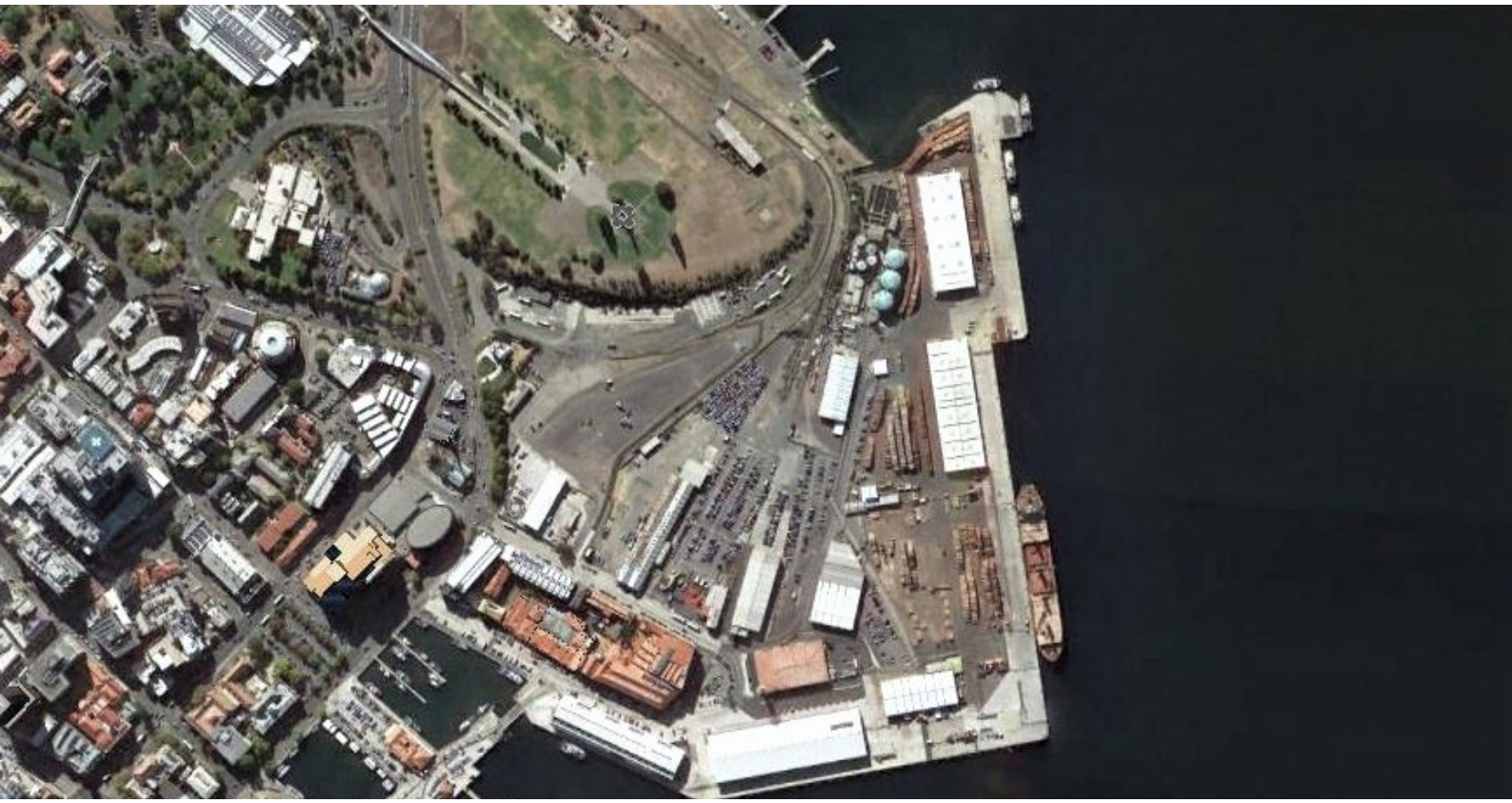
Contaminated Land Audit Report - Macquarie Point Development Project - The Precinct South

Ref: 754-MELEN225720.1-R01

Macquarie Point Development Corporation



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21/04/2026

CONTAMINATED LAND AUDIT REPORT - MACQUARIE POINT DEVELOPMENT PROJECT - THE PRECINCT SOUTH

Macquarie Point Development Corporation

Report reference number: 754-MELEN225720.1-R01
21/04/2026

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QUALITY INFORMATION

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EXECUTIVE SUMMARY

The overall site for the Macquarie Point Development Project (MPDP), is located to the east of the Hobart CBD and is approximately 9.3 ha in area. The MPDP includes a large area of reclaimed land and has historically been used for rail yard and industrial purposes. The overall site is being used for a range of interim activities such as initial landscaping, car parking and workers compounds to support a range of infrastructure projects in the Hobart area, with a number of the existing buildings and open areas being used for public events.

To allow progressive redevelopment, the overall site was originally divided into sub-areas referred to as Audit Area 1 (AA1) through to Audit Area 7 (AA7). Although it had been envisaged that each of the nominated Audit Areas would be the subject of successive audits (one audit for each audit area), this approach was varied, because of development sequencing and development pattern imperatives.

The site has now been divided into eight assessment areas. The subject of this Contaminated Land Audit is 'The Precinct South'. The area of The Precinct South is shown occupying the south-eastern corner of the overall site. Precinct South comprises all of former AA3 and the eastern portion of former AA5. It is the fifth audit parcel addressed within the overall site audit program and follows earlier audits for other site parcels. David Lam, of Tetra Tech Coffey Pty Ltd (Coffey), has been engaged to undertake contaminated land audits for the overall site.

This Contaminated Land Audit is a legislative requirement for redevelopment under Clause 39F of the *Macquarie Point Development Corporation Act 2012* (consolidated to include amendments including those under the *Macquarie Point Development Corporation Amendment Act 2015*.

The proposed future land uses for Precinct South, as set out in the Precinct Plan, comprise mixed commercial / public open space functions including the Complementary Integrated Mixed Use Zone and the Multipurpose Stadium and Associated Concourse Zone. For the purposes of this audit, a conservative range of Protected Environmental Values (PEVs) / beneficial uses for land, groundwater and air (vapour) have been considered. Although no surface water is present on site, potential off-site receptors in the Derwent River and Sullivans Cove have been assessed with respect to potential groundwater discharge.

A substantial program of site assessment and remediation has been completed within Precinct South and its 20 m buffer. Remediation works undertaken to date include excavation and validated removal of discrete soil impacts (including a lead hot spot and hydrocarbon-impacted soils from a former UST area), removal of disused fuel pipelines (Diesel Pipeline and Oil Pipeline) and associated soils, validated reinstatement with approved backfill and VENM, and targeted LNAPL recovery and monitoring. Some excavated material suitable for reuse (Level 1/2) has been reused on site in accordance with validation and SEMP controls.

Environmental assessment of soil at the site (pre- and post-remediation) demonstrate residual, spatially variable contamination across the Precinct South by petroleum hydrocarbons (TRH/TPH fractions including PAHs and naphthalene), metals (notably lead) and, in limited locations, PFAS. Observed anthropogenic inclusions, staining and hydrocarbon odour also give rise to aesthetic impacts. Where present, these residual soil impacts would, in the absence of controls, preclude a subset of PEVs. These precluded beneficial uses/PEVs are: Maintenance of Ecosystems; Human Health (residential use, low and medium/high density); Human Health (commercial use); Recreation / Open space; and Aesthetics.

