



**ENVIRONMENTAL EARTH
SCIENCES**
CONTAMINATION RESOLVED

**AUDITOR CERTIFICATION
REPORT & STATEMENT OF
REASONS: PROSERPINE FIRE
STATION, 102 MAIN STREET,
PROSERPINE, QLD
QUEENSLAND FIRE AND EMERGENCY
SERVICES**

19 FEBRUARY 2020
719052
VERSION 1

19 February 2020

Queensland Fire and Emergency Services
24 Corporate Drive
Cannon Hill QLD 4170

Attention: **Dr Raymond Bott**
Inspector

Dear Raymond

**Auditor certification report and statement of reasons: Detailed site investigation (DSI)
for Proserpine Fire Station, 102 Main Street, Proserpine, Queensland**

Please find enclosed a copy of my report entitled as above. Thank you for the opportunity to undertake this work.

Following evaluation of the site investigation report (SIR) in relation to relevant guidelines, policy and legislation, the Contaminated Land Auditor (CLA) has concluded that the SIR meets the objectives of the project, in that the DSI and SIR:

- was undertaken in accordance with current best-practice methodologies, cognisant of and in accordance with applicable guidance and legislation;
- fulfils the objectives of the project with regards to the characterisation of per and poly fluoroalkyl substances (PFAS) impact (concentration and distribution) on and at the boundaries of the subject site; and
- complies with the relevant elements of the *Environmental Protection (EP) Act 1994* (Chapter 7, Part 8, Subsections 389 (1) and (2)).

Based on the above determination, the CLA agrees with the conclusions of the SIR that the site does not currently pose an unacceptable human health risk but that further (off-site) investigation is warranted to quantify potential impacts to off-site receptors (human and ecological).

If you have any queries concerning this report, contact the undersigned on (07) 3852 6666.

For and on behalf of
Environmental Earth Sciences QLD



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EXECUTIVE SUMMARY

Environmental Earth Sciences QLD was commissioned by Queensland Fire and Emergency Services (QFES) to undertake the contaminated land auditor (CLA) role for a per and poly fluoroalkyl substances (PFAS) assessment of the Proserpine Fire Station (102 Main Street, Proserpine, QLD “the site”), legally described as Lot 1, RP706146.

The CLA function was necessary due to QFES’s requirement that a third party review all investigation activities and reporting outcomes for the site to ensure compliance with relevant requirements of Chapter 7, Part 8, Subsections 389 (1) and (2) of the *Environmental Protection (EP) Act 1994*.

The following site investigation report (SIR) was provided by AECOM as a Contaminated Land Investigation Document (CLID) and is the subject of this Auditor Certification Report:

- AECOM (2019b). PFAS Detailed Site Investigation Proserpine Fire Station, 102 Main Street, Proserpine, Queensland. Prepared for Queensland Fire and Emergency Services. Ref: 60609758 Revision 0 (Final). Dated 16 December 2019.

Following evaluation of the SIR in relation to relevant guidelines, policy and legislation (in particular NEPC 2013, HEPA 2018, DES 2018 and the *EP Act 1994*), the CLA has concluded that the SIR meets the objectives of the project, in that the DSI and SIR (CLID):

- was undertaken in accordance with current best-practice methodologies, cognisant of and in accordance with applicable guidance and legislation;
- fulfils the objectives of the project with regards to the characterisation of PFAS impact (concentration and distribution) on and at the boundaries of the subject site; and
- complies with the relevant elements of the *Environmental Protection (EP) Act. 1994* (Chapter 7, Part 8, Subsections 389 (1) and (2)).

Based on the above determination, the CLA agrees with the conclusions of the CLID that the site does not currently pose an unacceptable, direct-contact human health risk in the context of on-going commercial/ industrial land use. However, based on the identification of elevated contaminant concentrations (sum of PFOS & PFHxS) greater than human health and ecological assessment criteria in all four groundwater monitoring bores at and along the boundaries of the site, further (off-site) investigation is warranted.

The off-site investigation should seek to confirm (or otherwise) to what extent impacted groundwater has migrated beyond the site boundary and if so, whether contaminants have migrated off-site at concentrations likely to pose an unacceptable human and/ or ecological health risk to sensitive receptors located down-gradient of the site.

The above notwithstanding, the CLA does not consider that contaminant concentrations within the site boundary pose a risk to human and/ or ecological site users and thus does not preclude on-going use of the site for commercial/ industrial purposes. Rather, additional off-site investigation should be undertaken to determine if notification, remediation and/ or management actions should be implemented to comply with legislation and mitigate risks to any identified off-site receptors along a complete exposure pathway.

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1 INTRODUCTION

Environmental Earth Sciences QLD was commissioned by Queensland Fire and Emergency Services (QFES) to undertake the contaminated land auditor (CLA) role for the per and poly fluoroalkyl substances (PFAS) assessment project at the Proserpine Fire Station (102 Main Street, Proserpine, QLD “the site”), legally described as Lot 1, RP706146.

The CLA function was necessary due to QFES’s requirement that a third party review all investigation activities and reporting outcomes for the site to ensure compliance with relevant requirements of Chapter 7, Part 8, Subsections 389 (1) and (2) of the *Environmental Protection (EP) Act 1994*.

The following report was provided by AECOM and is the subject of this Auditor Certification Report:

- AECOM (2019b). PFAS Detailed Site Investigation Proserpine Fire Station, 102 Main Street, Proserpine, Queensland. Prepared for Queensland Fire and Emergency Services. Ref: 60609758 Revision 0 (Final). Dated 16 December 2019.

2 OBJECTIVES

The objectives of the CLA works were to:

- evaluate the efficacy of the detailed site investigation (DSI) and the accompanying site investigation report (SIR) in achieving the objective of characterising PFAS impacts (concentration and distribution) within and adjacent to the boundaries of the site;
- confirm that works were undertaken in accordance with best practice and all relevant national and state legislation/ guidelines; and
- certify (or, where justified, propose amendments to ensure) that the SIR meets Department of Environment and Science (DES) requirements for a SIR that is a contaminated land investigation document (CLID)¹.

3 SCOPE OF WORK

The following scope of works was undertaken to meet the objectives:

- Communication with the suitably qualified person (SQP) (James Peachey of AECOM) and review of documents regarding the sampling and analysis methodology;

¹ As far as practicable, noting that the investigation has been undertaken specifically to target PFAS only.

- a site visit immediately following the soil sampling and groundwater bore installation program (on 1 August 2019);
- review of the CLID, including revisions following the initial review; and
- provision of this report and appended auditor certification and declaration.

4 SITE IDENTIFICATION AND SETTING

4.1 Location and property description

The regional locality of the site is provided on **Figure 1** and site identification details provided in **Table 1**. The subject property lot and site layout are provided on **Figure 2**.

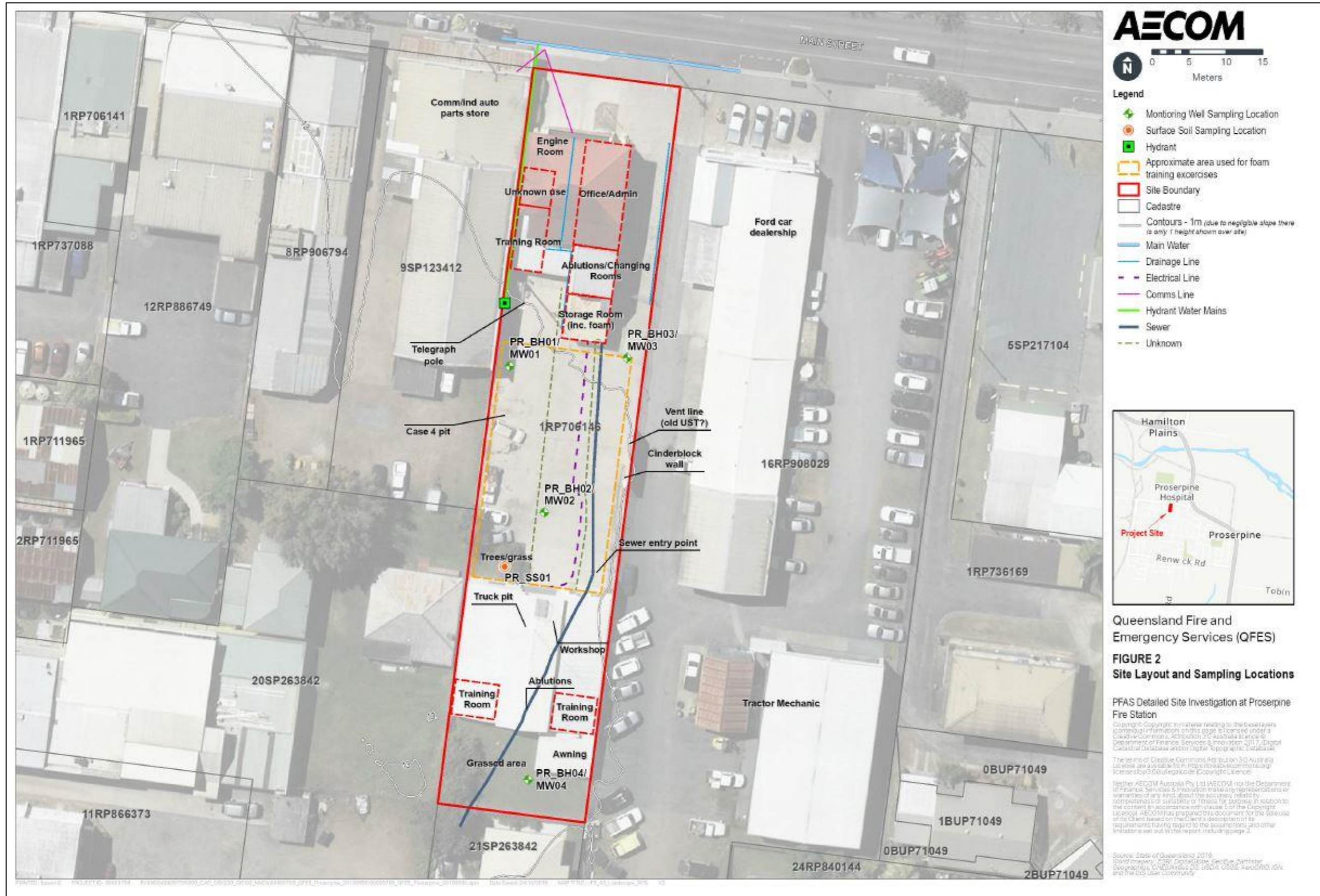
Table 1: Site details

Item	Details
Site address	102 Main Street, Proserpine, QLD 4800
Registered site owner	State of Queensland (represented by Public Safety Business Agency (PSBA))
Registered address of site owner	PSBA, L13 Makerston House, 30 Makerston Street, Brisbane QLD
Site occupier	QFES
Local government area	Whitsundays Regional Council
Zoning/ future zoning	Major Centre/ no change
Lot and plan	Lot 1/ RP706146
Tenure	Freehold
Latitude/longitude	-20.402313, 148.584109
Site area	2,023 m ²
Current/future use	Commercial/ industrial property (former fire station, disused since 2017). Future land-use unknown; likely ongoing commercial/ industrial
Environmental Management Register (EMR)/ Contaminated Land Register (CLR)	Lot 1/ RP706146 is not listed on either the EMR or CLR

Figure 1: Site location Plan (reproduced from AECOM 2019b)



Figure 2: Site layout and sampling locations (reproduced from AECOM 2019b)



AECOM

0 5 10 15
Meters

Legend

- ✕ Monitoring Well Sampling Location
- Surface Soil Sampling Location
- Hydrant
- Approximate area used for foam training exercises
- Site Boundary
- Cadastre
- Contours - 1m (due to negligible slope there is only 1 height shown over site)
- Main Water
- Drainage Line
- Electrical Line
- Comms Line
- Hydrant Water Mains
- Sewer
- Unknown



Queensland Fire and Emergency Services (QFES)
FIGURE 2
Site Layout and Sampling Locations

PFAS Detailed Site Investigation at Proserpine Fire Station

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Source: State of Queensland, 2019
Digital maps: © State of Queensland, Geospatial Data Agency, © Queensland GIS, USGS, USGS, Aerial00, USGS and the GIS User Community

4.2 Site description and surrounds

4.2.1 Site

At the time of the audit the site was a recently operational fire station, comprising several buildings relating to the various administration, operational and training activities required to discharge this role. Key site features included:

- One two-storey building at the northern end of the site housing the main engine bay and a number of interconnected rooms: office/ administration areas, ablution and personnel changing rooms, equipment/ chemical (e.g. foam) storage and desk-based training facilities;
- One single storey building housing a vehicle/ equipment workshop with in-ground truck pit for vehicle inspections, training rooms and additional ablutions;
- A decommissioned² concrete in-ground water tank (Case 4 pit) with dimensions of approximately 1.06 metres (m) x 3.8 m (deep) and a former holding capacity of 3,390 L;
- An open hardstand area is located in the centre of the site, occupied by a small number of parked cars along the western boundary and is understood to be used for foam training exercises.

A vent line, possibly indicative of an existing underground fuel storage tank (UST) was observed adjacent to the eastern boundary of the site (refer **Figure 2**). However, it is understood that no evidence of an existing *in-situ* UST was identified during the ground penetrating radar (GPR) survey undertaken during site investigation service clearance.

4.2.2 Surrounds

Surrounding land uses include:

- **North:** Main Street with commercial businesses beyond. The Proserpine Sugar Mill (Wilmar Sugar) is located approximately 350 m to the north of the site with the Proserpine River at a distance of approximately 850 m (see **Figure 1**).
- **East:** A commercial/ industrial business (Ford Car dealership) including administration/ display show room buildings and outdoor hardstand parking/ viewing areas is located adjacent to the site, to the east. Additional commercial properties and some residential dwellings are located beyond. A service station is located ~270 m to the east.
- **South:** Commercial/ industrial properties are located adjacent to the site, to the south and south-west (Proserpine Ex Servicemans Club). Residential properties are located to the south (east, south-east to south-west) at a range of 30-90 m .

