.

References:

- 1- *Interim Screening Levels from Managing PFC Contamination at Airports Interim Contamination Management Strategy and Decision Framework* (GHD, June 2015).
- 2- *PFAS Investigations – Derivation of PFAS Soil Criteria*, (GHD, 28 September 2016).
- 3- *Table B4, Intrusive Maintenance Worker and Direct Contact Health Screening Levels, in CRC Care Technical Report No. 10, Health Screening Levels for Petroleum Hydrocarbons in soil and groundwater, Part 2: Application Document, September 2011.*

Table F2: Guideline Criteria – Commonwealth Airports – Interim Surface Water Assessment Criteria

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
Full PFAS Suite (as commercially available from ALS)	PFOS	Human Health	0.07 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			0.7 µg/L (recreational water quality)	
			0.2 µg/L (drinking water quality)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			0.00065 µg/L (consumption of fish)	
			0.5 µg/L (drinking water quality)	enhealth June 2016 ² .
			5 µg/L (recreational water quality)	
		Ecological	6.66 µg/L %	GHD Guide June 2015 ¹ .
	PFHxS	Human Health	0.07 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			0.7 µg/L (recreational water quality)	
			0.5 µg/L (drinking water quality)	enhealth June 2016 ² .
			5 µg/L (recreational water quality)	
		Ecological	6.66 µg/L %	Adopted from PFOS surface water level in GHD Guide June 2015 ¹ . Inclusion reflects enHealth identifying PFHxS and PFOS as toxicologically aligned.
	PFOS/PFHxS	Human Health	0.07 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			0.7 µg/L (recreational water quality)	
			0.5 µg/L (drinking water quality)	enhealth June 2016 ² .
			5 µg/L (recreational water quality)	
		Ecological	6.66 µg/L	Adopted from PFOS surface water level in GHD Guide June 2015 ¹ . Inclusion reflects enHealth identifying PFHxS and PFOS as toxicologically aligned.
	PFOA	Human Health	0.56 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			5.6 µg/L (recreational water quality)	
			0.4 µg/L (drinking water quality)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			0.3 µg/L (consumption of fish)	
			5 µg/L (drinking water quality)	enhealth June 2016 ² .
			50 µg/L (recreational water quality)	
		Ecological	2900 µg/L	GHD Guide June 2015 ¹ .
	8:2FtS	Human Health	0.4 µg/L (drinking water quality)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			0.3 µg/L (consumption of fish)	GHD Guide June 2015 ¹ .
			5 µg/L (drinking water quality)	Adopting enHealth June 2016 ² level for PFOA on basis 8:2FtS is able to breakdown to PFOA (assume one to one ratio).
			50 µg/L (recreational water quality)	
		Ecological	2900 µg/L	GHD Guide June 2015 ¹ .

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
	6:2FtS	Human Health	5 µg/L (drinking water quality)	Refer GHD Guide June 2015 ¹ .
			0.0065 µg/L (consumption of fish)	GHD Guide June 2015 ¹ .
		Ecological	2900 µg/L	As for 8:2FtS (based on being a sulphonate and not known to break down readily) - GHD Guide June 2015 ¹ .
Hydrocarbons (TPH / TRH)#	TRH C ₆ -C ₁₀	Human Health	15 µg/L	WHO, 2008 ³ [Petroleum Products in Drinking Water]
	TRH C ₁₀ -C ₁₆		0.09 µg/L	
	TRH C ₁₆ -C ₃₄			
	TRH C ₃₄ -C ₄₀			
	TPH (C ₆ -C ₉)	Ecological	150 µg/L (freshwater)	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
	TPH (>C ₉)		600 µg/L (freshwater)	
Volatile Monocyclic Aromatic Hydrocarbons (BTEXN)	Benzene	Ecological	300 µg/L (freshwater and marine water)	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
	Toluene		300 µg/L (freshwater)	
	Ethyl-benzene		140 µg/L (freshwater)	
	Benzene	Human Health	10 µg/L (drinking water)	WHO, 2005 ⁴
	Toluene		700 µg/L (drinking water)	
	m, o & p-xylenes		300 µg/L (drinking water)	
	Benzene	Ecological	950 µg/L (freshwater); 700 µg/L (marine water)	ANZECC 95% of species protection ⁵
	Toluene		-	
	Ethyl-benzene		-	
	o-xylene		350 µg/L (freshwater)	
	m-xylene		-	
	p-xylene		200 µg/L (freshwater)	
	Naphthalene		16 µg/L (freshwater); 70 µg/L (marine water)	
Polycyclic Aromatic	Benzo(a)pyrene		-	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
	Benzo(a)pyrene		0.01 µg/L (drinking water)	NHMRC ⁶

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
Hydrocarbons (PAHs)	Total PAH		3 µg/L (freshwater and marine water)	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
Physical Parameters	pH (pH units)	Ecological	6.5-9.5 pH unit (accepted limit for fresh water) *	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
			6.5-8.0 pH (fresh water) *	ANZECC 95% of species protection ⁵
			8.0-8.4 pH (marine water) *	
	Conductivity		2,200 µS/cm (fresh & marine waters) *	ANZECC 95% of species protection ⁵
	TSS (mS/cm)		Changes of >10% from seasonal mean~	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
	TDS (mg/L)		Rises >1,000mg/L or by >5%~	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
	Redox (mV)		-	
	DO (mg/L)		Falls <6mg/L or to 80% of average saturation level~	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>
			Falls below 85% of average saturation (fresh water)* Falls below 90% of average saturation (marine water)*	ANZECC 95% of species protection ⁵
	Temperature (°C)		Rises of >2°C above seasonal average~	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>

Notes:

- # If TRH criteria are not given in the referenced guidelines, only TPH criteria are provided in the above table.
- ~ Seasonal surface water averages will need to be provided by Airservices for meaningful comparison of field parameters to guideline criteria.
- * Fresh water means water containing Total Dissolved Solids of less than 1,000 mg/L (AEPR, 1997).
- '-' not given in guideline.