Groundwater assessment indicates contamination in parts of the monitoring network by petroleum constituents (including dissolved hydrocarbons), metals and other parameters; TDS and specific constituents in some wells also reflect interaction with estuarine material off-site. LNAPL Plume B (predominantly diesel) is present beneath the SeaRoad Shed slab in the south-eastern corner of the Precinct South. Environmental assessment of groundwater at and adjacent to the site indicates impact by a range of contaminants, meaning the groundwater would not be suitable for possible (albeit highly unlikely) uses as follows:

Drinking Water (Human Health); Drinking Water (Aesthetics); Recreational (Primary Contact and Secondary Contact), Stock Watering, Irrigation and Industrial use. An assessment of possible off-site ecological impacts identified that risks to receiving environments (Derwent River and Sullivans Cove) are unlikely.

An assessment of Clean Up to Extent Practicable (CUTEP) has been made with respect to Victorian guidance. The Auditor has considered EPA Victoria (2016) (EPA Publication 840.2 *The Cleanup and Management of Polluted Groundwater*), which has been adopted as relevant guidance in the CUTEP assessment. Based on an assessment of the groundwater condition and the absence of practicable remediation options, the Auditor has assessed that there is no practicable remediation which would provide any net environmental benefit and so concludes that Clean Up to The Extent Practicable (CUTEP) has been achieved.

Soil vapour investigations, including sub-slab and indoor air sampling, did not identify an unacceptable petroleum hydrocarbon vapour intrusion risk for the assessed commercial uses at the time of sampling, although it is noted that there were some soil samples with contaminant concentrations representing possible hydrocarbon vapour risks that were not proximal to soil vapour investigation locations. Methane has been detected in soil vapour at concentrations warranting mitigation for enclosed or basement spaces (assessed as Characteristic Situation 3 (CS3) — moderate risk). Future building designs must therefore incorporate appropriate ground gas / vapour protection measures and verification (including ventilation and membrane systems where required).

While remediation of both soil and groundwater has occurred, and the site is considered suitable for development (risks for the proposed development plan would be manageable regardless of further remediation), the actual development works and any maintenance will encounter contaminated media, which will require controls for works including disposal of surplus material in accordance with EPA Tas requirements.

Risks associated with the soils and groundwater following remediation are able to be managed subject to conditions which are outlined in the Site Suitability Statement.

A Site Environment Management Plan (SEMP) has been prepared to outline appropriate measures to be applied to mitigate risks presented by the site conditions. A copy of the SEMP is attached to the Site Suitability Statement in Appendix A.

Based on the considerations covered in this Contaminated Land Audit Report, the site is considered suitable for use subject to conditions outlined in the Site Suitability Statement which is included in Appendix A.

A summary table of key site information is presented below.

Auditor	David Lam
Auditor account number	75695 (Vic), N/A for Tas
Date EPA notified of audit	1 March 2016 for overall site (no longer strictly required)
Name of person requesting audit	Greg Cooper
Relationship of person requesting audit to site	MPDC Chief Operating Officer and Company Secretary
Name of site owner	Macquarie Pointe Development Corporation
Date of auditor engagement	1 March 2016
Completion date of the audit	21/04/2026
Reason for Audit	Requested by MPDC to level of certainty on site suitability for development

Elements of the environment assessed	Land and Water (Groundwater and Surface Water)
Certificate of Title	Part of Certificate of Title (Volume 179192 Folio 003)
Site / Premises name	The Precinct South
Street / Lot	41
Street Name	Evans
Street type	Street
Suburb	Hobart
Postcode	7000
Site area	1.4 ha (approx.)
Plan of site/premises showing the audit site boundary attached	Yes – Figure F2a
Further works or requirements	Management in accordance with audit conditions and Site Environment Management Plan (SEMP, AECOM 2026c, or as amended). Includes groundwater monitoring under a Groundwater Quality Management Plan (GQMP) incorporated in the SEMP.
Nature and extent of continuing risk of harm	Remaining contamination includes: • Residual LNAPL in groundwater, and associated dissolved contaminants. • Soil impacts not fully remediated, including some representing potential vapour risks. • Methane assessed as representing Characteristic Situation 3. Management measures under the SEMP are required to mitigate ongoing risks.
Outcome of environmental audit report	The site has been subject to remediation of identified contamination of soils, including soil sources of groundwater contamination, so far as practicable. Remediation has included primary source removal, secondary source (soil) removal via excavation, and groundwater remediation for LNAPL. Groundwater is considered to have been cleaned up to the extent practicable, but residual groundwater contamination including LNAPL precludes PEVs on-site. Off-site as listed above. Residual soil contamination also remains on-site. The residual contamination requires management measures to be implemented in accordance with audit conditions, for the planned development as described below.
Land use suitability	The auditor is of the opinion that site is suitable for the proposed development (as described in AECOM 2026c and 2026d) providing the conditions made in this audit report are complied with. The proposed development includes • The Complementary Integrated Mixed Use Zone • The Multipurpose Stadium and Associated Concourse Zone. These are considered to represent commercial/industrial use and recreational/public open space use. The land may be suitable for other less sensitive uses. More sensitive use would require additional assessment and potentially additional management measures and/or remediation. The suitability of the site is based on implementation of the SEMP (AECOM 2026c) or any approved amended version of the SEMP.
Has groundwater cleanup been undertaken to the extent practicable?	Yes
Does groundwater contamination remain at the site and is the site the source?	Yes

If groundwater contamination remains, does it extend off-site?	Yes	
Is a Check Your Groundwater Area recommended?	N/A in Tasmania – AECOM had noted that TasPorts and TasWater have been advised regarding groundwater conditions off-site from MPDC land. The GQMP issued as part of the SEMP includes a requirement that "*risks to potential off-Site users from groundwater identified based on the results of the GME, or assumptions on groundwater use by occupiers of off-Site land which form part of the assessment of groundwater data, should be communicated to the owners/controllers of those areas.*"	
If applicable, please indicate which of the following are threatened environmental values of groundwater	**Protected Use**	**Precluded?**
	Water dependent ecosystems and species	☒ (unlikely to be precluded at the point of discharge)
	Potable water supply (desirable)	☒ Unlikely and manageable by use restriction
	Potable water supply (acceptable)	☒ Unlikely and manageable by use restriction
	Potable mineral water supply	Not relevant - not a mineral springs district
	Irrigation	☒ Unlikely and manageable by use restriction
	Stock watering	☒ Unlikely and manageable by use restriction
	Industrial and commercial use	☒ Not directly assessed based on uncertain uses – but to the extent that uses may be possible, they are unlikely and manageable by use restriction
	Primary/secondary contact recreation	☒ Unlikely on-site and manageable by use restriction – note likely to be precluded off-site in receiving water
	Buildings and structures	☐ Not precluded based on data, acid sulfate management may be required where drainage of certain materials may occur and change conditions.
Is ongoing groundwater monitoring required?	Yes – per the GQMP in the SEMP.	
Is ongoing vapour/gas monitoring required	No – but vapour mitigation is required under the SEMP. Depending on the approved mitigation system, an element of monitoring may be incorporated.	
Are vapour/gas mitigation measures required	Yes – as detailed in the SEMP.	
List any other ongoing management requirements if applicable	As detailed in the SEMP: • Health and safety plan as specified in the SEMP for any party conducting subsurface works. • A physical barrier – hardstand or engineered break layer must be installed, and maintained. • Requirement to prevent groundwater entering buildings. • Requirements for managing any drained groundwater. • Requirements for garden plantings. • Requirements for managing soil disposal, re-use, or importation. • Management of unexpected finds. • Management of any found asbestos under the Asbestos Management Plan (AMP) in the SEMP.	

	• Groundwater use only for remediation of monitoring. • Any voids from removed services to be backfilled with a graded engineered fill with a maximum hydraulic conductivity of 2 m/day or under a documented methodology which prevents creation of a preferential pathway for groundwater flow, verified as acceptable by an Environmental Auditor.