² Note: The Case 4 pit was not in use at the time of inspection, having been decommissioned via sand infill and concrete capping.

- **West:** Commercial businesses are located adjacent to the western boundary of the site and extend beyond Chapman Street to the west. The nearest residential properties are located approximately 150 m to the west on Dobins Lane.

Review of available environmentally sensitive area (ESA) mapping indicates that wetlands at the Proserpine River (850 m north of the site) are designated a “high potential aquatic and terrestrial groundwater dependant ecosystem (GDE)” (BOM, 2020) and a Category B Endangered Regional Ecosystem ESA. In addition, Lagoon Creek (located approximately 1.5km south-west of the site) is also a high potential aquatic and terrestrial GDE and Category B Endangered Regional Ecosystem ESA. Parts of Lagoon Creek are also a Category C Essential Habitat Of Concern Regional Ecosystem ESA.

See **Figure 1** for these features.

No subterranean GDEs were identified within 4 km of the site.

5 SUMMARY OF SITE HISTORY

The site history review detailed by AECOM (AECOM, 2019a) included a review of client-supplied, publicly available and third-party information from the following sources:

- Historical air photographs obtained from the Queensland Governments online mapping portal (QImagery online) from 1945, 1960, 1962, 1974, 1983, 1992, 2001 and 2005.
- Historical land title details from the Department of Natural Resources, Mines and Energy (DNRME).
- Search of DES’s Environmental management register (EMR) and contaminated land register (CLR);
- Review of previous environmental reports/ sampling activities undertaken at the site (namely, QFES, 2016 water sampling); and
- Interviews with nominated QFES personnel and site inspection (13 February 2019).

The purpose of the review was to identify potential historic sources of PFAS at and in the vicinity of the site in order to facilitate the development of a robust, PFAS-specific investigation strategy.

The results of the historic data review determined that the site was used as a fire station for approximately 57 years (since 1962), prior to cessation of operations at the site in 2017. Accordingly, a number of PFAS sources were identified at the site (primarily via information obtained during site interviews), associated with past fire-fighting activities foam usage (training exercises) and storage practices, specifically:

- Training use/ application of firefighting aqueous film forming foam (AFFF) containing PFAS (3M Lightwater) between circa 1990 and 2003 to sealed/ unsealed areas during training exercises.

- This may also include overspray and/ or surface run-off toward then, unsealed areas of the site/ perimeter drainage; and
- Storage/ transfer of 3M Lightwater (to/ from 20L drums) within the existing fire station building and in training areas at the site.

No inadvertent releases of foam/ significant spillage/ leakage events were recorded.

6 POTENTIAL FOR CONTAMINATION AND CONCEPTUAL SITE MODEL DEVELOPMENT

A conceptual site model (CSM) of the site can be formed by considering the geophysical characteristics at play at the site, the contaminant source, potential receptors and the pathways to the receptors. The CSM, as required by NEPC (2013), is an iterative process constantly being updated during the investigation process as more information becomes available.

6.1 Physical setting topography, hydrology and drainage

Surface levels at the site range from 13 metres Australian Height Datum (m AHD) in the south, sloping down to 12.5 m AHD in the north/ north west.

Stormwater drainage at the site comprises a concrete spoon drain which bisects the centre of the fire station and a perimeter drain along the eastern boundary of the site. Surface water flows, according to the topography, toward Main Street, to the north.

6.2 Geology and soils

According to the Geoscience Australia portal (<http://portal.geoscience.gov.au/>) the site is underlain by Quaternary flood plain alluvium, comprising clay, silt, sand and gravel. GSQ (1971) reports this unit as Qa “mainly alluvium, some colluvium and residual soil”.

Records held by the Australian Soil Resource Information System (ASRIS) (CSIRO, 2020) and Queensland Globe (DNRM, 2020) indicate soils at the site are classified as “Rudosols”. Rudosols are described according to the Australian Soil Classification (ASC, Isbell 2002) as:

“Soils with negligible (rudimentary) pedologic organisation apart from (a) minimal development of an A1 horizon or, (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite.

The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present” and

“A variable group of deep sandy soils with coarse to medium textured A horizons over coarse sandy to medium clay D horizon. Normally contains a water table in coarse sandy D horizons.”

6.3 Acid Sulfate Soils

According to ASRIS (CSIRO, 2020) the site is located in an area where there is a high probability of acid sulfate soil occurrence while the Whitsundays Regional Council (WRC) online mapping designates the site as “land above 5 m and below 20 m AHD” indicating ASS may be present at the site. However, DNRW (2007a and 2007b) and DNRM (2020) indicates that the site is low potential (LP) or not assessed (NA) and unlikely to be acid sulfate soil.

This is supported by the geology map (GSQ, 1971) which shows Quaternary age coastal muds (Qm) to the east of the township, correlating to higher risk acid sulfate soil areas on DNRW (2007b).

As such, the Auditor considers that potential acid sulfate soil occurrence requires no further consideration on this site.

6.4 Hydrogeology

6.4.1 Results of registered bore search

Queensland Globe (DNRM,2020) was used by the Auditor and AECOM (2019b) to search registered bores in the vicinity of the site. The database indicated that there are a total of 47 registered groundwater bores within a 1 km radius of the site (refer **Figure 1**); with 14 of these bores located within 500 m of the site boundary. At least seven of the bores within 500 m of the site are registered for “water supply” use, although the type of water supply (e.g. irrigation, stock watering or potable use is not known).

It is acknowledged, given the shallow water-table in the area (generally <6 m depth), that the local groundwater resource is deemed potable (salinity <500 mg/L) with a yield of 5-15 L/s³, there is a potential that additional, unregistered bores could be present down-gradient of the site.

6.4.2 Aquifers and aquitards

It is anticipated that the uppermost aquifer beneath the site will be present within the Quaternary (Proserpine) flood plain alluvium (clayey sand and sand).

6.4.3 Groundwater dependent ecosystems (GDEs)

The Auditor also used BOM (2020) to determine whether local surface ecosystems have been classified as GDEs. The map indicates that the wetland at Proserpine River, approximately 850 m north of the site, is classified as a “high potential aquatic and terrestrial GDE”. In addition, Lagoon Creek (located approximately 1.5km south-west of the site) is also a high potential aquatic and terrestrial GDE. No subterranean GDEs were recorded at or in the vicinity of the site.

³ Groundwater Resources of Queensland 1:2,500,000 map.

6.4.4 Summary of groundwater usage and potential receptors

With reference to the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 and AECOM (2019b, Section 3.6) a review of potential groundwater receptors and likely impacts to receptors/ users of the receiving water body (Proserpine River/ Lagoon Creek) has been undertaken.

In summary, the following potential groundwater/ surface water receptors were identified:

- aquatic ecosystems (surface water);
- irrigation (surface water and groundwater);
- farm supply/ use (surface water and groundwater);
- stock water (surface water and groundwater);
- human consumption/ drinking water;
- industrial use;
- visual recreation (surface water); and
- cultural and spiritual values (surface water).

The Auditor completed a review of the identified potential groundwater receptors and agrees with those listed in AECOM (2019b). Results have been compared against adopted assessment criteria of aquatic ecosystems, recreational contact and drinking water as these are the most sensitive receptors.

6.5 Chemicals of potential concern

This investigation was undertaken to investigate human health and ecological health risks at the site associated with PFAS contamination only. Accordingly, no assessment and/or commentary is provided pertaining to other chemicals of potential concern (CoPC) that could be present at the site associated with historic activities (e.g. placement of fill, legacy landfilling activities and historic fire station use).

For the purposes of this assessment therefore, CoPCs comprise:

- PFAS compounds (28 analyte suite, refer **Table 2**); and
- PFAS compounds (28 analyte suite – total oxidisable precursor assay (TOPA) analysis).

Table 2: PFAS Compounds (28 analyte suite) – CoPCs

PFAS Group	Compound	Acronym	Carbon Chain Length	CAS No.
Perfluoroalkyl Sulfonic Acids	Perfluoro butane sulfonic acid	PFBS	4	375-73-5
	Perfluoropentane sulfonic acid	PFPeS	5	2706-91-4
	Perfluorohexane sulfonic acid	PFHxS	6	355-46-4
	Perfluoroheptane sulfonic acid	PFHpS	7	375-92-8
	Perfluorooctane sulfonic acid	PFOS	8	1763-23-1
	Perfluorodecane sulfonic acid	PFDS	10	335-77-3
Perfluoroalkyl Carboxylic Acids	Perfluorobutanoic acid	PFBA	4	375-22-4
	Perfluoropentanoic acid	PFPeA	5	2706-90-3
	Perfluorohexanoic acid PFHxA	PFHxA	6	307-24-4
	Perfluoroheptanoic acid	PFHpA	7	375-85-9
	Perfluorooctanoic acid	PFOA	8	335-67-1
	Perfluorononanoic acid	PFNA	8	375-95-1
	Perfluorodecanoic acid	PFDCa	10	335-76-2
	Perfluoroundecanoic acid	PFUnDA	11	2058-94-8
	Perfluorododecanoic acid	PFDoDA	12	307-55-1
	Perfluorotridecanoic acid	PFTTrDA	12	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	14	376-06-7
Perfluoroalkyl Sulfonamides	Perfluorooctane sulphonamide	FOSA	8	754-91-6
	N-Methyl perfluorooctane	MeFOSA	8	31506-32-8
	N-Ethyl perfluorooctane	EtFOSA	8	4151-50-2
	N-Methyl perfluorooctane	MeFOSE	8	2448-09-7
	N-Ethyl perfluorooctane	EtFOSE	8	1691-99-2
	N-Methyl perfluorooctane	MeFOSAA	8	N 2355-31-9
	N-Ethyl perfluorooctane	EtFOSAA	8	2991-50-6
Fluorotelomer Sulfonic Acids	4:2 Fluorotelomer sulfonic acid	4:2 FTS	4	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2 FTS	6	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2 FTS	8	39108-34-4
	10:2 Fluorotelomer sulfonic	10:2 FTS	10	120226-60-0

6.6 Source to receptor pathway evaluation

AECOM (2019a)⁴ developed a source, pathway and receptor exposure model for the site in both graphical and written form. This included consideration of the site's physical

⁴ AECOM (2019a) *Preliminary Site Investigation and Sampling, Analysis and Quality Plan, QFES*, April 2019

characteristics that could provide a pathway to potential receptors for the CoPCs that may be identified in environmental media on the site.

The site history assessment allowed for a preliminary conceptualisation of the potential location and likely distribution of these chemicals in environmental media at the site. This in turn, facilitated the design of a robust sampling and analytical program to identify and quantify such chemicals at the site and along the site boundaries, if present.

The Auditor reviewed and approved (following discussion) the preliminary CSM and the corresponding sampling plan for the SI works (AECOM, 2019a) in March 2019 prior to the commencement of intrusive works.

7 FIELD PROGRAM

7.1 Auditor site inspection

The Auditor visited the site on 1 August 2019 to confirm in-field methodologies utilised by AECOM and ground-truth the site setting details identified during the data review phase. Due to the rapidity of the drilling program and mobilisation limitations, the Auditor was unable to attend site during soil sampling and bore installation. However, a site inspection and, validation of the works completed by the SQP's site representative (permanent bore installation locations, soil bore, sediment/ surface water sampling locations) was undertaken immediately thereafter.

Final soil sampling and permanent groundwater monitoring bore locations are presented on **Figure 2** above. During the Auditor inspection the entire site was traversed on foot. The surface of the site consisted of a relatively flat area sloping slightly to north/ northwest containing a combination of concrete hardstand, unsealed, grassed areas and legacy fire station buildings and sheds.

No sub-surface infrastructure was observed on the site at the time of the inspections that could "be affected by contaminants" or "be a barrier to or facilitate the migration of contaminants", other than the stormwater and sewer networks potentially providing a conduit to contaminant migration. However, the Auditor noted:

- An old vent line, potentially indicative of a UST was present on the eastern boundary of the site (refer **Figure 2**). It is understood no evidence of the tank was identified during the AECOM service clearance activities (GPR survey) and it appears the tank has been removed. However, tank bedding sands may still be present *in-situ* that could impact upon contaminant migration pathways; and
- It is understood a concrete, in-ground tank (the Case 4 pit) formerly used to store water, was decommissioned *in-situ* at the site via pump-out, sand infill and capping with concrete. Bedding sands in the vicinity of this tank could influence contaminant migration.

It was observed that there were no obvious indications of uses for, or activities carried out on the surrounding land that could affect the safety of or cause environmental harm to the

subject land. No soil stockpiles or inert waste was present across the site at the time of the inspection.

It is therefore concluded that no “waste storage, treatment or disposal” has occurred on the site as per the definition in Schedule 3 of the EP Act 1994 (Notifiable Activity no.37), hence no waste has been “disposed of or stored on the land”. As per the definition of “waste” in s.13(1), (2) and (3) of the EP Act 1994 “including anything” that is “left over” or “surplus” to an activity, it is considered that the “left over” and “surplus” material does not constitute “waste” as per the definition in s.389(1)(d) because it was not “disposed of or stored”.

In addition to the above, and with particular reference to s.389(1)(d)(ii) of the EP Act 1994, there was no evidence of any potential contamination of the land or the presence of any hazardous contaminant on the site at the time of the inspection.

7.2 Field investigations

Field investigations comprised the following events:

- Preliminary Site Investigation (PSI, reported in AECOM 2019a, summarised in AECOM, 2019b);
 - **Event 1** (13 February 2019): site inspection to identify areas of potential environmental concern (including interviews with selected QFES personnel regarding historic site activities) – reported in (AECOM, 2019a);
- Detailed Site Investigation (DSI, reported in AECOM, 2019b):
 - **Event 2** (26-27 July 2019):
 - Drilling of four soil bores (PR_BH01 to PR_BH04), installation of four monitoring bores (PR_MW01 to PR_MW04) and bore development;
 - Advancement of one shallow soil bore (PR_SS01);
 - **Event 3** (07 August 2019) groundwater monitoring event (PR_MW01 to PR_MW04) and monitoring bore survey.