References:

- 1- US EPA Fact Sheet – PFOA & PFOS Drinking Water Health Advisories (US EPA, May 2016), referenced in Interim Screening Levels from Managing PFC Contamination at Airports Interim Contamination Management Strategy and Decision Framework (GHD, June 2015)..
- 2- enHealth Statement: Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia (enHealth, June 2016).
- 3- Petroleum Products in Drinking Water – Background document for Development of WHO Guidelines for Drinking-water Quality, WHO, 2008
- 4- Petroleum Products in Drinking Water – Background document for Development of WHO Guidelines for Drinking-water Quality, WHO, 2005
- 5- ANZECC National Water Quality Management Strategy – Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).
- 6- National Health and Medical Research Council, Investigation Levels for Drinking Water (2011).
- 7- Food Standards Australia New Zealand, Toxicity Reference Values (PFOS, PFHxS and PFOA) in Drinking Water and Recreational Water (2017).

Table F3: Guideline Criteria – Commonwealth Airports – Interim Groundwater Assessment Criteria

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
Full PFAS Suite as commercially available from ALS	PFOS	Human Health	0.07 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			0.7 µg/L (recreational water quality)	
			0.2 µg/L (drinking water quality)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			0.5 µg/L (drinking water quality)	
			5 µg/L (recreational water quality)	
		Ecological	6.66 µg/L %	Adopted surface water level in GHD Guide June 2015 ¹ .
	PFHxS	Human Health	0.07 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			0.7 µg/L (recreational water quality)	
			0.5 µg/L (drinking water quality)	enhealth June 2016 ² .
			5 µg/L (recreational water quality)	
		Ecological	6.66 µg/L %	Adopted from PFOS surface water level in GHD Guide June 2015 ¹ . Inclusion reflects enHealth identifying PFHxS and PFOS as toxicologically aligned.
	PFOS/PFHxS	Human Health	0.07 µg/L (drinking water quality)	FSANZ April 2017 ⁷ – toxicity reference values
			0.7 µg/L (recreational water quality)	
			0.5 µg/L (drinking water quality)	enhealth June 2016 ² .
			5 µg/L (recreational water quality)	
		Ecological	6.66 µg/L %	Adopted from PFOS surface water level in GHD Guide June 2015 ¹ . Inclusion reflects enHealth identifying PFHxS and PFOS as toxicologically aligned.
	PFOA	Human Health	0.56 µg/L (toxicity reference value – drinking water)	FSANZ April 2017 ⁷ – toxicity reference values
			5.6 µg/L (recreational water quality)	
			0.4 µg/L (drinking water quality)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			5 µg/L (drinking water quality)	enhealth June 2016 ² .
			50 µg/L (recreational water quality)	
		Ecological	2900 µg/L %	Adopted from PFOA surface water level in GHD Guide June 2015 ¹ .
	8:2FtS	Human Health	0.4 µg/L (drinking water quality)	US EPA 2009; Refer GHD Guide June 2015 ¹ .
			5 µg/L (drinking water quality)	Adopting enHealth June 2016 level for PFOA on basis 8:2FtS is able to breakdown to PFOA (assume one to one ratio).
			50 µg/L (recreational water quality)	
		Ecological	2900 µg/L %	Adopted from 8:2FtS surface water level in GHD Guide June 2015 ¹ .
	6:2FtS	Human Health	5 µg/L (drinking water quality)	Refer GHD Guide June 2015 ¹ .
		Ecological	2900 µg/L %	As for 8:2FtS (based on being a sulphonate and not known to break down readily) Refer GHD Guide June 2015 ¹ .

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
Hydrocarbons (TRH/TPH)#	TRH C ₆ -C ₁₀	Human Health	15 µg/L	WHO, 2008 [Petroleum Products in Drinking Water]
	TRH C ₁₀ -C ₁₆		0.09 µg/L	
	TRH C ₁₆ -C ₃₄			
	TRH C ₃₄ -C ₄₀			
	TPH (C ₆ -C ₉)	Ecological	150 µg/L (freshwater)	Commonwealth Airports (Environment Protection) Regulations 1997
	TPH (>C ₉)		600 µg/L (freshwater)	
Volatile Monocyclic Aromatic Hydrocarbons (BTEXN)	Benzene	Ecological	300 µg/L (freshwater and marine water)	Commonwealth Airports (Environment Protection) Regulations 1997
	Toluene		300 µg/L (freshwater)	
	Ethyl-benzene		140 µg/L (freshwater)	
	Benzene	Human Health	10 µg/L (drinking water)	WHO, 2005 ⁴
	Toluene		700 µg/L (drinking water)	
	m, o & p-xylenes		300 µg/L (drinking water)	
	Benzene	Ecological	950 µg/L (freshwater); 700 µg/L (marine water)	ANZECC 95% of species protection ⁵
	Toluene		-	
	Ethyl-benzene		-	
	o-xylene		350 µg/L (freshwater)	
	m-xylene		-	
	p-xylene		200 µg/L (freshwater)	
	Naphthalene		16 µg/L (freshwater); 70 µg/L (marine water)	
Polycyclic Aromatic Hydrocarbons (PAHs)	Benzo(a)pyrene		-	Commonwealth Airports (Environment Protection) Regulations 1997
	Benzo(a)pyrene		0.01 µg/L (drinking water)	NHMRC ⁶
	Total PAH		3 µg/L (freshwater and marine water)	Commonwealth Airports (Environment Protection) Regulations 1997
Physical Parameters	pH (pH units)	Ecological	6.5-9.5 pH unit (accepted limit for fresh water) *	Commonwealth Airports (Environment Protection) Regulations 1997
			6.5-8.0 pH (fresh water) *	ANZECC 95% of species protection ⁵
			8.0-8.4 pH (marine water) *	
	Conductivity		2,200 µS/cm (fresh & marine waters) *	ANZECC 95% of species protection ⁵
	TSS (mS/cm)		Changes of >10% from seasonal mean~	Commonwealth Airports (Environment Protection) Regulations 1997
	TDS (mg/L)		Rises >1,000mg/L or by >5%~	Commonwealth Airports (Environment Protection) Regulations 1997
	Redox (mV)		-	
	DO (mg/L)		Falls <6mg/L or to 80% of average saturation level~	Commonwealth Airports (Environment Protection) Regulations 1997