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APPENDIX E – CERTIFICATE OF TITLE

APPENDIX F – ASSESSMENT CRITERIA

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AA1	Audit Area 1
AA2	Audit Area 2
AA3	Audit Area 3
AA4	Audit Area 4
AA4 East	Audit Area 4 East
AA4 West	Audit Area 4 West
AA5	Audit Area 5
AA6	Audit Area 6
AA7	Audit Area 7
ACM	Asbestos Containing Material
AECOM	AECOM Australia Pty Ltd
AFFF	Aqueous Fire Fighting Foam
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ANZECC	Australian and New Zealand Environment and Conservation Council
AS	Australian Standard
AST	Aboveground Storage Tank
BaP	Benzo(a)pyrene
BCA	Building Code of Australia
BTAG	Biological Technical Assistance Group
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BTOC	below top of casing
C6-C36	hydrocarbon chain length fraction
CBD	Central Business District
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environment Management Plan
cfu	Colony forming units
Coffey	Coffey Environments Australia Pty Ltd (now Tetra Tech Coffey)
CoPC	Contaminants of Potential Concern
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CS	Characteristic Situation
CSM	Conceptual Site Model
CQA/CQC	Construction Quality Assurance / Construction Quality Control
CUTEP	Clean Up To Extent Practicable
DGV	Default Guideline Value

Acronyms/Abbreviations	Definition
DIER	Department of Infrastructure Energy and Resources
DIV	Dutch Intervention Value
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DSI	Detailed Site Investigation
E.coli	*Escherichia coli*
EC	Electrical Conductivity
EIL	Ecological Investigation Level
EMPCA	Environmental Management and Pollution Control Act 1994
EPA Tas	Environment Protection Authority Tasmania
EPA Victoria	Environment Protection Authority Victoria
ERA	Ecological Risk Assessment
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
Eurofins	Eurofins mgt
F1	C6-C10
F2	>C10-C16
F3	>C16-C34
F4	>C34-C40
FRS	Fluid Recovery System
GDA	Geocentric Datum of Australia
GHD	GHD Pty Ltd
GME	Groundwater Monitoring Event
GPR	Ground Penetrating Radar
GSV	Gas Screening Value
GQRUZ	Groundwater Quality Restricted Use Zone
GQMP	Groundwater Quality Management Plan
ha	hectare
HIL	Health Investigation Level
HSL	Health Screening Level
ISCO	In-Situ Chemical Oxidation
ISS	In Situ Stabilisation
ITRC	Interstate Technology and Regulatory Council
K	hydraulic conductivity
km	kilometres
L	litres
LCC	Leachable Contaminant Concentrations

Acronyms/Abbreviations	Definition
L/s	litres per second
LDPE	Low Density Polyethylene
LNAPL	Light Non-Aqueous Phase Liquid
LOR	Limit of Reporting
m	metre
m/day	metres per day
m2	square metre
mAHD	metres Australian Height Datum
mbgl	metres below ground level
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
MLRU	Mobile LNAPL Remediation Unit
MODFLOW	Modular Finite-Difference Flow Model
MPDC	Macquarie Point Development Corporation
MPDP	Macquarie Point Development Project
NAPL	Non-Aqueous Phase Liquid
NATA	National Association of Testing Authorities
PFAS NEMP	PFAS National Environmental Management Plan
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NHMRC	National Health and Medical Research Council
NMI	National Measurement Institute
NZMH	New Zealand Ministry of Health
OCP	Organochlorine Pesticide
OPP	Organophosphorous Pesticide
ORP	Oxygen Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Perchloroethylene, also known as tetrachloroethene
PEV	Protected Environmental Value (also referred to a ‘beneficial use’)
PFAS	Perfluorinated Alkylated Substances or Per- and Poly-Fluoroalkyl Substances
PFOS	Perfluorooctanesulfonic acid
PID	Photoionisation Detector
PPE	Personal Protective Equipment
ppm	parts per million
PVI	Petroleum Vapour Intrusion
QA	Quality Assurance

Acronyms/Abbreviations	Definition
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RIVM	Rijksinstituut voor Volksgezondheid en Milieu (Dutch: National Institute for Health and Environment)
RPD	Relative Percentage Difference
RSL	Regional Screening Level
SAQP	Sampling and Analytical Quality Plan
SEMP	Site Environment Management Plan
SEPP	State Environment Protection Policy
SGS	SGS Leeder Consulting
SKM	Sinclair Knight Merz
SRS	Site Remediation Strategy
STV	Short-term Trigger Value
SVOC	Semi-Volatile Organic Compounds
SWL	Standing water level
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TEQ	Toxic Equivalent Quantity or Toxicity Equivalency Quotient
TFL	Total Fluids Extraction
TIT	Triple Interceptor Trap
TO-15	Toxic Organics - 15
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbon
TPHCWG	Total Petroleum Hydrocarbon Criteria Working Group
TRH	Total Recoverable Hydrocarbon
TCC	Total Contaminant Concentrations
ug/L	micrograms per litre
US EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WHO	World Health Organisation
WHSP	Work Health and Safety Plan

1. INTRODUCTION

1.1 BACKGROUND

The overall Macquarie Point Development Project (MPDP) site lies east of the Hobart CBD and is approximately 9.3 ha in area, as shown in Figure F1[1] and in Figure 1 below. MPDP includes a large area of reclaimed land, and has historically been used for rail yards and a range of industrial purposes. The overall site is currently being used for a range of interim activities such as initial landscaping solutions, car parking and at times for public events, both in existing buildings and some open areas. Other short term uses include a microbrewery (Hobart Brewing Company) and the offices of the Macquarie Point Development Corporation (MPDC).

To allow progressive redevelopment, the overall site was previously divided into sub-areas named Audit Area 1 (AA1) through to Audit Area 7 (AA7). The originally described Audit Areas are shown in Figure F3. Although it had been envisaged that each of the nominated Audit Areas would be the subject of successive audits (one audit for each audit area), this approach was varied because of development sequencing and development pattern imperatives.

The overall site has now been divided into eight assessment areas shown on Figure F2a. The subject of this Contaminated Land Audit is 'The Precinct South'. The area of The Precinct South is shown occupying the south-eastern corner of the overall site, in Figure 1 below.

[1] Note that Figure F1 and all other figures are reproduced in this report directly from the *Precinct South - Clean Up to the Extent Practicable* Report AECOM (2026d), a copy of which is provided in Appendix D.13 of this report.