Sampling locations are presented on **Figure 2**.

7.2.1 Soil sampling methodology

Boreholes were advanced to a clearance depth of 1.5 metres below ground level (m BGL) via non-destructive drilling techniques (NDD) prior to follow-on with a mechanical drill rig (Geoprobe equipped with push-tube) to the maximum target depth of 6 m BGL for soil sample collection and logging. Each bore was subsequently “reamed out” to target depth by Proactive using a Geoprobe drilling rig equipped with solid stem augers for groundwater monitoring bore installation at each location.

Hole diameters were 60 mm and 100 mm for soil and groundwater bores respectively. All boreholes were advanced to natural material.

The shallow soil bore (PR_SS01) was advanced via hand auger to a maximum depth of 0.5 m BGL to assess shallow soil conditions.

Samples were collected from each location, directly from the push-tube liner, solid stem auger cuttings and/or hand auger, by hand, using a fresh, clean pair of nitrile gloves for each sampling interval. Soil samples were collected into laboratory-supplied PFAS-suitable containers and immediately stored on ice for transport to the laboratory under appropriate, chain of custody (COC) control.

Representative samples were submitted for laboratory analysis for the identified contaminants of concern as per the agreed SAQP (AECOM, 2019a), namely:

- Three samples from each borehole/monitoring bore installation (two within the 0 to 1 m bgl depth interval and one at depth, within the saturated zone); and
- Two samples from the shallow bore (PR_SS1), within the 0 to 1 m depth interval.

7.2.2 Lithology encountered

The lithology encountered at the site comprised fill material (firm, dry, low plasticity sandy clay) to a maximum depth of 0.8 m BGL, overlying natural soil described as silty/ sandy clay or silty sand (Quaternary floodplain alluvium) to target depth (6 m BGL).

No visual and/ or olfactory evidence of contamination (e.g. odour, stain and/ or foreign materials) was identified during the drilling program.

7.2.3 Groundwater assessment

Four groundwater bores (PR_MW01 to PR_MW04) were installed by AECOM (2019b). Each bore was screened across the water strike (encountered in each bore at approximately 4 m BGL within the Quaternary floodplain alluvium) and across the post-drilling, stabilised, standing water level (SWL). Screened intervals ranged from:

- PR_MW01; screened in sand and clay (3 to 5 m BGL);
- PR_MW02; screened in sandy clay/ silty sand (3 to 6 m BGL);
- PR_MW03; screened in silty sand (3.7 to 5.7 m BGL); and
- PR_MW04; screened in silty sand/ clay (4 to 5.6 m BGL).

Based on the groundwater elevations reported, local groundwater flow direction was inferred toward the north-west, west and south-west. Although it was noted that the potential for groundwater flow toward the east could not be fully discounted given the absence of groundwater elevation data in this area.

The field chemistry within the bores showed that the groundwater was fresh (salinity 127 mg/L to 190.2 mg/L as total dissolved solids (TDS)) and slightly acidic (pH 6.22 to 6.43).

No visual and/ or olfactory evidence of contamination (e.g. odour, sheen, foaming) was identified during the groundwater sampling program.

7.3 Auditor's comments on field program

The Auditor considers that the sampling design was suitable and that the soil and groundwater assessment works were performed in accordance with best practice methodologies.

While it is noted that due to the size, shape and orientation of the current lot and the resulting required positioning of permanent groundwater bore installations, some uncertainty remains as to whether a proportion of local groundwater flow may be toward the east, the Auditor does not consider this to have adversely affected the findings of the groundwater assessment.

Any data gaps associated with groundwater flow and contaminant delineation will be addressed in a subsequent phase of work intended to focus on off-site assessment (refer to Sections 11 and 12 below.)

8 LABORATORY ANALYTICAL PROGRAM REVIEW

Samples were analysed by Australian Laboratory Services (ALS) as the primary laboratory and National Measurement Institute (NMI) as the secondary laboratory. Both laboratories are accredited with the National Association of Testing Authorities (NATA) for the methods used.

Primary samples, intra laboratory duplicates and rinsates were sent to ALS in Stafford (QLD), and inter laboratory duplicates were sent to NMI in Ryde (NSW).

Intra and inter laboratory duplicates and rinsates were analysed as part of AECOMs quality assurance/ quality control (QA/QC) procedures.

8.1 Analytical schedule and suites

The analytical schedule used for each sampling event is detailed in **Table 3** below.

Table 3: Analytical schedule

Sampling Location	Analyte	Primary samples	QA/QC		
			Intra laboratory duplicate	Inter laboratory duplicate	Rinsate
SOIL					
PR_BH01-PR_BH04	PFAS (28)	12	2	2	3
PR_SS01	PFAS (28)	2			
PR_BH03	TOPA	1			
GROUNDWATER					
PR_MW01 – PR_MW04	PFAS (28)	4	1	1	1
PR_MW02	TOPA	1			

Notes:

PFAS (28) – per and polyfluoroalkyl substances 28 compound suite (refer Table 2)

TOPA: total oxidisable precursor assay

The Auditor agrees with the analytical schedule used and that it is considered sufficient to characterise PFAS impacts (concentration and distribution) within and adjacent to the boundaries of the site and identify the potential for off-site contaminant migration.

8.2 Procedures for quality control and quality assurance

Quality control is achieved by using NATA registered laboratories using ASTM standard methods supported by internal duplicates, the checking of high, abnormal or otherwise anomalous results against background and other chemical results for the sample concerned.

Quality assurance is achieved by confirming that field results, or anticipated results based upon comparison with field observations, are consistent with laboratory results. Also, that sampling methods are uniform, and decontamination is thorough. In addition, the laboratory undertakes additional internal quality assurance procedures and tests.

These QA/QC processes were undertaken as part of this assessment, including collection and analysis of intra and inter laboratory duplicates and rinsate blanks.

Field observations are compared with laboratory results when they are not as expected. Confirmation, re-sampling and re-analysis of a sample are undertaken if the results are not consistent with field observations and/or measurements. In addition, field duplicate sample results have to be within the acceptable range of reproducibility.

A discussion of the quality of internal laboratory results and field duplicate relative percentage difference (RPD) calculations was included in AECOM (2019b) Appendix G and are discussed below.

The following was noted with regards to the QA/QC procedures:

- Sample integrity and container requirements were documented as acceptable;
- Holding time compliances were documented as acceptable with the exception of moisture content for four samples in batch EB1921187;
- Laboratory matrix spike results were mostly within acceptable control limits;
- Laboratory duplicate %RPD results were acceptable;
- All laboratory QA/QC method blanks were found to be acceptable; and
- Field replicate and triplicate RPD values were acceptable or, where non-conformances were identified, were appropriately assessed and deemed acceptable for use.

It is therefore the opinion of AECOM (2019b) and the Auditor that the data quality process for both field and laboratory components of the investigation was appropriate to enable the report conclusions to be relied upon.

9 ASSESSMENT CRITERIA REVIEW

9.1 Soil

Site investigation criteria were selected to provide an appropriate indication of the environmental status of the site with consideration given to the current and future land-uses as determined by existing site zoning and information provided by QFES. The adopted assessment criteria and rationale for their selection is detailed in Section 5.0 (AECOM, (2019b).

Typically for a soil contaminant concentration to be considered acceptable for the respective land-use criteria, the data set must conform to the following requirements:

- the 95% upper confidence limit (UCL) of the arithmetic mean of analytical results is below the site criteria;
- the arithmetic (or geometric in cases where the data is log normally distributed) mean is below the site criteria;
- the standard deviation is less than 50% of the site criteria; and
- no single sample analytical result is greater than 250% of the site criteria.

Soil analytical results have been tabulated (AECOM 2019b, Appendix B, Table T4) and compared to NEMP (2018) guidelines for human health and ecological indirect exposure, namely:

- Soil criteria for investigation:

- human health-based guidance value (industrial/ commercial);
- ecological guideline values for indirect exposure (industrial/ commercial); and
- ecological guideline values for indirect exposure (residential).

The Auditor notes that although the site is and is intended to continue as a commercial/ industrial property, AECOM has also assessed the soil analytical results against ecological guideline values for indirect exposure for the residential land-use exposure setting given:

- Parts of the site and areas adjacent to the site to the west are unsealed therefore there is a potential (albeit low) for exposure for terrestrial organisms (albeit transient as a result of on-going land-uses) in these areas; and
- The PFAS DRAFT NEMP Version 2.0 (HEPA 2019 unpublished, draft for consultation) intends to adopt the current residential guideline (0.01 mg/kg) as standard for both exposure scenarios, albeit endorsing modification of the guideline⁵ for commercial/ industrial sites on a case by case basis where use of a residential exposure scenario is deemed too conservative, for example:
 - The site is intensively developed with the percentage of the surface area covered by hard surfaces higher than 80% of each hectare (to be applied separately to each hectare);
 - Secondary consumers are effectively absent from the site;
 - The site is situated in an extensively built-up urban setting; and
 - The site is not in close proximity to waterways, drainage networks or groundwater.

9.2 Groundwater

Groundwater analytical results have been tabulated (AECOM 2019b, Appendix B, Table T5) and compared to the guidelines presented in **Table 4** below, as summarised in:

- NHMRC (2019) Guidance on Per and Polyfluoroalkyl Substances in Recreational Water; and
- HEPA (2018) PFAS National Environmental Plan (NEMP), January 2018.

⁵ Up to a maximum guideline concentration of 0.14 mg/kg, equivalent to the currently endorsed commercial/ industrial ecological guideline criteria for indirect exposure.

Table 4: Adopted assessment criteria – groundwater

Media	Environmental value	PFAS compound	Applicable guideline value (µg/L)
Groundwater	Human health – drinking water	Sum of PFHxS & PFOS	0.07
		PFOA	0.56
Groundwater discharging to surface water	Aquatic ecosystem protection – 99%	PFOS	0.00023
			0.051
	PFOA	19	
	Human health – recreational contact	Sum of PFHxS & PFOS	2.0
PFOA		10	

Notes:

0.07: (NEMP, 2018),

0.051: (Batley et al, 2018 – draft guidance, after AECOM 2019b);

2.0: (NHMRC, 2019)

9.3 Auditor's comments

The Auditor has reviewed the results and confirms that the criteria have been correctly applied, noting that the draft guidance applied by AECOM (2019b) for ecosystem protection has not been ratified by Australian regulators.

10 REVIEW OF RESULTS

10.1 Soil results compared to guidelines

10.1.1 Discussion

Detectable concentrations of PFAS, greater than the laboratory limit of reporting (LOR) were recorded in all fourteen soil samples analysed.

The highest proportion of PFAS was generally observed at shallow depth (in fill materials) consistent with a “top-down” mode of contamination associated with historic application of AFFF during training activities followed by leaching and/ or vertical infiltration through the soil profile.

Compositional analysis indicates that while the widest range of PFAS compounds were detected within the shallow depth interval 0.1 to 0.5 m BGL, the PFAS signature was dominated by PFOS and PFHxS throughout the soil profile and into the water-table.

Comparison with the adopted assessment criteria confirmed:

- No exceedances of the human health assessment criteria (commercial/ industrial land use scenario);

- One exceedance of the ecological guideline criterion for PFOS (PR_BH03 at 0.5 m BGL, 0.196 mg/kg) (ecological indirect exposure, commercial/ industrial scenario, criteria 0.14 mg/kg); and
- Ten exceedances (of 14 primary samples analysed) of the ecological guideline criterion for PFOS (ecological indirect exposure, residential scenario, criteria 0.01 mg/kg).
 - Noting (as discussed in Section 9 above) that assessment against the ecological indirect exposure limits was undertaken as a conservative measure, to account for the southern, unsealed portion of the site where secondary consumers such as insectivorous birds and/or mammals could forage.

10.1.2 Auditor interpretation of soil PFAS data

Given the majority of site soils are beneath an existing concrete slab and effectively capped on a site understood to have been subject to on-going commercial/ industrial use for the past 57 years, the ecological guideline exceedance at PR_BH03 at 0.5 m BGL is not deemed significant nor is it considered to pose a significant ecological health risk, in particular as the sample analysed at PR_BH03 at 1.0 m BGL had a PFOS concentration over an order of magnitude lower (0.0126 mg/kg).

Furthermore, while widespread exceedances of the residential ecological indirect exposure limit were identified; as noted above, assessment against residential criteria is a conservative approach given the minimal area of unsealed land and likely transient nature of wildlife likely to be directly exposed at the site. All but two of these exceedances were from samples located beneath the existing concrete slab in legacy commercial/ industrial areas.

10.2 Groundwater results compared to guidelines

10.2.1 Discussion

Detectable concentrations of PFAS were recorded in all four monitoring bores at the site with compositional analysis confirming the PFAS groundwater signature to be dominated PFOS and PFHxS (approximately 90% of the PFAS mass present) with a further five compounds accounting for the remaining 10%. This distribution is deemed indicative of potential higher mobility of shorter-chain compounds in the subsurface and/ or higher solubility of shorter chain compounds in groundwater.

Comparison with the adopted assessment criteria confirmed:

- Sum of PFOS and PFHxS concentrations exceeded the human health assessment criterion for drinking water and recreational water quality guideline in all four monitoring bores (PR_MW01 – PR_MW04), with the highest concentration reported in bore PR_MW02, located within the former foam training area (see **Figure 2**); and
- PFOS concentrations in all four groundwater bores exceeded the adopted ecological guideline value (99% species protection – fresh water).

10.2.2 Auditor interpretation of groundwater PFAS data

Given the above, and based on the assessment completed to date, the Auditor considers that the extent of PFAS in groundwater has not yet been fully delineated and, given the observed concentrations of PFOS and PFHxS in groundwater in particular, there is a potential that these compounds have migrated beyond the site boundary at concentrations greater than human health and ecological assessment criteria. This warrants further investigation.