Analyte Suite	Analytes to be assessed	Exposure Scenario	Assessment Criteria	Reference
			Falls below 85% of average saturation (fresh water)* Falls below 90% of average saturation (marine water)*	ANZECC 95% of species protection ⁵
	Temperature (°C)		Rises of >2°C above seasonal average~	Commonwealth <i>Airports (Environment Protection) Regulations 1997</i>

Notes:

- # If TRH criteria are not given in the referenced guidelines, only TPH criteria are provided in the above table.
- ~ Seasonal surface water averages will need to be provided by Airservices for meaningful comparison of field parameters to guideline criteria.
- * Fresh water means water containing Total Dissolved Solids of less than 1,000 mg/L (AEPR, 1997).
- '-' not given in guideline.
- % Only given as reference level – assessment of environmental impact must relate to the discharge (including contamination mass flux) of impacted groundwater to a surface water body, and resultant likely impact on the aquatic/marine ecosystems. Refer to GHD Guide June 2015.

References:

- 1- *US EPA Fact Sheet – PFOA & PFOS Drinking Water Health Advisories (US EPA, May 2016), referenced in Interim Screening Levels from Managing PFC Contamination at Airports Interim Contamination Management Strategy and Decision Framework (GHD, June 2015).*
- 2- *enHealth Statement: Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia* (enHealth, June 2016).
- 3- *Petroleum Products in Drinking Water – Background document for Development of WHO Guidelines for Drinking-water Quality*, WHO, 2008
- 4- *Petroleum Products in Drinking Water – Background document for Development of WHO Guidelines for Drinking-water Quality*, WHO, 2005
- 5- *ANZECC National Water Quality Management Strategy – Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000).
- 6- *National Health and Medical Research Council, Investigation Levels for Drinking Water* (2011).
- 7- *Food Standards Australia New Zealand, Toxicity Reference Values (PFOS, PFHxS and PFOA) in Drinking Water and Recreational Water* (2017).