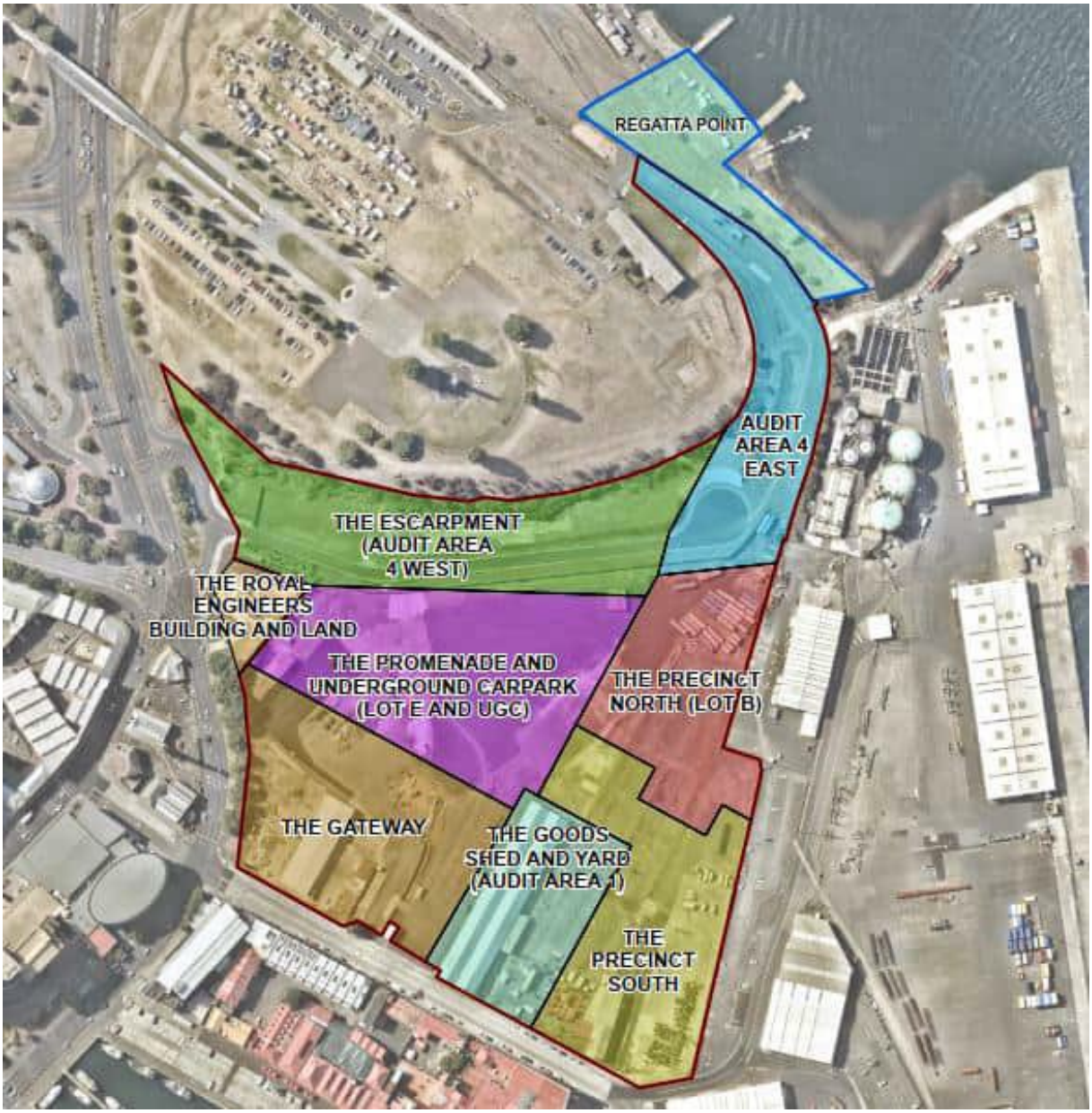


Figure 1 - Overall Macquarie Point Precinct showing location of The Precinct South

The subject of this audit report – the Precinct South - is made up of all of the original AA3 and part of the eastern half of AA5.

The Precinct South ('the Site') is the fifth Contaminated Land Audit parcel within the overall site to be audited. Audit reports (and associated Site Suitability Statements) have been issued for the following areas, noting that area naming as shown in Figure 1 has in some cases changed since the initial audit reporting:

- The Goods Shed and Yard - AA1 (issued in June 2019)
- The Escarpment - AA4 West (September 2020)
- The Promenade and Underground Car Park (previously 'Lot E and Underground Car Park') – Parts of AA2 and AA5 (July 2021)
- The Precinct North (previously 'Lot B') – AA7 and small parts of AA4 West, AA4 East, AA2 and AA5 (November 2021)

Although Tasmania does not have a formal auditing system, a process has been developed to allow contaminated land auditing by an Auditor accredited under legislation for other Australian states. A contaminated land audit in Tasmania may be undertaken voluntarily (to satisfy a planning authority or for due diligence) or it may be required by legislation (such as an Act or Notice). Further description of the audit process is provided in Section 2.1 of this audit report.

David Lam, of Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey - formerly Coffey Environments Australia Pty Ltd), has been engaged to undertake contaminated land audits for the overall site. A notification of the commencement of the audit was provided to Environment Protection Authority Tasmania (EPA Tas) in a letter dated 1 March 2016 (a copy of which is provided in Appendix C).

This Contaminated Land Audit is a legislative requirement for redevelopment under Section 39F of the *Macquarie Point Development Corporation Act 2012* (consolidated to include amendments including those under the *Macquarie Point Development Corporation Amendment Act 2015*) (Tasmanian Government (2012) and Tasmanian Government (2015) respectively). Clause 39F notes that:

> *Redevelopment of a part of the site may not occur until an accredited environmental auditor has certified that the remediation of the part of the site has occurred to a standard that is satisfactory for the purposes of the proposed redevelopment.*

In some circumstances, active remediation may not be required, either because contamination does not affect beneficial uses or protected environmental values (PEVs), or because the risks are manageable by reasonable control measures such as limiting access to soils or groundwater affected by contamination.

1.2 PURPOSE OF ENVIRONMENTAL AUDIT

The purpose of this Contaminated Land Audit Report is to determine whether remediation of the Precinct South has occurred to a standard such that the Site is satisfactory for the purposes of the proposed uses. The audit objective is to produce a ‘Site Suitability Statement’ confirming the suitability of the land for the proposed use/s, subject to conditions which may apply for the suitable use of the Site.

This Contaminated Land Audit Report provides a formal evaluation of the environmental condition of the site in terms of risks to human health and/or the environment associated with the presence of soil or groundwater contamination. This Contaminated Land Audit Report also describes management conditions that must be applied to ensure ongoing suitability for certain Site uses, and describes any uses for which the Site is unsuitable.

It is important to note that while remediation may occur to a point at which the Site is satisfactory for the proposed development, there may still be contamination on the Site, and for some development scenarios, some of the affected soils and groundwater may be encountered. Where the contaminated media are encountered, they will require management and, in some cases, off-site disposal.

1.3 STAKEHOLDERS

The parties involved in the environmental audit and the members of the audit team are listed in the following Table 1-1 and Table 1-2.

Table 1-1: Parties involved in the Environmental Audit

Role	Organisation
Regulator	Environment Protection Authority Tasmania (EPA Tas)
Site owner / Developer	Macquarie Point Development Corporation (MPDC)
Project manager for developer	Greg Cooper
Project Remediation Consultant (environmental site assessor)	AECOM Australia Pty Ltd (AECOM)
Project director / manager for assessor	Paul Carstairs / Rob Crowe
Primary laboratory	ALS Laboratories (ALS) for soil and groundwater, and SGS Leeder Consulting (SGS) for soil vapour.
Secondary laboratory	Eurofins for soil and groundwater, and National Measurement Institute (NMI) for soil vapour.

Table 1-2: Audit Team

Name	Role
David Lam	Site Environmental Auditor (Auditor)
Adi Thomas	Project Manager and assistance with Audit Report preparation
Zahra Derakhshan Nejad	Assistance with Audit Report preparation

2. AUDIT FRAMEWORK AND METHODOLOGY

2.1 CONTAMINATED LAND AUDITS – TASMANIA

While the *Environmental Management and Pollution Control Act 1994* (EMPCA) as amended 2021 and 2025 outlines a broad definition of a contaminated land audit, it does not include a formal system for the appointment or accreditation of persons able to conduct audits nor does it include guidance on how audits must be conducted. The lack of an existing formal auditing system was considered by MPDC to pose risks in relation to the level of certainty that could be provided to site developers and users of the Macquarie Point site. MPDC wished to institute a formal auditing system in order to obtain voluntarily-triggered audits. No audit requirement has been made by EPA Tas. In order to provide a formal auditing system for the overall site, MPDC proposed a system under which Interstate Contaminated Land Auditors could conduct audits on the Macquarie Point site.