While it is noted, based on groundwater elevation and associated groundwater contours, off-site migration may be primarily toward the west as discussed in Section 7.2.3 above, the proportion of localised, easterly flow cannot yet be determined, given the absence of elevation data in this area. Further assessment should also be undertaken to resolve this data gap. Observation of potential receptors for groundwater discharge indicates that the Proserpine River is 850 m north and Lagoon Creek approximately 1.5km south-west of the site, with numerous registered groundwater bores along these potential flow paths (see **Figure 1**). There is also a drain in Johns Estate Park, located 550 m south-east of the site.

10.3 TOPA analysis

The results of the TOPA analysis (completed on one soil and one groundwater sample) determined that the soil and groundwater analytical results are likely indicative of a degraded PFAS product that is unlikely to significantly increase or alter via biotransformation or oxidation processes over time.

10.4 Data quality, data gaps and other considerations

Based on the results obtained from the assessment, including QA/ QC data, it is concluded that the data quality is appropriate and as such the results can be relied upon.

AECOM (2019b) outlined that any RPD exceedances were a result of heterogeneity and did not affect the outcomes of the report. AECOM (2019b) also reviewed document completeness, data completeness, data comparability, data representativeness and precision and accuracy for sampling and analysis. No outliers were reported when compared to the adopted evaluation criteria.

The Auditor has undertaken his own assessment of the data and arrived at the same conclusions as the SQP. This assessment has included a check of RPD calculations (discussed above), as well as comparison of field and laboratory collected data (where available).

10.5 Confirmation of conceptual site model and source-receptor pathway linkages

Based on the findings of the CLID (AECOM, 2019b), it can be confirmed that all possible source to receptor pathway linkages have been identified and quantified to the extent practicable within the limitations of this investigation:

- AECOM (2019b) concludes there is no unacceptable human health and/ or ecological risk associated with the identified PFAS concentrations on-site, within the commercial/ industrial exposure context; and
- AECOM (2019b) considers that, based on the groundwater investigation completed to date, there is a potential that impacted groundwater may have or be migrating beyond the site boundary at concentrations greater than human health (drinking water/ recreational) and/ or ecological assessment criteria and that further investigation to appropriately delineate the PFAS plume and quantify risks posed to down-gradient sensitive receptors should be undertaken.

The Auditor concurs with AECOMs conclusions and considers further off-site investigation is warranted to appropriately assess risk to off-site receptors and determine an appropriate management and/ or remediation strategy, if required. Specifically, the potential exposure pathway associated with off-site groundwater migration and subsequent groundwater use (potable/ other) by or discharge to sensitive receptors needs to be investigated and quantified in order to allow an assessment of environmental harm.

11 ASSESSMENT OF REPORT AGAINST S389 OF EP ACT 1994

11.1 Key descriptive elements under S389 (1) of the EP Act (1994)

In summary, it is the Auditor's opinion that the CLID reviewed has provided adequate information about the land, as it has described the relevant elements, and the Auditor has assessed these descriptions against s.389(1) of the EP Act (1994).

A summary of the findings of the Audit is provided in this report (statement of reasons), with a reference table for each element in **Table 5** below.

11.2 Endorsement of statements under S389 (2) of the EP Act (1994)

Following on from the above summary of reasons for accepting the CLID, the Auditor is able to endorse the statements made in the CLID relating to s.389(2) of the EP Act (1994):

- Insufficient data has been collected (chemical and physical) beyond the site boundary to determine whether the site is prescribed contaminated land;
- The extent of PFAS contamination on the land has been assessed to an acceptable degree and it has been determined that the site is suitable for on-going commercial/ industrial land-use;
- Further data is required to be collected off-site to determine the extent that the land is impacting, or has the potential to impact on, any receptors or beneficial uses of groundwater; and

- It is the Auditor's opinion that the CLID complies with the contaminated land NEPM (NEPC, 2013).

Table 5: Auditors assessment of CLID contents

Subsections of section 389 of the <i>Environmental Protection Act 1994</i>		Reference to CLID (i.e. sections, pages and/or paragraphs) that comply with the corresponding subsection of section 389 of EP Act	Reference to auditor's statement of reasons (i.e. sections, pages and/or paragraphs) of why each requirement has been deemed compliant
(1)(a)	the reasons particulars of the land have been recorded in a relevant land register	Table 2	Section 4
(1)(b)	a description of all surface and subsurface infrastructure on the land, including details of the location, size and type of the infrastructure	Section 2.2 Site Layout and features/Figure 2	Sections 4.2 and 7.1
(1)(c)	a description of the surrounding area of the land, including a description of each of the following in the surrounding area:	Section 3	Section 4.2
(1)(c)(i)	- all environmentally sensitive areas	Section 3.7 GDEs and Environmentally sensitive areas	Section 4.2 and 6.4.3
(1)(c)(ii)	- the location of all water, watercourses and wetlands	Section 3.4 Hydrology, Section 3.7 GDEs and Environmentally sensitive areas	Sections 6.1 and 6.4.3
(1)(c)(iii)	- the location of all storm water drainage	Section 2.2 Site layout and features/ Figure 2, Section 2.4 Previous environmental investigation, Section 3.4 Hydrology	Sections 6.1 and 7.1
(1)(c)(iv)	- all uses of the land, including uses that may affect the safety of the relevant land or cause environmental harm	Section 2.2 Site Layout and features, Section 2.3 Surrounding land use	Sections 4 and 5
(1)(c)(v)	- all activities carried out that may affect the safety of the relevant land or cause environmental harm	Section 2.4 Previous environmental investigations/ Table 1	Section 5
(1)(d)			
(1)(d)(i)	- details of the location, volume and type of the waste	Section 2.4 Previous environmental investigation	Section 7.1

Subsections of section 389 of the Environmental Protection Act 1994		Reference to CLID (i.e. sections, pages and/or paragraphs) that comply with the corresponding subsection of section 389 of EP Act	Reference to auditor's statement of reasons (i.e. sections, pages and/or paragraphs) of why each requirement has been deemed compliant
(1)(d)(ii)	- details of any potential contamination of the land caused by disposing of or storing the waste on the land	Section 2.4 Previous environmental investigation	Section 10
(1)(e)	a description of the geology and hydrogeology of the land	Section 3.2 Soil type and ASS; Section 3.3 Geology; Section 3.5 Hydrogeology	Sections 6.2, 6.3 and 6.4
(1)(f)	details of any environmentally relevant activities or notifiable activities carried out on the land, including the materials used and waste produced during the carrying out of the activities	Section 2.1 Site Identification, Section 2.4 Previous Environmental Investigation	Sections 1 and 5
(1)(g)	details of any earthworks carried out on the land, including the materials used and waste produced during the earthworks	Section 2.2 Site layout and features, Section 2.4 Previous Environmental Investigation, Section 4.0 fieldwork	Sections 5 and 7
(1)(h)	if work has been carried out on the land to remediate the contamination of the land—the contamination levels recorded on the land before and after the work was carried out	Not applicable	Not applicable
(1)(i)	for a draft site management plan:		
(1)(i)(i)	- the proposed objectives to be achieved and maintained under the plan	N/A	N/A
(1)(i)(ii)	- the proposed methods for achieving and maintaining the objectives	N/A	N/A
(1)(i)(iii)	- the proposed monitoring and reporting compliance measures for the land	N/A	N/A
(2)(a)	a statement (a <i>site suitability statement</i>) of the uses or activities for which the site is suitable	-	Cover Letter and Section 12
(2)(b)	a statement of the following matters:		

Subsections of section 389 of the <i>Environmental Protection Act 1994</i>		Reference to CLID (i.e. sections, pages and/or paragraphs) that comply with the corresponding subsection of section 389 of EP Act	Reference to auditor's statement of reasons (i.e. sections, pages and/or paragraphs) of why each requirement has been deemed compliant
(2)(b)(i)	- whether the land is prescribed contaminated land	Section 6: Results, Section 7: Discussion, Figs 2-5	Sections 10 and 11.2
(2)(b)(ii)	- if the land is contaminated—the extent to which the land is contaminated		
(2)(b)(iii)	- for a draft site management plan—whether the proposed objectives, methods and measures stated in the plan under subsection (1)(i) are appropriate	N/A	N/A
(2)(b)(iv)	- the extent to which the assessment of the land is in accordance with the contaminated land ASC NEPM	Section 1.3: Objectives, Section 4: Fieldwork- DSI, Section 8: Conceptual site model, Appendix G: Data quality evaluation	Sections 11 and 12

12 AUDITOR CONCLUSION AND RECOMMENDATIONS

The following evaluation has been made on the CLID (AECOM, 2019b):

- the SIR adequately justifies the conclusions in the context of site history, level of assessment, development of a robust CSM, and relevant aspects of NEPC (2013), NEMP (2018) and DES (2015 and 2018) in particular;
 - the CSM developed for the site (AECOM, 2019b) adequately identifies CoPC including their sources and potential pathways to identified receptors at and about the site, and then allocates appropriate Tier 1 criteria to ensure the identified potential receptors are protected by concentrations at the source/s; and
 - the conclusions of the final CLID (AECOM 2019b) are therefore underpinned by a robust assessment and consistent with the appropriate guidelines and legislation.

In summary, the CLID findings have determined that while soil contamination in excess of adopted ecological indirect exposure guidelines exists at the site, given the presence of concrete hardstand, the legacy commercial/ industrial use of the site, and the relatively low concentrations identified, this does constitute a significant ecological risk and the site is suitable for on-going commercial/ industrial use.

However, noting that concentrations of PFOS and PFHxS in groundwater at the site exceed relevant guideline criteria, there is a potential that impacted groundwater has migrated beyond the site boundaries. Accordingly, the CLA considers that further off-site investigation is warranted to comply with legislation and quantify the risk (if any) to off-site human and/ or ecological receptors along a complete exposure pathway and therefore determine what notification, remediation and/ or management measures may be necessary at the site to mitigate these risks.

13 LIMITATIONS

Mark Stuckey of Environmental Earth Sciences has prepared this CLA report (719052_QFES_PNE_AuditorCert_V1) in accordance with Section 568 of the *EP Act 1994* and DES (2018). The Report has been prepared solely to support the CLA's (Mark Stuckey's) certification of the CLID prepared by the SQP for the site.

The Report relates only to those matters relevant to certification of the CLID under relevant provisions of the *EP Act 1994*. It is not intended, nor is it suitable, for any other purpose and should not be relied upon for any other purpose.

The Report only considers the contaminated land aspects of the site (in relation to PFAS compounds only) and does not provide an opinion regarding other aspects of the site or the environment not related to site contamination such as (but not limited to):

- hazardous building materials in buildings or structures;
- structures, footings, infrastructure and the like (whether above or below ground);
- the suitability of fill materials for any use and any geotechnical considerations;
- regulatory responsibilities or obligations (for which a legal opinion should be sought);
- work health and safety legislation; or
- the suitability of any engineering design.

If specialist technical review of such additional issues is required, then separate advice should be obtained from appropriate specialists.

The Auditor is not one of the specialists who prepared the CLID. The Auditor has independently evaluated the CLID and its site suitability statement prepared by the SQP in order to certify that the CLID complies with the content requirements of Sections 389(1) and 389(2) of the *EP Act* as far as practicable, noting the investigation was undertaken to characterise PFAS contamination, only. In preparing the Report, the Auditor has assessed the suitability of the SQP to prepare the CLID in accordance with the *EP Act*, and has relied on the experience, expertise and integrity of the SQP, as declared by the SQP.

Whilst the Auditor has taken reasonable measures to verify the accuracy and completeness of information presented by the SQP and included in the CLID, neither the Auditor nor Environmental Earth Sciences accepts any liability for misrepresentation of information or for the omission of any information in the CLID that is material to the Auditor's certification.

Sampling and chemical analysis of environmental media are based on guidance made and approved by the relevant regulatory authorities. Conclusions arising from the assessment of environmental data are based on the sampling and analysis considered appropriate based on these regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants. Ground conditions between sampling locations may vary, and this should be considered when extrapolating between sampling points.

As environmental sampling for this program has been undertaken to characterise the concentration and distribution of PFAS compounds only, no warranty or guarantee is provided that other hazardous and/ or toxic chemicals associated with previous historic land uses do not exist at the site. Furthermore, it is noted that assessment of risk is based on currently available guidance; given regulatory standards change over time and there may be materials present at the site that whilst not considered hazardous at the present time may be considered hazardous in the future.

Changes to the site conditions may occur subsequent to the investigations described in this Report, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this Report are based on the available information at the time of the investigation of the site.

Should new information become available about contamination at the site that may materially affect the validity or appropriateness of the conclusions in the Report, the Auditor reserves the right to review the Report in the context of any such additional information.

14 REFERENCES

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Public Safety Business Agency (PSBA) (2019). Terms of Reference – Audit of Site Investigation Plan for the evaluation of concentration and distribution of per- and poly-

fluoroalkyl substances (PFAS) from selected Queensland Fire and Emergency Services facilities.

United States Environmental Protection Agency (USEPA) (2006). Guidance on systematic planning using the data quality objectives process. EPA QA/G-4, February 2006.

ENVIRONMENTAL EARTH SCIENCES GENERAL LIMITATIONS

Scope of services

The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for.

Data should not be separated from the report

A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Subsurface conditions change

Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly be present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

Obtain regulatory approval

The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party.

Limit of liability

This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose.

APPENDIX A: AUDITOR CERTIFICATE OF APPROVAL

Certificate

Environmental Protection Act 1994

Certificate of Approval

Approval No: CLAD06400917

This certificate of approval as an auditor is issued by the chief executive¹ pursuant to section 573 (2)(a) of the Environmental Protection Act 1994.

1. Approved person

Mark Stuckey

2. Approved auditor functions

The approved person is approved to perform auditor's functions under 568(b) of the *Environmental Protection Act 1994* and relevant auditor's functions pursuant to the provisions of the *Planning Act 2016*.