Appendix G – PSI Sampling and Past Results Summary Tables



SUMMARY RESULTS ISSUED FOR MELBOURNE AIRPORT PSI - SOIL & SEDIMENT

TPH/TRH, PAH, BTEXN & PFAS				Analyte Grouping	TPH								TRH								PAH								BTEXN								PFAS											
				Analyte		Criteria		Guideline Limit		Units		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg
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TPH/TRH, PAH, BTEXN & PFAS				Analyte Grouping	TPH								TRH								PAH								BTEXN								PFAS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
				Analyte	C6-C9				C10-C16				C17-C24				C25-C32				C33-C40				C41-C48				C49-C56				C57-C64				C65-C72				C73-C80				C81-C88				C89-C96				C97-C104				C105-C112				C113-C120				C121-C128				C129-C136				C137-C144				C145-C152				C153-C160				C161-C168				C169-C176				C177-C184				C185-C192				C193-C200				C201-C208				C209-C216				C217-C224				C225-C232				C233-C240				C241-C248				C249-C256				C257-C264				C265-C272				C273-C280				C281-C288				C289-C296				C297-C304				C305-C312				C313-C320				C321-C328				C329-C336				C337-C344				C345-C352				C353-C360				C361-C368				C369-C376				C377-C384				C385-C392				C393-C400				C401-C408				C409-C416				C417-C424				C425-C432				C433-C440				C441-C448				C449-C456				C457-C464				C465-C472				C473-C480				C481-C488				C489-C496				C497-C504				C505-C512				C513-C520				C521-C528				C529-C536				C537-C544				C545-C552				C553-C560				C561-C568				C569-C576				C577-C584				C585-C592				C593-C600				C601-C608				C609-C616				C617-C624				C625-C632				C633-C640				C641-C648				C649-C656				C657-C664				C665-C672				C673-C680				C681-C688				C689-C696				C697-C704				C705-C712				C713-C720				C721-C728				C729-C736				C737-C744				C745-C752				C753-C760				C761-C768				C769-C776				C777-C784				C785-C792				C793-C800				C801-C808				C809-C816				C817-C824				C825-C832				C833-C840				C841-C848				C849-C856				C857-C864				C865-C872				C873-C880				C881-C888				C889-C896				C897-C904				C905-C912				C913-C920				C921-C928				C929-C936				C937-C944				C945-C952				C953-C960				C961-C968				C969-C976				C977-C984				C985-C992				C993-C1000				C1001-C1008				C1009-C1016				C1017-C1024				C1025-C1032				C1033-C1040				C1041-C1048				C1049-C1056				C1057-C1064				C1065-C1072				C1073-C1080				C1081-C1088				C1089-C1096				C1097-C1104				C1105-C1112				C1113-C1120				C1121-C1128				C1129-C1136				C1137-C1144				C1145-C1152				C1153-C1160				C1161-C1168				C1169-C1176				C1177-C1184				C1185-C1192				C1193-C1200				C1201-C1208				C1209-C1216				C1217-C1224				C1225-C1232				C1233-C1240				C1241-C1248				C1249-C1256				C1257-C1264				C1265-C1272				C1273-C1280				C1281-C1288				C1289-C1296				C1297-C1304				C1305-C1312				C1313-C1320				C1321-C1328				C1329-C1336				C1337-C1344				C1345-C1352				C1353-C1360				C1361-C1368				C1369-C1376				C1377-C1384				C1385-C1392				C1393-C1400				C1401-C1408				C1409-C1416				C1417-C1424				C1425-C1432				C1433-C1440				C1441-C1448				C1449-C1456				C1457-C1464				C1465-C1472				C1473-C1480				C1481-C1488				C1489-C1496				C1497-C1504				C1505-C1512				C1513-C1520				C1521-C1528				C1529-C1536				C1537-C1544				C1545-C1552				C1553-C1560				C1561-C1568				C1569-C1576				C1577-C1584				C1585-C1592				C1593-C1600				C1601-C1608				C1609-C1616				C1617-C1624				C1625-C1632				C1633-C1640				C1641-C1648				C1649-C1656				C1657-C1664				C1665-C1672				C1673-C1680				C1681-C1688				C1689-C1696				C1697-C1704				C1705-C1712				C1713-C1720				C1721-C1728				C1729-C1736				C1737-C1744				C1745-C1752				C1753-C1760				C1761-C1768				C1769-C1776				C1777-C1784				C1785-C1792				C1793-C1800				C1801-C1808				C1809-C1816				C1817-C1824				C1825-C1832				C1833-C1840				C1841-C1848				C1849-C1856				C1857-C1864				C1865-C1872				C1873-C1880				C1881-C1888				C1889-C1896				C1897-C1904				C1905-C1912				C1913-C1920				C1921-C1928				C1929-C1936				C1937-C1944				C1945-C1952				C1953-C1960				C1961-C1968				C1969-C1976				C1977-C1984				C1985-C1992				C1993-C2000				C2001-C2008				C2009-C2016				C2017-C2024				C2025-C2032				C2033-C2040				C2041-C2048				C2049-C2056				C2057-C2064				C2065-C2072				C2073-C2080				C2081-C2088				C2089-C2096				C2097-C2104				C2105-C2112				C2113-C2120				C2121-C2128				C2129-C2136				C2137-C2144				C2145-C2152				C2153-C2160				C2161-C2168				C2169-C2176				C2177-C2184				C2185-C2192				C2193-C2200				C2201-C2208				C2209-C2216				C2217-C2224				C2225-C2232				C2233-C2240				C2241-C2248				C2249-C2256				C2257-C2264				C2265-C2272				C2273-C2280				C2281-C2288				C2289-C2296				C2297-C2304				C2305-C2312				C2313-C2320				C2321-C2328				C2329-C2336				C2337-C2344				C2345-C2352				C2353-C2360				C2361-C2368				C2369-C2376				C2377-C2384				C2385-C2392				C2393-C2400				C2401-C2408				C2409-C2416				C2417-C2424				C2425-C2432				C2433-C2440				C2441-C2448				C2449-C2456				C2457-C2464				C2465-C2472				C2473-C2480				C2481-C2488				C2489-C2496				C2497-C2504				C2505-C2512				C2513-C2520				C2521-C2528				C2529-C2536				C2537-C2544				C2545-C2552				C2553-C2560				C2561-C2568				C2569-C2576				C2577-C2584				C2585-C2592				C2593-C2600				C2601-C2608				C2609-C2616				C2617-C2624				C2625-C2632				C2633-C2640				C2641-C2648				C2649-C2656				C2657-C2664				C2665-C2672				C2673-C2680				C2681-C2688				C2689-C2696				C2697-C2704				C2705-C2712				C2713-C2720				C2721-C2728				C2729-C2736				C2737-C2744				C2745-C2752				C2753-C2760				C2761-C2768				C2769-C2776				C2777-C2784				C2785-C2792				C2793-C2800				C2801-C2808				C2809-C2816				C2817-C2824				C2825-C2832				C2833-C2840				C2841-C2848				C2849-C2856				C2857-C2864				C2865-C2872				C2873-C2880				C2881-C2888				C2889-C2896				C2897-C2904				C2905-C2912				C2913-C2920				C2921-C2928				C2929-C2936				C2937-C2944				C2945-C2952				C2953-C2960				C2961-C2968				C2969-C2976				C2977-C2984				C2985-C2992				C2993-C3000				C3001-C3008				C3009-C3016				C3017-C3024				C3025-C3032				C3033-C3040				C3041-C3048				C3049-C3056				C3057-C3064				C3065-C3072				C3073-C3080				C3081-C3088				C3089-C3096				C3097-C3104				C3105-C3112				C3113-C3120				C3121-C3128				C3129-C3136				C3137-C3144				C3145-C3152				C3153-C3160				C3161-C3168				C3169-C3176				C3177-C3184				C3185-C3192				C3193-C3200				C3201-C3208				C3209-C3216				C3217-C3224				C3225-C3232				C3233-C3240				C3241-C3248				C3249-C3256				C3257-C3264				C3265-C3272				C3273-C3280				C3281-C3288				C3289-C3296				C3297-C3304				C3305-C3312				C3313-C3320				C3321-C3328				C3329-C3336				C3337-C3344				C3345-C3352				C3353-C3360				C3361-C3368				C3369-C3376				C3377-C3384				C3385-C3392				C3393-C3400				C3401-C3408				C3409-C3416				C3417-C3424				C3425-C3432				C3433-C3440				C3441-C3448				C3449-C3456				C3457-C3464				C3465-C3472				C3473-C3480				C3481-C3488				C3489-C3496				C3497-C3504				C3505-C3512				C3513-C3520				C3521-C3528				C3529-C3536				C3537-C3544				C3545-C3552				C3553-C3560				C3561-C3568				C3569-C3576				C3577-C3584				C3585-C3592				C3593-C3600				C3601-C3608				C3609-C3616				C3617-C3624				C3625-C3632				C3633-C3640				C3641-C3648				C3649-C3656				C3657-C3664				C3665-C3672				C3673-C3680				C3681-C3688				C3689-C3696				C3697-C3704				C3705-C3712				C3713-C3720				C3721-C3728				C3729-C3736				C3737-C3744				C3745-C3752				C3753-C3760				C3761-C3768				C3769-C3776				C3777-C3784				C3785-C3792				C3793-C3800				C3801-C3808				C3809-C3816				C3817-C3824				C3825-C3832				C3833-C3840				C3841-C3848				C3849-C3856				C3857-C3864				C3865-C3872				C3873-C3880				C3881-C3888				C3889-C3896				C3897-C3904				C3905-C3912				C3913-C3920				C3921-C3928				C3929-C3936				C3937-C3944				C3945-C3952				C3953-C3960				C3961-C3968				C3969-C3976				C3977-C3984				C3985-C3992				C3993-C4000				C4001-C4008				C4009-C4016				C4017-C4024				C4025-C4032				C4033-C4040				C4041-C4048				C4049-C4056				C4057-C4064				C4065-C4072				C4073-C4080				C4081-C4088				C4089-C4096				C4097-C4104				C4105-C4112				C4113-C4120				C4121-C4128				C4129-C4136				C4137-C4144				C4145-C4152				C4153-C4160				C4161-C4168				C4169-C4176				C4177-C4184				C4185-C4192				C4193-C4200				C4201-C4208				C4209-C4216				C4217-C4224				C4225-C4232				C4233-C4240				C4241-C4248				C4249-C4256				C4257-C4264				C4265-C4272				C4273-C4280				C4281-C4288				C4289-C4296				C4297-C4304				C4305-C4312				C4313-C4320				C4321-C4328				C4329-C4336				C4337-C4344				C4345-C4352				C4353-C4360				C4361-C4368				C4369-C4376				C4377-C4384				C4385-C4392				C4393-C4400				C4401-C4408				C4409-C4416				C4417-C4424				C4425-C4432				C4433-C4440				C4441-C4448				C4449-C4456				C4457-C4464				C4465-C4472				C4473-C4480				C4481-C4488				C4489-C4496				C4497-C4504				C4505-C4512				C4513-C4520				C4521-C4528				C4529-C4536				C4537-C4544				C4545-C4552				C4553-C4560				C4561-C4568				C4569-C4576				C4577-C4584				C4585-C4592				C4593-C4600				C4601-C4608				C4609-C4616				C4617-C4624				C4625-C4632				C4633-C4640				C4641-C4648				C4649-C4656				C4657-C4664				C4665-C4672				C4673-C4680				C4681-C4688				C4689-C4696				C4697-C4704				C4705-C4712				C4713-C4720				C4721-C4728				C4729-C4736				C4737-C4744				C4745-C4752				C4753-C4760				C4761-C4768				C4769-C4776				C4777-C4784				C4785-C4792				C4793-C4800				C4801-C4808				C4809-C4816				C4817-C4824				C4825-C4832				C4833-C4840				C4841-C4848				C4849-C4856				C4857-C4864				C4865-C4872				C4873-C4880				C4881-C4888				C4889-C4896				C4897-C4904				C4905-C4912				C4913-C4920				C4921-C4928				C4929-C4936				C4937-C4944				C4945-C4952				C4953-C4960				C4961-C4968				C4969-C4976				C4977-C4984				C4985-C4992				C4993-C5000				C5001-C5008				C5009-C5016				C5017-C5024				C5025-C5032				C5033-C5040				C5041-C5048				C5049-C5056				C5057-C5064				C5065-C5072				C5073-C5080				C5081-C5088				C5089-C5096				C5097-C5104				C5105-C5112				C5113-C5120				C5121-C5128				C5129-C5136				C5137-C5144				C5145-C5152				C5153-C5160				C5161-C5168				C5169-C5176				C5177-C5184				C5185-C5192				C5193-C5200				C5201-C5208				C5209-C5216				C5217-C5224				C5225-C5232				C5233-C5240				C5241-C5248				C5249-C5256				C5257-C5264				C5265-C5272				C5273-C5280				C5281-C5288				C5289-C5296				C5297-C5304				C5305-C5312				C5313-C5320				C5321-C5328				C5329-C5336				C5337-C5344				C5345-C5352				C5353-C5360				C5361-C5368				C5369-C5376				C5377-C5384				C5385-C5392				C5393-C5400				C5401-C5408				C5409-C5416				C5417-C5424				C5425-C5432				C5433-C5440				C5441-C5448				C5449-C5456				C5457-C5464				C5465-C5472				C5473-C5480				C5481-C5488				C5489-C5496				C5497-C5504				C5505-C5512				C5513-C5520				C5521-C5528				C5529-C5536				C5537-C5544				C5545-C5552				C5553-C5560				C5561-C5568				C5569-C5576				C5			