The *Macquarie Point Development Corporation Amendment Act 2015* (Tasmanian Government (2015)) was passed in late 2015, and now forms part of the consolidated *Macquarie Point Development Corporation Act 2012* (Tasmanian Government (2012)). This 2015 Act requires certification of the site as suitable for the proposed redevelopment, as described in Section 1.1 above.

In order to facilitate this requirement, the Act also included provision for the Director (within the meaning of the EMPCA) to accredit a person as an Environmental Auditor for the purposes of the remediation of the overall site. In February 2016, EPA Tas produced a Fact Sheet '*Register of Interstate Contaminated Land Auditors*' (a copy is provided in Appendix B, EPA Tas (2016)) which outlined the following[2]:

- The Auditor Registration process.
- A description of a contaminated land audit and a Contaminated Land Audit Report.
- The process of Audit commencement, and Auditor engagement, and audit fees (nil).
- Insurance requirements for Auditors.
- Compliance with guidelines for auditing, which effectively require the Auditor to comply with obligations outlined in legislation, mandatory guidelines and Codes of Practice that apply in the home state/s of accreditation.

The Fact Sheet further requires that Auditors must comply with the standards expressed in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM (2013)), which is a State Policy in Tasmania. The Fact Sheet goes on to note that for any areas of ambiguity a determination from the Director, EPA may be requested, and the Auditor must comply with Director's determination.

This audit is being conducted under the consolidated *Macquarie Point Development Corporation Act 2012* (Tasmanian Government (2012)) and in accordance with EPA Tas (2016). This Contaminated Land Audit Report needs to be provided to EPA Tas as it is the result of a regulatory instrument (Tasmanian Government (2012)) per the Fact Sheet.

[2] This Fact Sheet issued in 2016 has since been superseded by web-based information available at the EPA Tas website – 'Information for Contaminated Land Auditors'. A copy of the 2016 Fact Sheet is provided for information in Appendix B of this audit report as this was the relevant document at the time the audits commenced. The web-based version is available at the following link: https://epa.tas.gov.au/environment/land/identification-and-assessment-of-contaminated-land/contaminated-land-and-the-planning-process/information-for-contaminated-land-auditors

2.2 AUDIT METHODOLOGY

In conducting this contaminated land audit, the Auditor and/or his representative has:

- applied to and been placed on Tasmania's *Register of Interstate Contaminated Land Auditors* (although the original commencement of auditing was also notified to EPA - see Appendix C, the current web-based advice to auditors is that audits do not need to be notified to EPA);
- reviewed the history of the Site and the surrounding area, including other relevant background information;
- reviewed and provided comment on reports and documents prepared by the environmental site assessor (including work plans, assessment reports, and derivation of Remediation Criteria);
- conducted site visits and attended meetings;
- assessed the environmental condition of soil, groundwater and soil vapour at the Site, using all available information;
- assessed the potential risks to human health and the environment relevant to the potential land use/s;
- consulted with MPDC and their consultant, AECOM, to discuss planning intentions;
- consulted with EPA Tas with respect to the audit process and the determination of 'clean up to the extent practicable' (CUTEP) using EPA Victoria guidance; and
- prepared this Contaminated Land Audit Report.

Section 2.2.1 below describes site visits undertaken by the Auditor and/or his representative. Section 2.2.2 lists relevant technical guidance and legislation whilst Section 2.2.3 lists documentation directly relevant to the Precinct South or the overall site.

2.2.1 Site visits

The Auditor has undertaken multiple visits to the overall site since 2014, including to audit areas AA3 and AA5, parts of which now make up the Precinct South. Details of the site visits are listed in Table 2-1 below.

Table 2-1: Site visits conducted by the Auditor and/or his representative

Date	Who Attended
19 August 2014	Auditor
24 October 2014	Auditor
23 December 2014	Auditor Representative
24 February 2015	Auditor
18 March 2015	Auditor
30 April 2015	Auditor
18 Sept 2015	Auditor
15 February 2017	Auditor
3 April 2020	Auditor and Auditor Representative (virtual video link tour via Teams, focussed on AA5)
29 June 2022	Auditor and Auditor Representative
26 April 2024	Auditor and Auditor Representative (virtual video link tour via Teams, focussed on the Gateway)
24 May 2024	Auditor and Auditor Representative (virtual video link tour via Teams, focussed on the Gateway)

The site visits have provided the Auditor with overall site familiarisation and a spatial appreciation of the activities relevant to the overall site and the general site setting. The Auditor has also relied upon Site observations made by the assessor during field investigations, and extensive photography provided in reporting – particularly with respect to remediation excavations.

The Precinct South – Remediation Validation Report (AECOM, 2024c) presents several photographs of the Site, which is presented in Appendix D.10.

The Auditor considers that by a combination of previous site visits, virtual video link tours via Teams, and photographic and other records from the Site, the conditions of the Precinct South are adequately understood for the purposes of the audit report.

2.2.2 Technical guidance and legislation

As outlined in the Fact Sheet, Auditors undertaking Contaminated Land Audits must comply with the technical auditing standards in their accrediting State legislation.

It is noted that environmental auditing under the (Victorian) Environment Protection Act 1970 (and associated guidance) may continue under that guidance for audits commenced prior to 1 July 2021, and not necessarily change to the auditing system described by legislation taking effect on 1 July 2021.

The following guidance documents have been used in assessing Site conditions to facilitate this audit report:

- NEPM (2013) - National Environment Protection Council [NEPC] - *National Environment Protection (Assessment of Site Contamination) Measure* (1999, as amended 2013)
- State Government of Victoria (1970), *Environment Protection Act No. 8056/1970* (and amendments of July 2021), State of Victoria, 1970
- State Government of Victoria (2002), *State Environment Protection Policy (Prevention and Management of Contamination of Land), No: S95,* State of Victoria, Environment Protection Act, 4 June 2002
- State Government of Victoria (2018), *State Environment Protection Policy (Waters),* State of Victoria, Environment Protection Act, October 2018
- SAI Global (1999). *Guide to the Sampling and Investigation of Potentially Contaminated Soil. Part 2: Volatile Substances AS 4482.2-1999*
- SAI Global (2005). *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds AS 4482.1-2005*
- SAI Global (2009). *Piling – Design and Installation AS 2159-2009*
- ANZG (2018). *Australian and New Zealand guidelines for fresh and marine water quality* (2018) [Water Quality Australia website, under the auspices of the National Water Quality Management Strategy (NWQMS), an Australian Government initiative in partnership with state and territory governments]
- NHMRC (2011). *Australian Drinking Water Guidelines* National Health and Medical Research Council, January 2011 (amended 2025)
- EPA Victoria (2015). EPA Publication 759.3 *Environmental auditor (Contaminated Land): Guidelines for Issue of Certificates and Statements of Environmental Audit* 21 December 2015
- EPA Victoria (2016). EPA Publication 840.2 *The Cleanup and Management of Polluted Groundwater* 20 April 2016
- EPA Victoria (2024). IWRG702 *Soil Sampling* 17 May 2024
- EPA Victoria (2000). EPA Publication 669 *Groundwater Sampling Guidelines* 17 April 2000
- EPA Victoria (2006). EPA Publication 668 *Hydrogeological Assessment (Groundwater Quality) Guidelines*, 8 September 2006