3. Term of approval

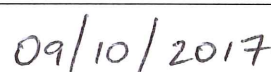
This approval will remain in force until **9 October 2020** unless it is earlier cancelled or suspended.

4. Conditions of approval

The approved person must comply with the most recent version of The Queensland Auditor Handbook for Contaminated Land, Module 4: Code of Professional Conduct.



Signature



Date

Chris Loveday

Director
Environmental Services and Regulation
Department of Environment and Heritage Protection
Delegate of the chief executive
Environmental Protection Act 1994

Enquiries:

Ralph Riese

A/Manager,
Regulatory Capability and Customer Service
Department of Environment and Heritage
Protection
Phone: (07) 3330 5706

¹ The Director-General of the Department of Environment and Heritage Protection is the chief executive under the *Environmental Protection Act 1994*.

APPENDIX B: AUDITOR CERTIFICATION AND DECLARATION

Auditor certification and declaration

Contaminated land investigation document

This template is for use by an auditor, in relation to a function under s. 568(b) of the Environmental Protection Act 1994 (EP Act), to certify a contaminated land investigation document under s. 389(3) of the EP Act, and to make a declaration under s. 574C of the EP Act.

1. Details of the auditor's function

Auditor

Name Mark Stuckey
Company Environmental Earth Sciences
Registered business address Unit 3, 1 Ross Street, Newstead, QLD
Telephone 07 3852 6666
Email mstuckey@eesigroup.com
Auditor approval number (Qld) CLAD06400917

Details of the contaminated land investigation document

Title of the contaminated land investigation document: PFAS Detailed Site Investigation: Proserpine Fire Station, 102 Main Street, Proserpine Queensland. Rev 0 (FINAL). 16 December 2019. Author: James Peachey (SQP)
The contaminated land investigation document comprises (tick all applicable boxes): <input checked="" type="checkbox"/> site investigation report <input type="checkbox"/> validation report <input type="checkbox"/> draft site management plan <input type="checkbox"/> draft amended site management plan
Objective of the contaminated land investigation document: <input type="checkbox"/> Required by a notice issued by the administering authority under the EP Act (notice reference number:) <input checked="" type="checkbox"/> Prepared voluntarily to remove, or change details of, land on the environmental management register (EMR) or contaminated land register (CLR) <input type="checkbox"/> Other (provide details):
Title(s), version number, date, and author(s) of report(s) or draft site management plan(s) evaluated—for each separate document forming a component of the contaminated land investigation document. AECOM (2019a) Preliminary Site Investigation and Sampling, Analysis and Quality Plan, QFES, April 2019

Auditor certification and declaration
Contaminated land investigation document

Title(s), version number, date, and author(s) of any report(s) or plan(s) previously submitted to the administering authority that forms part of the current contaminated land investigation document.

Auditor engagement

Auditor was engaged by:

- Owner
 Occupier
 Developer
 Administering authority
 Other (provide details):

Name of person/company who engaged the auditor:

Raymond Bott, Queensland Fire and Emergency Services

Date auditor was commissioned: 18/07/2019

Relevant land

Lot on plan 1/RP706146	Title(s) of attached site plan(s): Ref: 20154201
Street address 102 Main Street, Proserpine, QLD	Postcode 4800
Local government area Whitsundays Regional Council	EMR/CLR ID (if applicable)
Registered owner name The State of Queensland (represented by Public Safety Business Agency)	Registered owner address Public Safety Business Agency, Level 13 Makerston House, 30 Makerston Street, Brisbane, QLD 4000

Is there a radiation impact on site?

- Yes—you must provide a support expert's statement
 No

Support expert(s) engaged by auditor

- No support expert was engaged
 One support expert was engaged—the support expert's details are provided below.
 More than one support expert was engaged—a full list of each support expert's details is attached.

Name

N/A

Company

N/A

Describe the matter(s) for which the support expert provided expert advice:

N/A

- Support expert's report (or other document) attached

2. Auditor's certification and declaration

Certification

I certify that the contaminated land investigation document complies with ss. 389(1) and 389(2) of the *Environmental Protection Act 1994* having regard to the guidance provided in the *Queensland auditor handbook for contaminated land, Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports* (Department of Environment and Science, 2018).

In particular, I certify that the site suitability statement provided in the contaminated land investigation document accurately states the uses or activities for which the land is suitable.

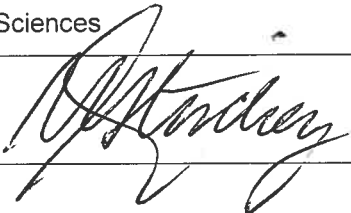
I have attached an audit report, titled *719052_QFES_PNE AuditorCert_V1*, about my conclusions with respect to the requirements of subsections 389 (1) and 389(2) of the *Environmental Protection Act 1994*. The audit report explains and justifies how I arrived at my decision to certify that the contaminated land investigation document and its site suitability statement comply with ss. 389(1) and 389(2) of the EP Act.

Declaration

I am an auditor approved to undertake a function under s. 568(b) of the *Environmental Protection Act 1994*.

I declare that:

1. I possess qualifications and experience relevant to the audit of the contaminated land investigation document, or, where not, I have engaged an appropriately qualified and experienced support expert.
2. I have not knowingly included false, misleading or incomplete information in my certification of the contaminated land investigation document.
3. I have not knowingly failed to reveal any relevant information or document to the administering authority.
4. The certification of the contaminated land investigation document, including the audit report, addresses the relevant matters for the audit and is factually correct.
5. The opinions I have expressed in the certification and audit report are honestly and reasonably held.

Auditor's name	Mark Stuckey
Company	Environmental Earth Sciences
Auditor's signature	
Date	19 February 2020

APPENDIX C: CORRESPONDANCE WITH SQP

James Peachey
Associate Director- Environment
AECOM
Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006



Mr Peachy,

Thank you for the AECOM draft report "*PFAS Detailed Site Investigation – Proserpine Fire Station, 102 Main Street, Proserpine, Queensland*".

I would like to provide the following comments, together with the Contaminated Land Assessors comments on your draft report for your consideration and reply.

Thank you for your work on this project

Regards

 	<p>Inspector Raymond Bott AFSM GradCert(EmerMngt) MAppSc(Research) PhD <i>Manager Scientific Volunteers</i> <i>Research and Scientific Branch</i> <i>Queensland Fire and Emergency Services</i> <i>24 Corporate Drive Cannon Hill, Q 4170</i> <i>P. (07) 3909 4305 M: 0417 783 779</i></p>
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Page	
Executive Summary	Key Findings Second bullet point: mixes both residential and commercial, which should be listed for both. Also be more explicit what contamination (e.g. PFOS) and source guidelines are referenced from. For commercial values only one sample is

	<p>exceeded (BH03-0.5m) – NEMP p813. This point should also clearly indicate that PFOS is the trigger concentration for ecological investigations.</p> <p>Third bullet point: states elevated PFAS concentrations exceed the drinking water and recreational water guidelines. This should clearly identify PFOS+PFHxS as PFOA is not exceeded - Last sentence should be first bullet point and re-expressed as contaminants, e.g. majority contaminants were...</p> <p>Also the highest reading is from previous fire fighting training.</p> <p>Forth bullet point: states elevated PFAS levels. This should state elevated PFAS levels for PFOS+PFHxS.</p> <p>Also last sentence is correct in stating residential properties lie 100 to the south, but shouldn't the commercial/industrial site between the fire station and residential block be stated, as transmission is through the commercial/industrial site.</p>
5	<p>Table 3: South: A Commercial site is adjacent to the southern boundary of the Proserpine fire station. A residential site is adjacent to the Southern boundary of this commercial site boundary which is adjoining Marathon street.</p> <p>2.4: dot point 2, sentence five – since 2003 ... positive approach in writing i.e manufacture's standards and the manufacturer supplies lab analyses for it's products showing no PFAS present.</p>
6	<p>Dot point 7: Sentence states potential other contaminators within 4km radius, these should include the bulk fuel storage site</p>
7	<p>3.4 Hydrology: This Chapmans Lagoon behind the Proserpine Business and Technology Park, where significant heavy machinery is stored</p> <p>3.5: Hydrogeology: Inferred groundwater flow of N is in contrast to executive summary and conclusions where inferred groundwater directions are N, S, W with unknown E. This is also inconsistent with the inferred groundwater flow listed in 6.2.2</p> <p>This area is an acid sulfate region which should be mentioned as it is known to interact with PFAS</p>
9	<p>4.2: Table 6. The location/rationale description for PR_BH02 and PR_BH03 are identical, but should reflect a northern area (adjacent to station building) and central area</p>
10	<p>4.2.1: Table 7: Soil sampling activity, under details final sentence not complete.</p>
11	<p>4.2.2: Table 8. Sample preservation. Ice bricks are generally not used because of the potential for PFAS contamination. Confirm these were PFAS free in the wording.</p>
13	<p>5.0 Assessment Criteria: needs to be more specific on contaminants and consistencies with residential and commercial values</p> <p>Table 10: Adopted investigation levels for PFAS Soil: The industrial/commercial is for human health which should be clearly identified.</p> <p>Whilst the interim soil-ecological exposure value for PFOS in residential settings is relevant for reference, the commercial/industrial ecological value should also be included for PFOS.</p> <p>Sediment: Whilst the 99% species protection is presented, the 95% species protection should be presented for consistency by virtue of the HEPA sign-off of the NEMP. The 95% value is clearly within laboratory LOR data.</p>

14	<p>6.2.1: It should be noted that all bore reports, except BH03 show water in the sand region and not the clay region, and that the soil composition is different in BH03. This is consistent with excavation work that may have influenced the PFAS migration and soil movements</p> <p>6.2.2: The inferred groundwater flow NW, W, S conflicts with executive summary and 3.5 hydrogeology</p>
15	<p>A summary table of the results of interest should be included to enable the reader to more easily see the trends you are trying to show across the site.</p> <p>Table 12: There is uncertainty in what criteria what level are being applied. If PFOS commercial criteria are used, only one exceedance exists. For PFOA you stated an ecological value earlier in the document, but show no guideline in this table. Similarly, for PFOA ecological column shows no guideline, but the NEMP has several criteria for it.</p>
17	<p>Based on the data provided, BH02 has a different soil profile and appears to have a faster vertical movement than the other bores where vertical movement is much lower.</p> <p>Table 15: BH02 and BH03 explanations appear to be inconsistent with draft map provided, the maps in Appendix A and with the section in 7.2, paragraph above it.</p> <p>7.2 discussion: There appears to be a change in the soil profile and the concentration of PFAS at BH03. Has consideration been given to the septic tank and petrol tank locations which would have disturbed the soil profile and composition. This may have provided a a trap for collection of PFAS, in contrast to the remaining BH locations.</p> <p>Table 15 explanation should be reviewed to taken into account the above observations. We also note that a septic tank is present which would have led to disturbed and change soil types/conditions. This appears to provide an easier entry into the aquifer water.</p>
18	<p>Second paragraph: please specify what PFAS (PFOS+PFHxS) is in exceedance of criteria and the criteria applied, as it appears you are referring to residential with gardens. However, residential without gardens is the value is an order of magnitude lower and if the commercial value is used, it is two orders lower. All three should be quoted with an explanation, or an explanation as to why only residential with gardens is used. Also, the exceedance of PR_BH03 is quoted for PFOS+PFHxS, when the ecological values are for PFOS only. The exceedance (PFOS 0.196 mg/kg) of the commercial value is thus . 40%, not the 50% as stated in the bracketed text. It should be noted that the PFOS concentration at 1m is below the commercial criteria and indicates that it is remaining near the surface below the concrete.</p> <p>Table 16: This is introduced as a summary of average composition of PFAS in the Proserpine soil, the use of distribution profile might be more informative. It is not a statistical analysis. Where is the standard deviation data and error analysis data. The table also states a population of 13 samples, when table 15 show 14 samples. Why is one sample been discounted?</p> <p>Need to be specific about language and what PFAS you are talking about. Why is the weighted average for all samples expressed as a single value? Surely a table with averages at the different depth be more informative? Or a least an explanation that there is no difference, and hence the one value used. You have stated a weighted average of 82.5%. There is a PFOS range of 31% - 87% and for PFOS+PFHxS there is an average range of 49% to 100%.</p> <p>Table 16 should split PFOS and PFHxS to reflect the different chain lengths which literature suggest have different mobilities through soil, and the text discussions use two different soil criteria, one that is exclusively PFOS.</p>