TPH/TRH, PAH, BTEXN & PFAS				Analyte Grouping	TPH								TRH								PAH						BTEXN								PFAS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				Analyte		C6-C9		C10-C14		C15-C28		C29-C36		Sum (C10-C36)		C6-C10		C6-C10 minus BTEX (F1)		>C10-C16		>C16-C34		>C34-C40		Sum >C10-C40)		>C10-C16 minus Naphthalene (F2)		Benzo(a)pyrene		Benzo(a)pyrene		Benzo(a)pyrene		Total PAH		Total PAH		Total PAH		Benzene		Toluene		Ethyl-benzene		m- & p-Xylene		o-Xylene		Total Xylenes		Naphthalene		Naphthalene		PFOS		PFOS		PFOA		6:2 FTS		8:2 FTS		PFHxS + PFOS		PFHxS + PFOS		PFBA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
				Criteria	Ecological, Areas of Environmental Significance (AEPR, 1997)						Ecological, General Airport (AEPR, 1997)		Human Health, HSL A (CRC Care)						Ecological, Areas of Env Significance (NEPM)		Ecological, Commercial/Industrial ESL (NEPM)		Ecological, General Airport (AEPR)		Ecological, Areas of Environmental Significance (AEPR)		Ecological, General Airport (AEPR)		Ecological, Areas of Ecological Significance (AEPR)						Ecological, 95% species protection - UK EA (GHD, 2015)		Ecological, Commercial/Industrial (60% protection) - UK EA (GHD, 2015)		Ecological (GHD, 2015)						Human Health, Low-Density Residential, (GHD, 2016)		Human Health, Commercial/Industrial, (GHD, 2016)		No Guideline																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
				Guideline Limit	100		10,000		10,000		1,000		800		5,000		82,000		62,000		85,000		120,000		10,000		10,000		0.7		1.4		5		100		5		100		0.5		3		5		5		10		3-5 (0- $<1m$) NL ($>1m$)		0.373		4.71		3.73		3.73		3.73		22		640																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Sample ID	Date sampled	Site	Reference	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

- Legend:
- grey shading indicates the specific criteria are not applicable to these sample locations
 - 999 value exceeds nominated criterion
 - 0.09 criterion value is lower than laboratory LOR
 - 220 bold value indicates result is > LOR
 - <20 less than value indicates results is less than the LOR
 - LOR Laboratory Limit of Reporting
 - NL Not Limiting

References:

AEPR, 1997 Airport (Environment Protection) Regulations 1997 (AEPR, 1997)

CRC Care Table B4, Intrusive Maintenance Worker and Direct Contact Health Screening Levels, in CRC Care Technical Report No. 10, Health Screening Levels for Petroleum Hydrocarbons in soil and groundwater, Part 2: Application Document, September 2011

NEPM, 2013 National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013

GHD, 2015 Interim Screening Levels from Managing PFC Contamination at Airports Interim Contamination Management Strategy and Decision Framework (GHD, June 2015)

GHD, 2016 PFAS Investigations – Derivation of PFAS Soil Criteria, (GHD, 28 September 2016).