- EPA Victoria (2009). IWRG701 *Sampling and Analysis of Waters, Wastewaters, Soils and Wastes* 30 June 2009
- CRC CARE (2011a). Friebel, E & Nadebaum, *Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 1: Technical Development Document, CRC CARE Technical Report no. 10* , September 2011
- CRC CARE (2011b). Friebel, E & Nadebaum, *Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 2: Application Document, CRC CARE Technical Report no. 10*", September 2011.
- CRC CARE (2013). J Wright 2013, *Petroleum hydrocarbon vapour intrusion assessment, CRC CARE Technical Report no. 23*, July 2013
- HEPA (2024) - Heads of EPAs Australia and New Zealand *PFAS National Environmental Management Plan Version 3.0* – December 2024
- NSW EPA (2020). *Assessment and management of hazardous ground gases*, May 2020
- NSW EPA (2022). *Contaminated Land Guidelines Sampling Design Part 1 – Application* 2022

The following legislation and state-based associated documents have been used:

- EPA Tasmania (2018) - Bulletin 105 *Classification and Management of Contaminated Soil for Disposal* (Version 3) 2018
- Tasmanian Government (2012) - *Macquarie Point Development Corporation Act 2012* version current from 1 July 2023
- Tasmanian Government (1997) - *State Policy on Water Quality Management 1997*
- Tasmanian Government (1994) - *Environmental Management and Pollution Control Act 1994*, current version 14 December 2022

Based on the ongoing use for this audit of the S53X audit approach under the Victorian Environment Protection Act 1970 (as described in Section 1), the term 'CUTEP' (Clean Up To the Extent Practicable) is used for groundwater clean up extent, rather than the newer term 'CUSFARP' (Clean Up So Far As Reasonably Practicable), which applies under newer legislation.

2.2.3 Assessment reports

The following reports relevant to the Precinct South or the overall site were provided to the Auditor for review and to support the findings of the contaminated land audit. Of these assessment reports the key documents are summarised in the text of this audit report in Section 7 and many of them are provided in Appendix D. Although all reports have been reviewed and considered over the course of the assessment and audit process since 2016, not all of these reports are discussed in detail. Many of the reports have results and outcomes summarised in the *Precinct South CUTEP Report* (AECOM, 2026d)[3].

AECOM (2016a)	Groundwater Assessment, August 2015 (draft)	21 January 2016
AECOM (2016b)	Soil Assessment, August 2015 (draft)	21 January 2016
AECOM (2016c)	Derivation of Remediation Criteria	9 August 2016
AECOM (2016d)	Groundwater Monitoring Event, February 2016 (draft)	26 October 2016
AECOM (2016e)	Groundwater Monitoring Event, July 2016, (draft)	5 December 2016
AECOM (2017a)	LNAPL Remediation Action Plan	30 May 2017

[3] Throughout this audit report, the 'Precinct South CUTEP Report' (AECOM, 2026d) is also referred to as the 'CUTEP Report'.

AECOM (2017b)	Site Remediation Strategy Update 2017	22 June 2017
AECOM (2017c)	Targeted Groundwater Monitoring Event, May 2017	6 July 2017
AECOM (2017d)	Preferential Pathway Assessment (draft)	22 August 2017
AECOM (2017e)	Fluid Extraction System, Operation and Performance Overview, May 2017	25 August 2017
AECOM (2018a)	Groundwater Monitoring Event, July 2017 (draft)	23 April 2018
AECOM (2019a)	Groundwater Well Installation and Monitoring Program, February and August 2018 (draft)	21 February 2019
AECOM (2020a)	Groundwater Well Installation and Monitoring 2019	13 March 2020
AECOM (2020b)	Assessment of Potential Off-Site Ecological Impacts	10 July 2020
AECOM (2020c)	Underground Carpark Soil Categorisation and Waste Management Plan	4 November 2020
AECOM (2020d)	Audit Area 2 – Detailed Site Investigation	17 December 2020
AECOM (2020e)	Audit Area 2 and Audit Area 7 – Remediation Work Plan	12 March 2020
AECOM (2021a)	Audit Area 5 – Detailed Site Investigation	16 March 2021
AECOM (2021b)	Assessment of LNAPL Remediation End-Points	27 April 2021
AECOM (2021c)	Soil Vapour and Indoor Air Investigations 2019	27 April 2021
AECOM (2021d)	Remediation Validation Report - Audit Areas 2 and 7 and Pipeline Removal	27 April 2021
AECOM (2022)	Audit Area 3 - Detailed Site Assessment, Macquarie Point Development Project	22 November 2022
AECOM (2024a)	Macquarie Point - Precinct South Lead Excavation Backfill Assessment	22 February 2024
AECOM (2024b)	The Precinct South - LNAPL Gauging and Transmissivity Testing, March 2024	18 April 2024
AECOM (2024c)	The Precinct South - Remediation Validation Report	09 August 2024
AECOM (2024d)	The Precinct South – Well Maintenance and Targeted Groundwater Monitoring Event, Macquarie Point,	11 October 2024
AECOM (2025a)	Soil, Groundwater and Soil Vapour Investigation 2025	10 August 2025
AECOM (2025b)	In Situ Soil Characterisation and Waste Management Plan – Stage 1 and Stage 2 Bulk Excavation	19 September 2025
AECOM (2025c)	Macquarie Point - Review of Site Specific Remediation Criteria 2025	10 October 2025
AECOM (2025d)	Macquarie Point – Acid Sulfate Soil Investigation	4 December 2025
AECOM (2025e)	Assessment of Potential Off-Site Ecological Impacts - 2025 Addendum	18 December 2025
AECOM (2026a)	Site Suitability Statement Review 2025	1 February 2026

AECOM (2026b)	Groundwater Quality Management Plan	16 February 2026
AECOM (2026c)	Site Environment Management Plan	10 April 2026
AECOM (2026d)	The Precinct South -Clean Up to the Extent Practicable Report	10 April 2026
AECOM (2026e)	Macquarie Point Development Project - Precinct South Clean Up to the Extent Practicable Report - Addendum 1: Backfill of Hobart Main Pipeline (Sewer)	21 April 2026

Summaries of the scope of work and findings for each of the key documents is provided in Section 7 of this audit report. The Site Environment Management Plan (SEMP) is discussed further in Section 9.3 and is attached to the Site Suitability Statement in Appendix A.

Other key documents considered by the Auditor include:

- Part of Certificate of Title (Volume 179192 Folio 003) (a copy of which is provided in Appendix E).
- Sullivans Cove Planning Scheme
- Mac Point Precinct Plan (MPDC, 2024).

2.2.4 Management plans

The following Site Environment Management Plan (SEMP) has been prepared for the overall site and reviewed by the Auditor:

- *Site Environment Management Plan*, 10 April 2026 (AECOM, 2026c)

The purpose of the SEMP is to provide controls and measures for the environmental management of the overall site following the issue of the Site Suitability Statement. The SEMP is to be implemented during the redevelopment/construction period and during future occupation (which may include maintenance activities). The SEMP may be updated/revised as required.

The SEMP referred to above is a consolidated SEMP for the overall Macquarie Point Development site. For previously issued audit reports at the Macquarie Point site, individual SEMPs were generally prepared. Following a change of envisaged overall site development to accommodate the Multipurpose Stadium, and the obtaining of additional data in the period since earlier audit reports were completed and issued, the consolidated sitewide SEMP was produced by AECOM, with revised management requirements to ensure suitability of the site. The consolidated SEMP supersedes the earlier SEMPs that were issued with previously audited areas, for which the Site Suitability Statements allowed for substantive revisions to the SEMP subject to verification of SEMP revision suitability by an Environmental Auditor. Further information regarding the SEMP is provided in Section 9.3 of this audit report.

A site-specific Groundwater Quality Management Plan (GQMP) has also been prepared for the overall site and reviewed by the Auditor:

- *Groundwater Quality Management Plan*, 16 February 2026 (AECOM, 2026b)

The GQMP is presented in Appendix F of the SEMP, and outlines ongoing groundwater monitoring requirements. The GQMP includes provision for amendment over time, subject to Auditor acceptance, as groundwater monitoring wells may become impracticable to retain. The GQMP allows for cessation of monitoring where it can be demonstrated to be appropriate, subject to Auditor acceptance.