	<p>We would prefer the analytical data with a table displaying the product distribution/profiles and concentrations of PFAS across all soil samples. – either here or appendix</p> <p>7.3: This should follow the same approach as discussed above for soil samples.</p>
19	<p>Table 17: as above in table 16 We would prefer the analytical data with a table displaying the product distribution/profiles and concentrations of PFAS across all soil samples. – either here or appendix</p> <p>Also, clearly outline the criteria you are applying, and disregarding and why.</p> <p>7.4. What is table 18 providing? Could this be merged with table 16 and 17. Could all three tables be merged to provide common data.</p>
20	<p>Discussion of table 18? This could be tied to tables 16 & 17 where soil: >C6 is greater than 91% of PFAS moieties and Water: >C6 is greater than 96%. This could be better spread if PFOS and PFHxS were separated in tables 16 & 17. This could also be compared to salinity, pH and other important parameters that can affect sorption (coefficient) and mobility across the soil matrix etc.</p>
21	<p>Should consider adding during product transfer and activities</p> <p>The last sentence after dot point 2 in primary sources “The main contaminants of concern.....” should be before 8.2.1 as it relates to all sources.</p>
27	<p>Conclusions: Dot point 3, product transfer and vehicle maintenance are other reasons that should be added for PFAS spillage potentially occurring on site.</p> <p>Dot point 2, throughout the document there is inconsistent language for groundwater flow. Please correct and explain why eastern uncertainty is important, as you have made inferred directions based on available data. If east is important, then you have chosen all directions and we don't really have any idea of ground water flow.</p> <p>Dot point 3, again discusses residential guidelines, but does not discuss any. There is no explanation for ignoring the commercial guidelines. Surely both should be included and a discussion of which are chosen and why.</p> <p>Dot point 4, more clearly define the issue. The four bores exceeded the drinking and recreational water guidelines for PFOS+PFHxS only. TOPA has also not been mentioned or discussed TOPA. This would indicate that this contaminant is historical and will not significantly increase through biotransformation or oxidation processes.</p> <p>Dot point 5, based on the inferred data you have and the available geological data, you have selected ground flow directions. Again, why introduce east?? It is mentioned in the document that there has been a number of bores around the station have shown low level (below) guidelines. This should be mentioned and explained what may change in increase the risk of this contaminant.</p> <p>Dot point 5, as discussed earlier, product transfer and activities should be added as possible sources.</p>
Appendix A	<p>Figure F6, identification of a septic tank site. Should this not be identified as a feature that may influence the PFAS mobility etc</p>
Appendix B	<p>Tables 4 & 5 should have all considered criteria that were discussed in the text, i.e. add PFAS NEMP Soil ecological commercial value for PFOS 0.14 mg/kg in table 4 and NEMP ecological freshwater 95% protection 0.13 µg/L especially since the 99% level is below lab LOR.</p> <p>Table 4: PR_QC204_190807 sum of PFAS value is incorrect</p>
Appendix C	<p>Plate no. 4 mentions an old fuel tank is mentioned, but not discussed in the body of the report or shown on the figure 6 in Appendix A</p>

Appendix D	Why are bore logs only in draft format
Appendix G	Table G2: There is some concern that you have accepted data that has not met your QC/QA criteria, especially since it relates to PFOS and a monitoring well of interest. This is also after the note that TOPA data was of concern and needed to be repeated.
Appendix H	<p>E2.0 AECOM QC assessment of data quality control list criteria for data quality indicators, e.g. outliers exist for matrix spikes, duplicates, lab control samples and numerous other criteria. Please explain why data is accepted with these outliers which seem to be in contrary to guidelines, e.g. EB1921176 quality control exceedances with no explanation why data has been accepted with these failures. Other numerous examples occur, e.g. EB1921176, sum PFOS+PFHxS shows RPD 24.6% (ALS acceptable recovery 0 – 50%), but as value is more than 20 times LOR, it should be a failure by AECOM QC guidelines.</p> <p>NMI data appears to have only performed a laboratory control standard. Where are there QC samples data?</p> <p>Method blank and Lab QC report. It appears that ALS are only spiking four of the standard analytes, EB1922105.</p>

Table 1: Auditor comments on specific sections of the SIR

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
1.		General	Please consider the value-add of including a “Glossary of Terms” as per the PSI/SAQP (AECOM, 2019)
2.		Figures	It is recommended that topography (e.g. 1 m and 10 m contours from Queensland Glove) be included on each site location/layout plan to assist in estimation/discussion of likely groundwater and surface water flow directions.
3.	Figures	Figure 1	<ul style="list-style-type: none"> • Bore RN162365 does not appear to be shown on Figure 1. • RN162343 (bottom) and RN12200225 (centre, top), are missing registered bore symbols, (although it is noted these locations may be difficult to who, in the vicinity of other nearby wells, at this resolution, please check and amend as necessary. • Please check symbol to the left of RN131800 (right side of diagram) – this symbol appears to be missing a label. • Given accompanying Table 4 presents data for those registered bores within 500 m of the site, it may be beneficial to add a “500 m site radius” to the Figure.
4.		Figures 2 – 5	Consider amending the symbol for PR_SS01 to provide clarity that this is a bore location. Due to proximity of trees/ grass label, the use of a cross can be slightly misleading in relation to which feature it is highlighting.
5.		Figure 3	Throughout the text, reference is made to groundwater flow direction varying from “north, north west, west and south”. Flow direction arrows on the Figure are not consistent with inferred directions provided in the text. Please review and amend as necessary.
6.		Figures 4 and 5	Please consider increasing the font size of the exceedances key at the base of the legend. (While it is noted electronically, this does not pose an issue, at print size A4 this data becomes unreadable in hard copy)

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
7.		Figure 6	<ul style="list-style-type: none"> • General Comments: Consider colour coding, or providing prefixes “P1/R1” to make labelling of pathways and receptors clearer • Geology presented on the CSM appears incorrect. Although the Fire station has concrete paving overlying natural soils and underlying geology, this is not presented on the CSM. Furthermore, it is noted that no consideration of depth of fill vs natural has been provided although these lithologies are referenced in the report text when discussing site setting. Please review and update to provide more accurate reflection of conceptual site geology and contaminant distribution therein. • An arrow has been provided in the legend to indicate “migration in stormwater drains”. However, no stormwater migration is shown on the CSM- please review and amend as necessary. • Groundwater flow direction is presented as North – South. However, in text it is understood inferred flow is to the north, west and south. Please provide an indication, on the CSM of the appropriate flow directions and check consistency of inferred groundwater flow directions, throughout. • Consider the inclusion of “Case Pit 4” and Foam storage room on the CSM. Case Pit 4 is of particular importance as a source given PFAS was historically detected here. • Consider the inclusion of the historic underground storage tank (UST and fuel bowser). Excavation and infill of the tank pit and associated underground pipework could change the subsurface conditions and create preferential pathways for contaminant migration, lateral movement and/or accumulation. <p>Transport Pathways: General: Site drainage and/or underground service conduits (potential preferential pathways) are not shown adequately to provide meaningful representation of PFAS migration via surface water run-off and offsite migration, sediment transport and/or groundwater migration via preferential pathways. Please review and amend as necessary.</p> <ul style="list-style-type: none"> • Transport pathway 1 – Consider inclusion of drums/other clipart to adequately demonstrate this release and differentiate between spillage/leakage and sorption to soils • Transport pathway 3 – Absence of concrete at site surface. (It is noted historically; site may have been unsealed during training application. However, site has been sealed during majority of service station activities therefore concrete cover should be accounted for, particularly as leaching from concrete has been specified as a potential transport pathway.)

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
			<ul style="list-style-type: none"> • Transport pathway 4 – “Leaching of PFAS from concrete” yet no concrete structures are shown on the CSM that would represent this source. • Transport pathway 9 – this pathway is not presented clearly. Arrow used to demonstration dispersion with wind is the same as infiltration/leaching. • Transport pathway 10 has been provided off the CSM as an afterthought. Consider extending the CSM to appropriately demonstrate this pathway if deemed viable <p>Receptors:</p> <ul style="list-style-type: none"> • Receptor A – Consider showing worker in excavation, in ground, to differentiate between receptor A (intrusive worker) and receptor B (QFES personnel). • Receptor C – Consider extending CSM to include off-site water users. • Receptor D and F - Consider extending CSM to show Proserpine River. Receptors D and F currently floating in mid-air. • Receptor E – Consider graphic to demonstrate the existence of a terrestrial ecosystem (grassed area).
8	Tables – Appendix B Table Headings		<ul style="list-style-type: none"> • Table T6: Surface water analytical results and Table T7 Sediment analytical results are listed. Neither T6 nor T7 exist and are included in text – please review and amend as necessary.
9.	Appendices	Appendix B	<ul style="list-style-type: none"> • Please add table notes detailing acronyms and/or meaning of table symbology (e.g. “<: less than limit of reporting and “-“not analysed/sampled etc”. • Consider greying out those concentrations that are <LOR to better distinguish detectable concentrations with non-detects. • All relevant assessment criteria should be presented in analytical result tables (Tables T4 and T5). Please review and amend as necessary. • Table T4: PR_QC204_190807 sum of PFAS value is incorrect.
10.			<p>Table T4 soil criteria</p> <p>For ecological exposure, you have adopted the residential soil criteria from the NEMP (0.01 mg/kg). Given the commercial/ industrial land-use on site and in the immediate surrounds (noting closest residential is about 100</p>

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
			m away)– might the commercial/ industrial indirect exposure criteria (0.14 mg/kg) be more relevant here (albeit, it is less conservative)?
11.	Appendices	Appendix C	<ul style="list-style-type: none"> Plate No. 4 indicates an old underground storage tank (UST) is present on site. However, this has not been considered in the soil discussion (e.g. excavation and infilling of tank pit/underground pipe network potentially impacting natural soil conditions and providing preferential pathways for contaminant flow/accumulation. Please review and amend relevant report text as necessary.
12.	Appendices	Appendix F	<ul style="list-style-type: none"> Section E4.3.3 indicates that RPDs for laboratory duplicate samples were within the limits for all analytes for all batches. However, laboratory duplicate outliers were reported for TOPA analysis (batch EB1921187) and soil/groundwater analysis (EB1921176), Section E4.2.4 indicates that the RPDs for all matrix spike recoveries were “within recovery limits for analytes”. However, it is noted that for batches EB1919842 and EB1921176 MS recoveries were either not determined or, were less than the lower data quality objective for three analytes. Laboratory control spike recovery outliers were reported for batch EB1921176. <p>Please review and provide brief commentary (as necessary) with regards to any impacts upon data quality/validity associated with these LCS/duplicate outliers/ matrix spike recoveries.</p>
13.	Appendices	Appendix F	Please review EB1921176 & EB1922105 attachments – ALS certificates do not reproduce fully in PDF. Please review final report and reattach laboratory documentation, as required.
14.	Appendices	Appendix G	<p>It is noted the report text indicates 1 rinsate collected for each day of sampling. However, three rinsates are presented for the Proserpine drilling in Appendix G Table G3, two collected on 26th July 2019.</p> <p>Please provide any necessary commentary detailing why two rinsates were required on 26th July and any implications with regards to data quality/data validation that may result (for example, if the additional rinsate was collected in response to a breach in procedures that required assessment etc).</p> <p>Please provide further explanation regarding the useability of data that has failed QA/QC criteria (PFOS in Table G2) and provide further commentary regarding problems with the TOPA analysis.</p>

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
15.		Executive summary (and throughout)	<p>Be cautious when using “PFAS” overall terminology. Try to specify which compounds for which exceedances have been recorded e.g. Key Findings – bullet point 2 “PFOS +PFHxS” guidelines were exceeded, not PFOA. Please check and amend throughout as necessary.</p> <p>Bullet 3 – commercial/industrial property is adjacent to the site, to the south, beyond which are residential properties (100 m to the south).</p> <p>Bullet 2 – use of ecological guideline for residential land-use – is this too conservative?</p>
16.	1.1	Introduction	Note Figure reference is “F1” and all figure attachments are labelled 1 to 6. Please check and amend throughout to ensure figure cross-referencing consistency.
17.	1.5	PFAS analysis	AFFF first mention – define acronym.
18.	1.6	Relevant regulation and guidance	<p>It may be worthwhile including DES (2018) Module 6 here as whilst there is currently no statutory requirement for a CLID to be produced, it is a request of QFES that the DSI reports comply with the Queensland Auditor Handbook for Contaminated Land. In addition, future DES notices may include such a requirement. It may also be worthwhile discussing HEPA (2019) consultation draft.</p> <p>Furthermore: It may be worthwhile expanding the NEMP reference to include specific schedules complied with (see Table 2 below) to ensure compliance with CLID documentation; and It is noted that the Western Australian Department of Health (2009) Assessment guidance for asbestos contaminated sites has been included – this is likely in error. Remove/amend as required.</p>
19.	2.1	Site identification	The registered address of the site owner has not been listed. This should be included in Table 2. Current use has been included but no reference to proposed future use. This should be referenced (e.g. ongoing commercial/industrial/unknown)
20.	2.2	Site layout and features	Consider inclusion of commentary relating to other underground services that may represent preferential pathways for contaminant migration and inclusion of dial before you dig (DBYD) service plans.

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
21.	2.3	Surrounding land-use	<ul style="list-style-type: none"> • Southwest: Suggest first line is amended to reads “The Proserpine ex services club is adjacent to the site, to the southwest” • South: Please check and confirm. The PSI/SAQP indicated that residential dwellings are present to the south/south east of the site. This observation is inconsistent, it appears that a commercial property is located adjacent to the site, to the south, with residential properties beyond (adjoining Marathon Street). <p>East: Note a BP garage is present approximately 310 m to the east of the site.</p> <p>North/North-west: The PSI/SAQP indicates the Proserpine Sugar Mill is located approximately 490 m to the north west of the site. Please check and amend as necessary. It is also noted Proserpine River is approximately 850 m north of the site, at its closest point. Please check and amend as necessary.</p>
22.	2.4	Previous environmental investigation	<p>It is noted Section 2.4 is largely a reproduction/summary of data provided in the PSI/SAQP. Please review and amend for consistency. Ensure all information pertaining to PFAS storage/waste is carried over. e.g.</p> <ul style="list-style-type: none"> • PSI/SAQP indicates the site has been in use since the 1950’s rather than implication of use since 1962 when the fire station is confirmed present. • Please review bullet two for clarity. Solberg foam “reportedly does not contain PFAS”. How has this been established – SDS/laboratory analysis (by manufacturer or stakeholders). • Bullet three consider rephrasing last sentence for clarity. • Bullet four – please provide some clarity with regard to site surface during training exercises. i.e. that foam application may have occurred to unsealed surfaces prior to placement of concrete and likely continued following hardstand placement. • Bullet 6 -please ensure reference to Queensland Government website is included in references section. • Bullet 7 – please review and amend to include BP service station if deemed appropriate.
23.	3.4	Hydrology	<p>It is noted Proserpine River appears closer to 850 m to the north of the site at its closest point – please check distances and amend as necessary.</p>

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
			<ul style="list-style-type: none"> Is the “unnamed water feature” Chapmans Lagoon? (located approximately 600 m to the east, behind the Proserpine Business and Technology Park)?
24.	3.5	Hydrogeology	<ul style="list-style-type: none"> Paragraph 1 – the inferred groundwater flow direction specified here is to the north. This is inconsistent with flow directions identified in other sections of the report (executive summary, conclusions, Section 6.2.2). Please check and amend as necessary. If this is to indicate differences in regional groundwater flow direction and localised flow directions, please provide clarification to this effect. It is noted paragraph 2 indicates 13 bores are located within 500 m of the site. However, only 12 are presented in Table 4. Please check and amend as necessary – it may be that RN105587 is missing from Table 4. RN131618 appears to be missing from Figure 1 – please check and amend as necessary.
25.	3.6	Environmental values	It is noted that the environmental values listed in Section 3.6 differ from those specified in the PSI/SAQP. Please check for consistency and amend as necessary.
26.	4.2	Sampling rationale	<p>Consider rephrasing location/rationale to reflect final borehole positions: BH02/MW02 – located relatively central to the site, rather than central eastern BH04 – located in grassed area to the south of the workshop.</p> <p>It is noted that the rationale for PR_BH02 and PRBH03 are identical. Please review and amend as necessary.</p> <p>The final paragraph of this section indicates cross contamination was minimised by using appropriate techniques specified in documentation and as stipulated in the SAQP. Consider the addition of “Further details are provided in Appendix X” to provide guidance to the reader as to where full details of the QAQC practices employed can be found.</p>
27.	4.2.1	Soil Investigation	<ul style="list-style-type: none"> Table 7 – Service Location activity. Typo “soil bores”, Table 7 – Drilling method and target depth – include reference to shallow soil bore advanced via hand auger to a maximum depth of 0.5 m bgs. Consider adding reference to concrete coring (as necessary) Table 7 – Final sentence is incomplete “...interlaboratory duplicate samples and...”