SEMF, 2018 Melbourne Airport (Tullamarine) - Aviation Rescue Fire Fighting Services Preliminary Site Investigation (SEMF, April 2018)

GHD, 2008 Preliminary Site Contamination Assessment, Melbourne ARFF Drill Ground, Melbourne Airport (GHD, September 2008)

SKM, 2011 Phase 1 and 2 Environmental Site Assessment (ESA) 0245 ARFF Melbourne Fire Station CAT 10 Upgrade, Melbourne Airport, Victoria (SKM, June 2011)

AECOM, 2010 Contamination Risk Assessment, Learning Academy Hot Fire Training Ground, Air Services Australia, Tullamarine (AECOM, 29 November 2010) - only samples analysed for PFAS have been included in the above table

SEMF, 2014 Perfluorinated Compounds (PFC) Speculative Sampling, Deep Creek, Melbourne Airport - Report (SEMF, 19 February 2014)

EDGE, 2013 Excavation of PFOS/PFOA Contaminated Soil at the Hot Fire Learning Academy (Melbourne Airport) (EDGE, 7 October 2013)

GHD, 2016a OneSKY Equipment Room Contamination Investigation and Risk Assessment (GHD, June 2016) - only samples analysed for PFAS have been included in the above table

GHD, 2016b Melbourne GBAS Program, Site Contamination Assessment - Additional Sampling Event (GHD, August 2016)