3. SITE INFORMATION AND ENVIRONMENTAL SETTING

3.1 SITE DESCRIPTION

Site identification details are provided in Table 3-1 below.

Table 3-1: Site identification summary

Site Detail	Description
Address	41 Evans Street, Hobart, Tasmania, 7000 (The Precinct South - Former Audit Area 3 and part of Former Audit Area 5)
Location	The overall site is located east of the Hobart CBD, northeast of Evans Street, and approximately 220 m east/southeast of the Tasman Highway (Davey Street). The Precinct South is located in the southeastern part of the overall site, with frontage to Evans Street in the south.
Certificate of Title	The Precinct South comprises a part of land title 179192/3, which also includes other parts of the overall site (Appendix E). Previously, the Precinct South has formed part of land title 113521/1, and prior to that land title CT 114462/1
Owner/s	State of Tasmania (Crown Land)
Site Area	Approximately 1.4 ha (within an overall site area of 9.3 ha).
Survey Drawing	Not available.
Municipality	Hobart City Council
Zoning	Macquarie Point Mixed Use Zone under the Sullivans Cove Planning Scheme 1997.

The Precinct South is described by the boundary as presented on Figure F3, and as shown in Figure 1 in Section 1.1 above. As shown on Figure F3, the Precinct South area occupies an irregularly shaped part of the southeastern half of AA5, and the whole of AA3. The Precinct South sits in the southeastern corner of the overall site.

The Site dimensions and Site features are shown on Figure F4. Key Site features include:

- The Red Shed, in the central southern area of the Precinct South.
- A concrete slab to the east of the Red Shed associated with the former SeaRoad Shed[4] (demolished late 2022).
- Red Square, to the west of the Red Shed.
- The former Goods Shed Annex, in the northwest of the Site.
- A public carpark located in the northern portion of the Site.

The Precinct South is set back from the waterfront: to the south, Evans Street and adjacent waterfront land create approximately 160 m of separation from Sullivans Cove. To the east, TasPorts land separates the Precinct South from the Derwent River by approximately 190 m in the east, and 350 m in the north northeast.

Environmental assessment of the Precinct South was based upon investigation locations within the boundary of the area shown in Figure 3, but also utilised analytical results in a 20 m ‘buffer zone’ beyond that area, as shown on Figure F3 (and other figures). The 20 m buffer zone extended into the following adjacent areas:

[4] The SeaRoad Shed was historically referred to as the Holyman Building.

- To the north of the Precinct South into adjoining parts of AA5 and a very narrow strip of AA2 and AA7.
- To the east-southeast of the Precinct South into TasPorts property.
- To the south of the Precinct South into Evans Street.
- To the west of the Precinct South into AA1.

The Auditor agrees with the consideration of conditions on and adjacent to each audit area as an acceptable approach given the significant number of data which are available and given the similar geological and hydrogeological conditions present across adjacent audit areas. The Auditor has referred to the land within the Site boundary combined with the land within the adjacent area, although the main focus is on data from within the immediate audit boundary.

3.2 SURROUNDING LAND USES

The surrounding site uses are presented in Table 4 and Table 13 of the *CUTEP Report* (AECOM, 2026d) as reproduced in Table 3-2 below.

Table 3-2: Surrounding Site Uses

Direction	Adjacent land use	Anticipated Future Change in Use
North	The Precinct South is bounded to the north by other parts of the overall site referred to as the Precinct North and the Promenade and Underground Carpark. These areas are currently unoccupied or used for open space carparking and may be used for intermittent public events.	The Multipurpose Stadium and Associated Concourse Zone, with the proposed Antarctic Facilities Zone beyond, will be constructed to the north.
East	TasPorts land, used for storage and port activities, lies directly east of the Precinct South. A sewage treatment plant operated by TasWater lies to the northeast.	TasPorts operations are expected to continue for the foreseeable future, based on currently available information. Decommissioning and removal of the sewage treatment plant, and replacement with a sewage pumping station, is planned to occur in the next few years.
West	The Precinct South is bounded to the west by the Goods Shed and Yard. This area is occupied by: • The Goods Shed, a former warehouse structure occupied by the Corporation's offices. • Open space carparking. The Goods Shed and Yard may also be used for intermittent public events.	The Multipurpose Stadium and Associated Concourse Zone, with the Aboriginal Culturally Informed Zone beyond, will be constructed to the west. The Goods Shed is understood to be proposed to be relocated to the Escarpment area in the northwest of the overall site.
South	Evans Street, with commercial properties beyond (including TasPorts and University of Tasmania), which extend towards Hunter Street and Sullivans Cove.	

3.3 CURRENT AND PROPOSED USE

The current and proposed uses for the Precinct South are summarised below, drawing on the previous AECOM information and the *Mac Point Precinct Plan* (MPDC, 2024).

3.3.1 Current land use

Surface cover: The Precinct South is predominantly sealed with bitumen, concrete and gravel. Some areas contain backfill/clean fill from earlier remediation works; several remediation areas were previously opened and some remain notable in the site record.

Buildings and structures:

- The Red Shed occupies the central-southern portion of the precinct and is currently tenanted by Hobart Brewing Company.
- A concrete slab east of the Red Shed remains, over which previously lay the former SeaRoad Shed (demolished late 2022).
- Red Square, immediately west of the Red Shed, is used intermittently for public events and as a marketplace for mobile vendors (e.g., coffee and food vendors, hairdressers).
- A public carpark occupies the northern part of the Precinct South.

Typical use: The Precinct South is generally unoccupied but has been used intermittently for public events, parking and temporary activities. Following remediation works completed up to 2020, much of the Site is currently vacant aside from the uses noted above.

Services and utilities: The Main Hobart Pipeline (sewer) currently traverses the western part of the Precinct South; and other subsurface utilities are present.

3.3.2 Proposed future land use

The *Mac Point Precinct Plan* (MPDC, 2024) proposes a mixed-use redevelopment of the overall site, combining Commercial uses with Public Open Space. Proposed uses of the overall site are shown in Figure 2, below.