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
			<ul style="list-style-type: none"> Table 7 – Soil sample preservation – noting NEMP requires that re-useable freezer blocks are not used during PFAS assessments due to the potential for cross-contamination, please check reference to ice-bricks and amend as necessary. Table 7 – Decontamination procedures – noting NEMP requires decontamination fluids to be avoided where possible, please confirm that Liquinox was/how this was certified PFAS free before use (e.g. manufacturers documentation/analytical test and confirmation).
28.	4.2.2	Groundwater investigation	<ul style="list-style-type: none"> Table 7 – Monitoring well installation. Typo remove “of”. “monitoring well construction comprised” Table 8 – Sample preservation – as per Table 7 in relation to freezer blocks/ice bricks. Consider amending last sentence to read “to a laboratory NATA accredited for the analysis requested”. Table 8 – decontamination procedures – it is understood sampling was undertaken using a peristaltic pump rather than a bladder pump. Please check and amend as necessary. <p>Could consider adding some commentary into this section regarding the use of dedicated sampling equipment for each well to minimise potential for cross contamination and use of appropriate silicone or HDPE tubing which is PFAS-free.</p>
29.	5.0	Assessment criteria	<ul style="list-style-type: none"> As per point 25 above – please check relevant EVs for Proserpine River and amend if necessary. Table 10 – Comment RE use of interim soil – ecological indirect exposure for residential. Should this be the commercial/industrial guideline? At the very least commercial/industrial guideline to be included alongside for consideration? Table 10 – Sediment sampling was not completed as part of this DSI.
30.	6.1	Soil Conditions	<p>Given ground conditions were broadly consistent across the site, perhaps consider presenting this in tabulated format, including concrete (where encountered) and differentiating between fill and natural materials as per the borehole logs provided this will aid interpretation.</p> <p>At minimum provide commentary with regard to fill and natural soil profile encountered at the site consistent with the borehole logs provided.</p>

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
31.	6.2.1	Observations during drilling	<ul style="list-style-type: none"> All borehole logs indicate that water strikes were encountered in sand, rather than clay. Please review and amend as necessary.
32.	6.2.2	Groundwater elevations and groundwater flow	<ul style="list-style-type: none"> Second sentence – repetition of “metres below top of casing (mbtoc)”. Second paragraph. Given there is insufficient data to confirm groundwater flow to the east (or otherwise) is there sufficient to determine that a groundwater mound exists? Confirm inferred groundwater flow directions for consistency throughout report text and as presented on Figure 3. It is noted groundwater flow directions in Section 6.2.2 are inconsistent with those specified elsewhere in the report.
33.	6.2.3	Table 11	<ul style="list-style-type: none"> Suggest Table 11 is renamed to “Summary of groundwater results” given surface waters were not assessed as part of this DSI. Suggest the last sentence is amended to read “...groundwater is slightly acidic, fresh...”
34.	6.3.1	Analytical results: soil	<ul style="list-style-type: none"> Consider presenting the nominated guideline values in this summary table for clarity. Please add a “notes” section expanding the “IL: Investigation level” acronym for reader clarity. Consider providing a summary table of “exceedances” in text to provide clarity and draw attention to locations/samples of interest for interpretation of site conditions. Guideline criteria – as per previous queries – is residential indirect appropriate?
35.	6.3.2	Groundwater	<ul style="list-style-type: none"> Please rephrase the last sentence, paragraph 1 for clarity. “A summary of an assessment”. Paragraph 2, sentence 2 – please remove repetition of “in the groundwater samples”.
36.	6.3.3	TOPA	Suggest Table 14 is renamed to “Summary of TOPA Analysis (Soil & Groundwater)” or similar. Current title appears incorrect.
37.	7.1.2	Hydrogeology	<ul style="list-style-type: none"> Paragraph 2 – it is noted that the training area was not always sealed with concrete. Is it possible, based on information provided, that AFFF may have directly infiltrated to subsurface following direct application, prior to the placement of concrete? Paragraph 2 last sentence – consider rephrasing for clarity “underground service runs”

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
38.	7.2	Soil analytical results	<ul style="list-style-type: none"> Paragraph 2, sentence 1. Consider rephrasing for clarity “The highest PFAS concentrations detected in shallow soil..” or “The highest PFAS concentrations detected in shallow soil samples” The analytical result discussion should consider variations in localised soil profiles that may have resulted from site excavation and infilling (e.g. associated with installation of the hydrocarbon underground storage tank (UST) and/or septic tank along with any preferential pathways that may exist associated with in-ground pipe infrastructure associated with these structures. First paragraph after Table 15 – please add carriage return to separate Table text & notes from discussion text. Second paragraph (P18) “The maximum soil PFAS concentrations detected are”. Please specify compounds for which exceedances were identified (PFAS is a catch-all). Paragraph 3 – consider replacing summarised with “provided”.
39.	7.3	Groundwater analytical results	<ul style="list-style-type: none"> Paragraph 1: consider rephrasing for clarity “...located within the south eastern portion of the former foam training area (refer Figure 2). Please include a reference for the Queensland Government 2018 sampling.
40.	7.4	Table 18	<ul style="list-style-type: none"> Consider moving PFDS in the groundwater column and associated carbon chain length down a row to align with the PFAS compounds listed on the soil side. Penultimate sentence, the word “to” appears to be missing “...shorter chain PFAS, or due to longer chain...”
41.	8.2.1	Primary sources	Bullet 1 – the former foam training area is described in different ways throughout text – e.g. central south eastern, central, central western. Please check and amend throughout (reference to the Figure could streamline this process and minimise the requirement for text descriptions).
42.	8.2.3	Off-site	<p>Please check stated distance to sugar mill throughout and amend as necessary to ensure consistency.</p> <p>Consider inclusion of the BP garage to the east of the site, if considered appropriate to do so.</p>

Item	Section (s) in report	Report Section Name	Environmental Earth Sciences Comments
43.	8.5	Table 18	<p>General: Consider splitting the “likelihood” of linkage (i.e. viable source-pathway-receptor linkage) into a new column to provide clarity, to the reader, as to which linkages require further assessment. The final column can then be amended to focus on further assessment is necessary (or otherwise).</p> <ul style="list-style-type: none"> • Primary source – consider splitting “on-site” from “off-site” - for example, is it reasonable to anticipate that the terrestrial ecosystem, on site, will be at risk, given the majority of the site is concrete covered, minimal vegetation to be ingested and subsequently consumed by higher order predators and no exceedances of commercial/industrial soil ecological criteria have been identified? <p>Commentary regarding the “indirect” ecological criteria for residential land use as potentially applicable for off-site areas.</p> <ul style="list-style-type: none"> • General QFES activities – linkage – would it be fair to add that the site is also unoccupied therefore no viable pollutant linkage? • PFAS in groundwater - “...the groundwater beneath the site is fresh and therefore suitable as a potable water source”. • Livestock exposure pathway: typo – replace “direct contact of groundwater” with “with groundwater” • Accumulation of PFAS in creek sediments. Exposure pathway – replace: “direct contact of” with “direct contact with”
44.	9.0	Conclusions	<ul style="list-style-type: none"> • Bullet 2 – as per previous comments please check groundwater flow direction and amend as necessary for consistency throughout the text. • Bullet three – full names provided for PFHxS and PFOS – acronyms should be expanded on first mention in text and acronyms provided thereafter. Please review and amend throughout as necessary. • Bullet three – it is noted that TOPA analysis was completed on soils and groundwater, yet a concluding comment confirming the findings of the TOPA analysis and their relevance to current site contamination has not been provided. Please review and amend as necessary. • Bullet five – ensure consistency throughout in relation to inferred groundwater flow directions. Please check and amend as necessary.

Table 2: Requirements of Module 6

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
3.1 Introduction			
State whether the CLID is a site investigation report, validation report, draft site management plan, or a combination of those.	Executive summary, paragraph 3	The report does not meet the definition of a CLID due to the absence of a regulatory trigger. However, the report does state that it is a site investigation report (SIR) for the detailed site investigation (DSI_	No
State why the contaminated land investigation document was prepared and note any statutory triggers.	1.1 General (Introduction)	No statutory triggers listed as none present.	No
State what the desired outcome is (e.g. to have the particulars of the land removed from, or amended on, the relevant land register).	1.3 Objectives	The auditor agrees with the desired outcomes.	No
State whether the document provides final information about the site and its intended use, or whether it is likely that one or more contaminated land investigation documents will be prepared in the foreseeable future for the same site and its same intended use.	1.2 Background	Table 2 confirms the fire station has not been operational since 2017. However, does not confirm the proposed future use of the site (e.g. ongoing commercial/industrial). Comment should be added to this effect (if known).	Yes
3.2 Site Investigations			
Describe and illustrate all the site investigations that were used when preparing the contaminated land investigation document, including any that may have been undertaken for previous purposes.	Executive summary: Key findings of the PSI; Section 2.4: Previous environmental investigation; Section 7.3 Groundwater analytical results	Information pertaining to previous environmental investigations has been provided appropriately.	No
3.3 Reasons the land is on a relevant land register			
Identify and describe the land by the following information:			
· street address of the site	Table 2		No

Requirement	Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
· registered lot-on-plan details		Table 2		No
· owner(s) of the land and their registered address		Table 2 (Owner only)	Registered address of owner not listed. Please provide	Yes
· current occupier(s) of the land		Table 2		No
· area of the land (m2 or hectares)		Table 2		No
· map of the site at a suitable scale, showing lot and plan boundaries, and latitude and longitude in decimal degrees		Figure 2		No
· relevant local government authority		Table 2		No
· zoning of the site and the surrounding land on the local government's planning scheme (current and proposed)		Table 2		No
· any proposed changes to the zoning of the site and the surrounding land on the local government's planning scheme			List future zoning "no change" or similar in Table 2	Yes
· any existing, pending or proposed development approval or building works approval.		Not provided	Not relevant to this report	No
State whether or not the land is currently listed on the EMR or the CLR, and provide the identifying number on the EMR or CLR. Provide a short history (if available) of when any listing(s) occurred, and any changes that were made to the listings.		Table 2		No
Describe the past and current activities and use(s) of the land that resulted in its potential or actual contamination and its listing on the register. Describe and map the locations where those activities occurred. In particular, address any notifiable activities and/or environmentally relevant activities.		Section 2.2: Site layout and features; Section 2.4 Previous environmental investigation		No

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
3.4 Surface and subsurface infrastructure			
Describe all surface and subsurface infrastructure on the land, including details of the location, size and type of the infrastructure. Relevant infrastructure includes pipes, tanks, drains, dams, bores, buildings and foundations.	Section 2.2 Site layout and features/Figure 2	Additional information required around other site features – e.g. in-ground services. Dial before you dig (DBYD) search results to be provided.	Yes
Describe any infrastructure that has contributed to contamination of the site, even if that infrastructure has since been removed.	Section 2.2 Site layout and features/Figure 2	See comment above.	Yes
Describe any infrastructure that may either retard or increase the movement of contaminants and describe how the effect may occur. For example, bedding sand for stormwater drainage or sewerage pipes can act as a preferential pathway for contaminants even if the pipe itself has been removed.	Section 8.3 Migration mechanisms	Include potential for transport of PFAS impacted groundwater in preferential pathways	Yes
Describe any infrastructure that would need to be removed or repositioned to facilitate any remediation of the site.	Not applicable		No
3.5 Site and surrounding area			
Provide a description of the site and surrounding area of the land. The description of the site and surrounding area must address the following matters (see s. 389(1)(c) of the EP Act):			
· all environmentally sensitive areas	Section 3.7: GDEs and Environmentally sensitive areas		No
· the location of all water, watercourses and wetlands	Section 3.4: Hydrology, Section 3.7 GDEs and Environmentally sensitive areas	Section 3.4 and throughout please confirm distance from site to Proserpine river – appears closer to 850 m at it's closest point.	Yes
· the location of all stormwater drainage	Section 2.2 Site layout and features		No