SUMMARY RESULTS ISSUED FOR MELBOURNE AIRPORT PSI - SURFACE WATER

TPH/TRH, PAH, BTEXN & PFAS					Analyte Grouping	TPH					TRH						PAH		BTEXN								PFAS																	
					Analyte	C6-C9	C10-C14	C15-C28	C29-C36	Sum (C10-C36)	C6-C10	C6-C10 minus BTEX (F1)	>C10-C16	>C16-C34	>C34-C40	Sum (<C10-C40)	C10-C16 minus Naphthalene (F2)	Benzo(a)pyrene	Total PAH	Benzene	Toluene	Ethyl-benzene	m- & p- Xylene	o-Xylene	Total Xylenes	Naphthalene	PFOS	PFOA	6:2 FTS	8:2 FTS	PFHxS	PFOS	PFOA	PFHxS	PFOS + PFOS	8:2 FTS	PFOA	PFOA	PFOS	6:2 FTS	8:2 FTS	6:2 FTS		
					Criteria	Ecological, Fresh Water (AEPR, 1997)					Human Health, Petroleum Products in Drinking Water (WHO, 2008)						Human Health, Drinking Water (NHMRC, 2011)	Ecological, Fresh Water (AEPR, 1997)	Ecological, Fresh Water (AEPR, 1997)		Ecological, Fresh Water - 95% species protection (ANZECC, 2000)		Human Health, Drinking Water (WHO, 2005)		Ecological, Fresh Water - 95% species protection (ANZECC, 2000)	Human Health, Fish Consumption (GHD, 2015)		Human Health, Recreational Water Quality (FSANZ, 2017)		Human Health, Recreational Water Quality (enHealth, 2016)				Ecological (GHD, June 2015)				Human Health, Drinking Water Quality (enHealth, 2016)						
					Guideline Limit	150				600	15	0.09	0.09	0.09	0.09		0.01	3	300	300	140	200	350	300	16	0.00065	0.3	0.0065	0.3	0.7	0.7	5.6	5	5	5	50	50	2900	6.6	2900	2900	5		
Sample ID	Date Sampled	Location	Reference	TDS (mg/L)	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
USS1	9/01/2014	Deep Creek	SEMF, 2014	1,079		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<0.5	0.52	<0.02	<0.1	----	----	<0.02	<0.02	----	<0.02	----	----	<0.02	<0.02	<0.1	----	<0.1		
DSS1	9/01/2014	Deep Creek	SEMF, 2014	1,073		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<0.5	0.23	<0.02	<0.1	----	----	0.52	<0.02	----	0.52	----	----	<0.02	<0.02	0.52	<0.1	----	<0.1	
DSS2	9/01/2014	Deep Creek	SEMF, 2014	1,160		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<0.5	0.23	<0.02	<0.1	----	----	0.23	<0.02	----	0.23	----	----	<0.02	<0.02	0.23	<0.1	----	<0.1	
USS1	24/09/2014	Deep Creek	SEMF, 2014a	854		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	<0.02	<0.02	<0.1	<0.1	----	<0.02	<0.02	----	<0.02	----	<0.1	<0.02	<0.02	<0.02	<0.1	<0.1		
DSS1	24/09/2014	Deep Creek	SEMF, 2014a	846		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.03	<0.02	<0.1	<0.1	----	0.03	<0.02	----	0.03	----	<0.1	<0.02	<0.02	0.03	<0.1	<0.1		
DSS2	24/09/2014	Deep Creek	SEMF, 2014a	917		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.03	<0.02	<0.1	<0.1	----	0.03	<0.02	----	0.03	----	<0.1	<0.02	<0.02	0.03	<0.1	<0.1		
USS1	13/05/2015	Deep Creek	SEMF, 2015a	1,187		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.13	<0.02	<0.1	<0.1	----	0.13	<0.02	----	0.13	----	<0.1	<0.02	<0.02	0.13	<0.1	<0.1		
DSS1	13/05/2015	Deep Creek	SEMF, 2015a	163		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.29	<0.01	<0.1	<0.1	----	0.29	<0.01	----	0.29	----	<0.1	<0.01	<0.01	0.29	<0.1	<0.1		
USS1	19/04/2016	Deep Creek	SEMF, 2016a	4,931		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	<0.01	<0.01	<0.1	<0.1	----	<0.01	<0.01	----	<0.01	----	<0.1	<0.01	<0.01	<0.01	<0.1	<0.1		
DSS1	19/04/2016	Deep Creek	SEMF, 2016a	3,832		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.05	<0.02	<0.1	<0.1	----	0.05	<0.02	----	0.05	----	<0.1	<0.02	<0.02	0.05	<0.1	<0.1		
USS1	21/07/2017	Deep Creek	SEMF, 2017a	1,601		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	<0.01	<0.01	<0.05	<0.05	----	<0.01	<0.01	----	<0.01	<0.05	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05		
DSS1	21/07/2017	Deep Creek	SEMF, 2017a	1,621		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.04	<0.01	<0.05	<0.05	----	0.04	<0.01	----	0.04	----	<0.05	<0.01	<0.01	0.04	<0.05	<0.05		
DSS2	21/07/2017	Deep Creek	SEMF, 2017a	1,729		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<2	<2	<2	<2	<1	0.04	<0.01	<0.05	<0.05	----	0.04	<0.01	----	0.04	----	<0.05	<0.01	<0.01	0.04	<0.05	<0.05		
SW4	6/10/2010	LAHFTG - North-western perimeter	AECOM, 2010	142		<20	<50	<100	<50	<50	----	----	----	----	----	----	----	<0.5	----	<1	<2	<2	<2	<2	<4	<1	0.57	0.02	<0.1	----	----	0.57	0.02	----	0.57	----	<0.02	0.02	0.57	<0.1	----	<0.1		
	16/10/2015	LAHFTG - Trade Waste Sampling Point	BECA, 2015	----		<20	1,250	1,160	<50	2,410	<20	<20	2,140	320	<100	2,460	2,140	----	----	<1	<2	<2	<2	<2	<2	<5	<0.02	<0.02	<0.1	<0.1	----	<0.02	<0.02	----	<0.02	----	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1		
	30/06/2016	LAHFTG - Trade Waste Sampling Point	BECA, 2016	----		<20	----	----	----	39,600	----	----	----	----	----	----	----	----	----	2	<2	<2	<2	<2	<2	----	0.1	<0.02	<0.1	----	----	0.1	<0.02	----	0.1	----	<0.02	<0.02	0.1	<0.1	----	<0.1		
	16/10/2015	Roofed Vehicle Washdown Area (B120) - Triple Interceptor Outlet	BECA, 2015	----		<20	120	1,310	500	1,930	<20	<20	210	1,600	230	2,040	210	----	----	<1	<2	<2	<2	<2	<2	<5	0.24	0.09	<0.1	<0.1	----	0.24	0.09	----	0.24	----	<0.1	0.09	0.09	0.24	<0.1	<0.1	<0.1	
	30/06/2016	Roofed Vehicle Washdown Area (B120) - Triple Interceptor Outlet	BECA, 2016	----		<20	----	----	----	1,830	----	----	----	----	----	----	----	----	----	<1	<2	<2	<2	<2	<2	----	0.3	<0.002	<0.1	----	----	0.3	<0.002	----	0.3	----	<0.002	<0.002	0.3	<0.1	----	<0.1		
MW1	5/09/2017	Site A (MFS) - Interceptor (first flush drain)	SEMF, 2018	55		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	----	----	----	----	----	----	----	----	----	3.89	0.09	<0.05	0.21	0.42	3.89	0.09	0.42	3.89	4.31	0.21	0.09	0.09	0.09	3.89	<0.05	0.21	<0.05
MW7	8/03/2018	Site A (MFS) - outlet to paddock SW of MFS	SEMF, 2018	194		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	----	----	<1	<2	<2	<2	<2	<2	<5	79.6	2.25	0.17	0.66	22.6	79.6	2.25	22.6	79.6	102	0.66	2.25	2.25	79.6	0.17	0.66	0.17	
MW8	8/03/2018	Site A (MFS) - input to drainage network SE of MFS	SEMF, 2018	46		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	----	----	<1	<2	<2	<2	<2	<2	<5	0.22	0.07	<0.05	<0.05	0.05	0.22	0.07	0.05	0.22	0.27	<0.05	0.07	0.07	0.22	<0.05	<0.05	<0.05	
	16/10/2015	Site A (MFS) - Mechanical Workshop Sewer Access Pit	BECA, 2015	----		40	7,710	4,150	2,600	14,500	30	30	7,580	5,540	1,160	14,300	7,580	----	----	<1	4	<2	<2	<2	<2	<5	28.2	0.1	0.2	<0.1	----	28.2	0.1	----										