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
· all uses of the land, including uses that may affect the safety of the relevant land or cause environmental harm	Section 2.3 Surrounding landuse Table 1		No
· all activities carried out that may affect the safety of the relevant land or cause environmental harm	Section 2.4: Previous environmental investigation Table 1		No
Describe the climate of the area of the land, and the vegetation on the site and the surrounding area.	Not provided.	Please provide	Yes
Illustrate the description with maps, diagrams and photographs, and include the topography of the area. If the site and/or its surrounding land have areas of low relief, illustrate the topography on maps with contours at no more than 1m intervals.	Section 3.1 Site topography.	Contour plans with 1-10 m intervals not provided. This data could be useful to assist in determining likely groundwater and surface water flow directions.	Yes
Describe the stormwater drainage, delineate the catchments, and include any stormwater quality improvement devices, weirs, sediment basins, storage dams, and so on. Include the potential for stormwater drainage to affect the movement of contaminants. Also, address flood risk and locations where significantly large pools of water occur during or after rain events.	Section 2.2 Site layout and features; Section 2.4 Previous environmental investigation; Section 3.4 Hydrology		No
3.6 Waste disposed of or stored on the land			
Provide details of any waste that has been disposed of on the land, or that is or was stored on the land. Under Queensland law, waste is defined by s. 13 of the EP Act. The details should include the location, quantity and type of the waste, and the method(s) of its storage or disposal.	Section 2.4 Previous environmental investigation	Section 2.4 appears to be a marginally cut-down version of S7.1.2.2 of the PSI. Ensure all references to waste storage/infrastructure are carried across from the PSI for consistency. Waste storage discussed in terms of PFAS only, which is sufficient to meet the objectives of this report.	Yes
Address any potential contamination of the land caused by storing or disposing of the waste on the land, such as might occur through the	Section 2.4 Previous environmental investigation	See commentary above	Yes

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
failure or breaching of an underground containment cell, the deterioration of storage vessels, or an accident such as a fire. That is, disposal should be taken to include accidental spills or releases.			
The description should also include any waste that may have been extracted, then moved or stored at the site during earthworks (see also section 3.9 below). Suitably qualified persons must search all available records when researching information for this section of the report.	Not provided	Comment should be provided regarding the use of uncharacterised fill.	Yes
3.7 Geology and hydrogeology			
Describe the geology and hydrogeology of the land, including soils, subsoils, rock strata, aquifers, and aquitards.	Section 3.2 Soil type and ASS; Section 3.3 Geology; Section 3.5 Hydrogeology		No
Describe the environmental values to be enhanced or protected under the <i>Environmental Protection (Water) Policy 2009</i> .	Section 3.6, Section 5.0	Please confirm applicable EVs for the Proserpine River Basin given these differ from those originally provided in the PSI/SAQP.	Yes
Guidance: The contaminated land NEPM (particularly its Schedules B2, B3 and B6) provides advice in regard to this requirement. However, there is a large body of research, other texts and sources of information about geology and hydrogeology that should be used to supplement the NEPM. When developing a concept or model of the groundwater system, comply with the <i>Australian groundwater modelling guidelines</i> (National Water Commission, June 2012).	As above	As above	No
Assess how the geology and hydrogeology of the land would affect the movement or retention of contaminants within soils, subsoils, and rock strata.	Section 7.1.2 Hydrogeology and Section 7.2 Soil analytical results, Section 8.0: Conceptual Site Model - PFAS		No
Describe groundwater quality and groundwater levels and flow directions.	Section 3.5: Hydrogeology; Section 6.2 Hydrogeology; Section 7.1.2: Hydrogeology, Section 7.3: Groundwater analytical results	Please review inferred groundwater flow direction throughout and ensure consistency. Some variation is noted – e.g. executive summary, paragraph 7 “northwest, west or	Yes

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
		<p>south”/ executive summary paragraph 10 “south, west and north”</p> <p>Please ensure groundwater contour Figure (Figure 3) includes appropriate inferred groundwater flow direction arrows consistent with those directions stated in-text.</p>	
Describe any barriers to, and migration pathways for, the dispersal of contaminants in groundwater.	Section 8.0: Conceptual Site Model - PFAS		No
Assess the rate at which any contaminants may move through or out of the ground.	Section 7.1.2 Hydrogeology	<p>Limited information pertaining to the likelihood of “low hydraulic conductivity clays” that may retard vertical and lateral migration of PFAS has been provided.</p> <p>It is noted the purpose of this assessment was to determine the concentration and distribution of PFAS on the site and near the site boundaries. However, ow noting that PFAS may be migrating beyond the site boundary, further consideration should be given to the assessment of permeability and hydraulic conductivity of water bearing zones underlying the site, to facilitate the lateral delineation of any PFAS plumes and assessment of risk to off-site receptors.</p> <p>This may be subject to assessment in a subsequent report.</p>	Yes
If there has been irrigation of waste water to land, or subsurface injection of waste water, describe the quantity and quality of waste water and the geological material and strata onto or into which the irrigation or injection occurred.	Not provided	Assumed not to occur	No

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
Describe the natural geochemistry including acid sulfate soils, or sulfide bearing minerals, if they might be present.	Section 3.2		No
Describe any naturally occurring toxicants that are present in quantities or concentrations that might affect the use or management of the site.	Not provided	Not relevant to this assessment	No
Address liquid and gaseous contaminants that may be dispersed in pore spaces, and assess the potential for, and the likely rate of, dispersal of contaminants to the atmosphere.	Not provided	Not relevant to this assessment	No
Assess whether the dispersal of contaminants from the ground could impact on air quality in buildings.	Not provided	Not relevant to this assessment	No
If groundwater remediation is required, assess how effectively the site's contamination could be remediated, describe any limitations, and assess the likely residual contamination.	Not provided	Not relevant to this assessment	No
3.8 Environmentally relevant activities or notifiable activities			
Provide details of any environmentally relevant activities or notifiable activities carried out on the land, whether formerly or currently	Not provided	Please provide reference to ERA search	Yes
Focus on the materials used and waste produced during the carrying out of the activities that could be sources of on-site or offsite contamination.	Section 8.4 Receptors and exposure pathways		No
Illustrate on maps where any environmentally relevant activities or notifiable activities were carried out.	Figure F2		No
3.9 Earthworks			
Provide details of any earthworks carried out on the land, including an inventory of any earth taken out to be treated or dumped elsewhere, and/or earth brought on to the site as fill.	Not provided.	Please provide any data pertaining to any cut and fill activities that may have occurred historically across the site. (This could represent a source of PFAS)	Yes

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
Provide maps and cross-sections to illustrate how earthworks have changed the topography and geology of the land.	As above	See comment above – if cut and fill activities have occurred that have pertinent implications for topographic/geological alteration, please include a figure to illustrate this.	Yes
Integrate the description of any earthworks with the required description of the site’s watercourses, wetlands, geology and hydrogeology.	As above	Please review as above and include as relevant.	Yes
Address whether the earthworks could be a source of contamination.	As above	Please review as above and include as relevant	Yes
Assess how earthworks may have affected how water and/or other liquids move over, into or through the ground dispersing contaminants.	As above	Please review as above and include as relevant	Yes
3.10 Contamination			
Provide details of the site investigations and the findings of those investigations with regard to contamination of the site, particularly the extent, fate and movement of contamination. Describe in detail all:			
· Desk-top assessments of the site	Section 2.4: Previous environmental investigation,	Information is summarised. PSI/SAQP (AECOM, 2019) is referenced for full details of the desktop assessment.	No
· Site inspections	Section 2.2 Site Layout and features; Section 2.4 Previous environmental investigation	Information is summarised. PSI/SAQP (AECOM, 2019) is referenced for full details of site inspection & site interview details.	No
· Sampling of soil, water, and any other media	Section 2.4: Previous environmental investigation (historic data), Section 4: Fieldwork – DSI, Section 6: Results, Section 7: Discussion		No

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
Provide maps and diagrams, including cross-sections where necessary, to illustrate the site and where sampling has taken place on the site or its surrounds.	Figure F2: Site layout & sampling locations,		No
Provide details of a site conceptual model using text, tables and/or diagrams.	Section 8, Table 19, Figure 6		
Describe the methods used to take, store, preserve and analyse samples of media. Discuss any limitations to those methods that may affect reliance on the results. Samples must be collected in accordance with appropriate standards, and the chain of custody of samples must be fully recorded. If the samples were handled and/or analysed by a third-party, identify the laboratory or contractor(s) that undertook the work, and state whether or not they are accredited (e.g. by the National Association of Testing Authorities, Australia (NATA)). If the laboratory or contractor is not accredited by NATA or a similar body, explain how the methods have been appropriately validated.	Section 4.2.1 Soil investigation; Section 4.2.2 Groundwater investigation, Section 4.3 Laboratory analysis and QA/QC Appendix G: Analytical Data Validation	<p>It is noted that both Tables 7 and Table 8 refer to use of “ice bricks” to cool eskies. It is noted the PFAS NEMP requires that “reusable freezer blocks” are not used during PFAS sampling due to potential for cross-contamination. Please review and confirm ice-brick reference and, of applicable please provide commentary regarding any potential cross-contamination impacts to transported samples.</p> <p>All reusable equipment was decontaminated by scrubbing with “Liquinox” prior to rinsing with PFAS-free distilled water. Noting that the PFAS NEMP indicates that decontamination solutions should generally “not be used” please confirm use of Liquinox and provide commentary as to “PFAS-free” status of the deco fluid confirmed by supplier/product testing and any implications for cross-contamination.</p>	Yes
Describe and validate the methods used to interpolate and extrapolate, from the sampling results, the spatial extent of any contamination.	Section 6: Results, Section 7: Discussion, Figures 2 to 5.		No
s. 389(2)(b)(ii) of the EP Act requires that the contaminated land investigation document states the extent to which the land is contaminated. Describe and illustrate (with data tables, maps, diagrams	Section 6: Results, Section 7: Discussion, Figures 2 to 5.		No

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
and cross-sections at suitable scales) the location(s) of any residual contamination, and the quantities or concentrations of contaminants.			
Assess, describe and illustrate the potential risks of contamination either moving off the relevant land to any surrounding area, or moving onto the relevant land from any offsite sources of contamination. The assessment should determine whether there is prescribed contaminated land.	Section 8: Conceptual Site Model - PFAS		
Assess the levels of contaminants against applicable criteria, considering all relevant environmental values, including human health, amenity, and ecological values.	Section 6.3 Analytical results, Section 7 discussion, Tables T4 and T5.		
Derive environmental values for water pursuant to the Environmental Protection (Water) Policy 2009 (EPP(Water)), Australian water quality guidelines for fresh and marine waters (ANZECC & ARMCANZ, 2000), and the Queensland water quality guidelines 2009 (EHP, republished in 2013). Include environmental values that relate to potential uses; for example, saline groundwater may be treated by reverse osmosis for potable or stock use during a drought, and therefore has a current environmental value. Furthermore, all environmental values that derive from Queensland's environmental protection policies cannot be subsequently disregarded or diminished by applying the contaminated land NEPM's risk-based process.	Section 3.6, Section 5.0	Assessment criteria has been provided in Table 10. However, the NEMP does not provide trigger values for all the identified EVs. Provide commentary on how the adopted assessment criteria will ensure a suitable level of protection for all EVs identified.	Yes
Assess how the levels of contaminants would impact on all current and foreseeable future uses, while taking account of the likely extent that the contamination can be remediated (see also the following section).	Section 8 Conceptual site model	An assessment of contaminant remediation has not been completed at this stage of the assessment.	No
If the land was found to be not contaminated, the contaminated land investigation document should justify how the conclusion was reached, with reference to the site investigations and any remediation (see also the following section).	Not provided	Not relevant to this assessment	No

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
3.15 Accordance with the NEPM			
As mentioned above, s. 389(2)(b)(iv) of the EP Act requires a contaminated land investigation document to make a statement of the extent to which it is in accordance with the contaminated land NEPM. Nevertheless, the contaminated land NEPM cannot override state legislation or policies. In practice, a contaminated land investigation document must:			
<ul style="list-style-type: none"> explicitly reference the various schedules of the NEPM 	Various	<p>Generally referenced appropriately. However, consider rewording bullet 3 of Section 1.3 to more explicitly reference the NEPM & NEMP e.g.</p> <p><i>Preparation of a draft SIR detailing the implementation of the DSI in accordance with Australian guidance for investigation of sites potentially impacted by PFAS including the National Environmental Protection Council (NEPC), National Environmental Management (Assessment of Site Contamination, (ASC)) Measure (NEPM) (1999, as amended 2013) (NEPC, 2013) and the PFAS National Environmental Management Plan (Heads of Environmental Protection Agencies (HEPA), 2018).</i></p> <p>Also, consider adding reference to specific schedules to Section 1.6.</p>	Yes
<ul style="list-style-type: none"> mention which schedules were or were not applicable when preparing the document 	Not provided	Consider updating Section 1.6 to include reference to specific, relevant schedules.	Yes
<ul style="list-style-type: none"> state the extent to which the applicable schedules were followed 	Not provided	It is noted, given the nature of the investigation (PFAS DSI) that the investigation was undertaken in general accordance with the NEPM, but, generally with greater reference to the NEMP. Please include reference to NEPM schedules (where relevant) and provide	Yes

Requirement Section of CLID in which requirement is addressed	Section in CLID Addressing Requirement	Auditors review comments	Action required
		commentary in relation to use of the NEMP (as relevant).	
<ul style="list-style-type: none"> • describe the extent of any deviations from the recommendations of the NEPM's schedules 	As above	As above	Yes
<ul style="list-style-type: none"> • explain whether any deviations were due to overriding state legislation or policies 	As above	As above	Yes
<ul style="list-style-type: none"> • evaluate with reference to current best practice how effective any alternative methods were in comparison to those of the NEPM. 	As above	As above	Yes
<p>The contaminated land investigation document must demonstrate that the investigation components of an assessment of site contamination listed in Section 1 of Schedule B2 of the contaminated land NEPM have been conducted for every stage of investigation. The components include a conceptual site model, data quality objectives, a sampling strategy, and a sampling and analysis quality plan. Those components should be updated as the investigations acquire better information about the site.</p>	<p>Section 8: Conceptual site model, Appendix G: Data quality objectives, Section 4: Fieldwork- DSI.</p>	<p>It is noted that appropriate reference to the PSI/SAQP (AECOM, 2019) is provided.</p>	No