SUMMARY RESULTS ISSUED FOR MELBOURNE AIRPORT PSI - GROUNDWATER

TPH/TRH, PAH, BTEXN & PFAS					Analyte Grouping	TPH					TRH					PAH		BTEXN								PFAS													
Sample ID	Date Sampled	Location	Reference	Poor / Unacceptable Drinking Water (>1,000mg/L TDS)	Analyte	C6-C9	C10-C14	C15-C28	C29-C36	Sum (C10-C36)	C6-C10	C6-C10 minus BTEX (F1)	>C10-C16	>C16-C34	>C34-C40	Sum >C10-C40)	C10-C16 minus Naphthalene (F2)	Benzo(a)pyrene	Total PAH	Benzene	Toluene	Ethyl-benzene	m-&p-Xylene	o-Xylene	Total Xylenes	Naphthalene	PFkxS	PFOS	PFDA	PFkxS	PFOS	PFDA	PFOS	PFDA	6:2 FTS	8:2 FTS	6:2 FTS	8:2 FTS	
						Ecological, Fresh Water (AEPR, 1997)					Human Health, Petroleum Products in Drinking Water (WHO, 2008)					Human Health, Drinking Water (NHMRC)	Ecological, Fresh Water (AEPR, 1997)	Ecological, Fresh Water (AEPR, 1997)		Ecological, Fresh Water - 95% species protection (ANZECC)	Human Health, Drinking Water (WHO, 2005)	Ecological, Fresh Water - 95% species protection (ANZECC)	Human Health, Recreational Water Quality (FSANZ, 2017)				Human Health, Recreational Water Quality (enHealth, 2016)				Ecological (GHD, June 2015)				Human Health, Drinking Water Quality (enHealth, 2016)	Human Health, Recreational Water Quality (enHealth, 2016)			
						Guideline Limit (lowest)					150	600	15	0.09	0.09	0.09	0.09	0.09	0.01	3	300	300	140	200	350	300	16	0.7	0.7	5.6	5	5	50	6.6	2900	2900	2900	5	50
						Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW-1	Always dry - not sampled	Sites D - CFTG																																					
MW-2	13/05/2013	Sites D - CFTG	Connolly, 2013	----		<100	<100	300	<100	300	<100	<100	100	300	<100	400	----	----	----	<1	<1	<1	<1	<1	<3	----	----	9,280	1,140	----	9,280	1,140	9,280	1,140	228	----	228	----	----
MW-2	24/09/2014	Sites D - CFTG	SEMF, 2014	Yes - 8,110		<20	370	890	230	1,490	<20	<20	550	900	400	1,850	550	<0.5	<0.5	<1	<2	<2	<2	<2	<2	<5	----	12,500	1,360	----	12,500	1,360	12,500	1,360	120	0.4	120	0.4	----
MW-3	20/06/2008	Sites D - CFTG	GHD, 2008	Yes - 7,300		<20	<50	<100	<50	----	----	----	----	----	----	----	----	<0.5	----	<1	<2	<2	<2	<2	----	<1	----	0.068	<0.05	----	0.068	<0.05	0.068	<0.05	----	----	----	----	----
MW-3	13/05/2013	Sites D - CFTG	Connolly, 2013	----		<100	<100	<100	<100	<50	<100	<100	<100	<100	<100	<100	----	----	----	<1	<1	<1	<1	<1	<2	----	----	5.83	0.05	----	5.83	0.05	5.83	0.05	<100	----	<100	----	----
MW-3	24/09/2014	Sites D - CFTG	SEMF, 2014	Yes - 7,390		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<2	<2	<2	<2	<5	----	<0.02	<0.02	----	<0.02	<0.02	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1	<0.1	
MW-3	13/05/2015	Sites D - CFTG	SEMF, 2015	Yes - 4,435		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<2	<2	<2	<2	<5	----	<0.02	<0.02	----	<0.02	<0.02	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1	<0.1	
MW-3	19/04/2016	Sites D - CFTG	SEMF, 2016	Yes - 6,466		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<2	<2	<2	<2	<5	----	<0.01	<0.01	----	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	
MW-3	21/07/2017	Sites D - CFTG	SEMF, 2017b	Yes - 8,120		<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<2	<2	<2	<2	<5	----	0.06	<0.01	----	0.06	<0.01	0.06	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	
MW01	7/07/2010	Site A - MFS	SKM, 2011	Yes - 3,100		<20	<50	<100	<100	<100	----	----	----	----	----	----	----	<1	<1	<1	<1	<1	----	<3	----	----	2.24	0.74	----	2.24	0.74	2.24	0.74	<0.1	----	<0.1	----	----	
					Min	<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<0.5	<0.5	<1	<1	<1	<1	<1	<2	<1	----	<0.01	<0.01	----	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05
					Max	<100	370	890	230	1490	<100	<100	550	900	400	1850	550	<1	<1	<1	<2	<2	<2	<2	<3	<5	----	12500	1360	----	12500	1360	12500	1360	228	0.4	228	0.4	----

Legend:

	grey shading indicates the specific criteria are not applicable to these sample locations
999	value exceeds nominated criterion
0.09	criterion value is lower than laboratory LOR
220	bold value indicates result is > LOR
<20	less than value indicates results is less than the LOR
LOR	Laboratory Limit of Reporting

References:

AEPR, 1997	Airport (Environment Protection) Regulations 1997 (AEPR, 1997)
enHealth, 2016	enHealth Statement: Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia (enHealth, June 2016)
FSANZ, 2017	Food Standards Australia New Zealand - Toxicity reference values in Health Based Guidance Values for PFAS, Department of Health, Australian Government, 2017 (FSANZ, 2017)
GHD, 2015	Interim Screening Levels from Managing PFC Contamination at Airports Interim Contamination Management Strategy and Decision Framework (GHD, June 2015)
WHO, 2008	Petroleum Products in Drinking Water – Background document for Development of WHO Guidelines for Drinking-water Quality, WHO, 2008
WHO, 2005	Petroleum Products in Drinking Water – Background document for Development of WHO Guidelines for Drinking-water Quality, WHO, 2005
ANZECC	ANZECC National Water Quality Management Strategy – Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)
NHMRC	National Health and Medical Research Council, Investigation Levels for Drinking Water (2011)
Connolly, 2013	Groundwater Monitoring Event, Melbourne International Airport, Fire Training Ground, Tullamarine, Vic (Connolly Environmental, May 2013)
SEMF, 2014	Aviation Rescue & Fire Fighting Services, Melbourne Airport Fire Training Ground, Groundwater Monitoring Event (SEMF, 24 October 2014)
SEMF, 2015	Aviation Rescue & Fire Fighting Services, Melbourne Airport Fire Training Ground, Groundwater Monitoring Event (SEMF, 26 June 2015)
SEMF, 2016	Melbourne Airport (Tullamarine) Fire Training Ground, April 2016 Groundwater Monitoring Event (SEMF, 24 May 2016)
SEMF, 2017b	Melbourne Airport (Tullamarine) Fire Training Ground, July 2017 Groundwater Monitoring Event (SEMF, 19 September 2017)
SKM, 2011	Phase 1 and 2 Environmental Site Assessment (ESA) 0245 ARFF Melbourne Fire Station CAT 10 Upgrade, Melbourne Airport, Victoria (SKM, June 2011)
GHD, 2008	Preliminary Site Contamination Assessment, Melbourne ARFF Drill Ground, Melbourne Airport (GHD, September 2008)