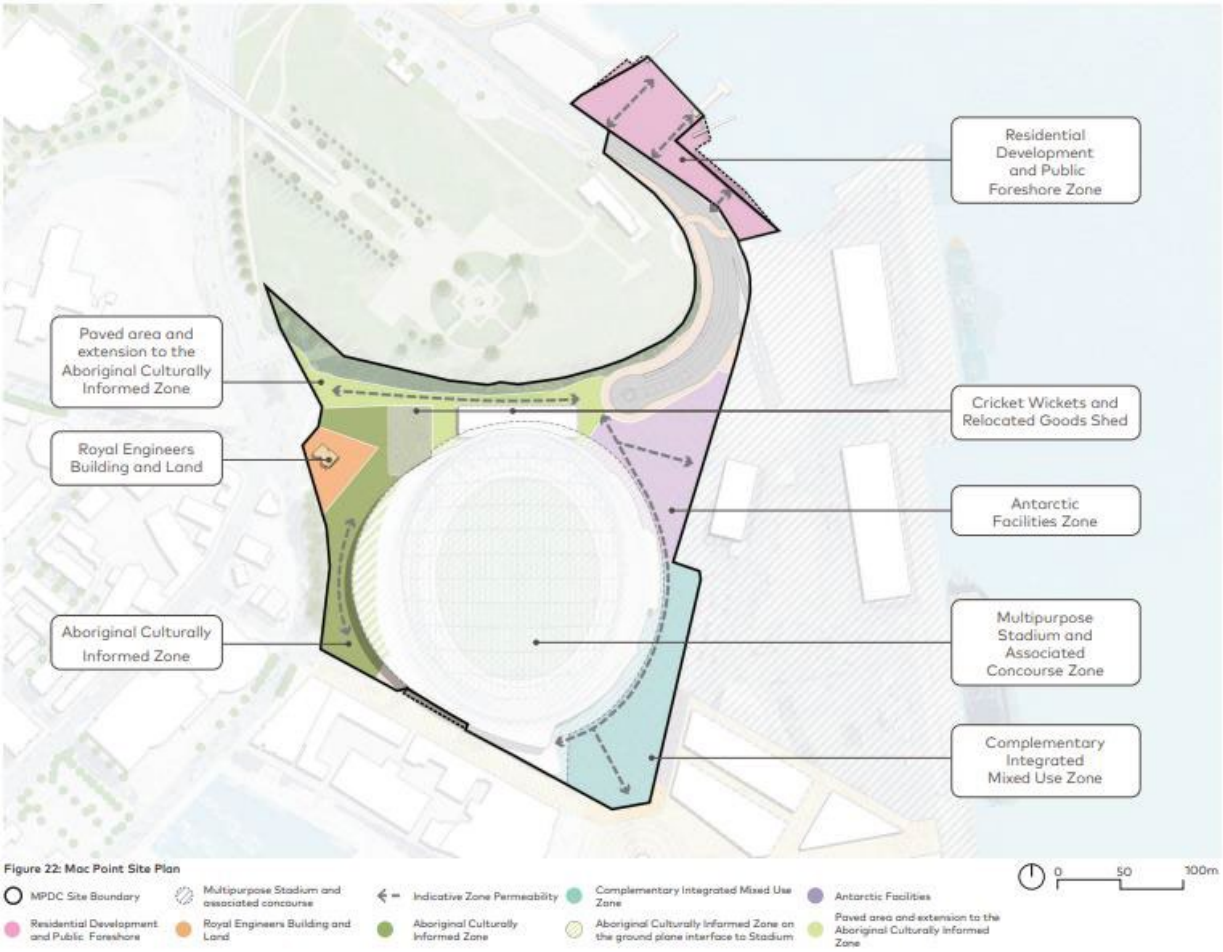


Figure 2 - Macquarie Point Proposed Future Land Uses (MPDC, 2024)

The extent of the Precinct South relative to the uses shown in Figure 2 is shown in Figure 3 below, extracted from Figure F3. Figure 3 includes hatched red areas depicting the extent of proposed building footprints within the Complementary Integrated Mixed Use Zone.

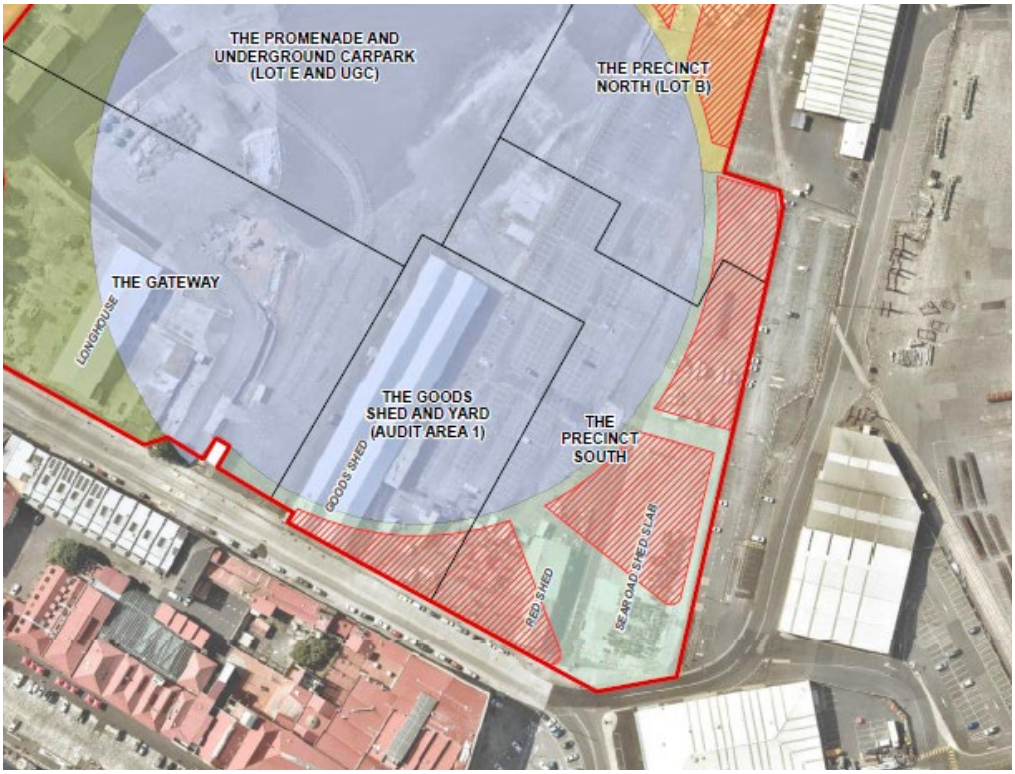


Figure 3 - Proposed Uses relative to the Precinct South Boundary (source: AECOM, 2026d)

Specific zoning for the Precinct South includes:

- Complementary Integrated Mixed Use Zone (southeastern part of the Precinct South)
- Multipurpose Stadium and Associated Concourse Zone (northwestern part of the Precinct South)

Probable uses within these zones are understood to include commercial activities (visitor accommodation, retail, arts and institutional uses) integrated with significant public open space and stadium functions.

Key development considerations and constraints:

- **Hardstand and basement parking:** Precinct South is expected to be largely covered by a maintained layer of hardstand. Basement car parking is unlikely across much of the Site due to a shallow groundwater table and management issues associated with residual LNAPL (specifically LNAPL Plume B) in this area.
- **Stadium and excavation:** The proposed playing surface for the future stadium is understood to have an elevation of 3.0 m AHD. It is understood that construction works may include broad excavation within the stadium footprint to approximately 2.0 mAHD. Specific details regarding depth of foundations and sumps or lift overruns are not known at this time.
- **Utility realignment:** The Main Hobart Sewer, which currently runs through the western part of the Precinct South, is planned to be realigned off-Site beneath Evans Street to the south and through TasPorts land to the east. A TasWater project to relocate the sewage treatment plant to the northeast of Precinct South will include associated sewer realignment; a disconnected section of sewer beneath the overall site will be capped and left *in situ*.
- **Subsurface activity:** Development will require installation and management of subsurface utilities and ongoing maintenance access.

3.4 ENVIRONMENTAL SETTING

3.4.1 Topography

The overall Macquarie Point site is generally flat, with three main tiers:

- The upper (northwestern) tier consisting mostly of a gravel surface.
- The second (middle) tier consisting mostly of an asphalt and gravel surface.
- The third (southeastern) tier consisting of concrete, asphalt and gravel surfaces and a series of sheds including the Goods Shed, Red Shed and former SeaRoad Shed.

The Precinct South is generally flat, with a slight slope down from north to south. The current surface consists of primarily hardstand (asphalt and concrete), with some areas of gravel in the northwest corner. The Site lies predominantly within the lower tier of the overall site, although the north-northwestern portion of the Site extends into the middle tier.

Surface drainage is captured through stormwater drains which discharge to the Derwent River.

3.4.2 Geology and hydrogeology

3.4.2.1 Geology

Regional Geology

The regional geology is described in Section 3.2.1 of AECOM (2026d) and Table 1 of AECOM (2024c). The description in both reports notes that the overall site is underlain by a combination of reclaimed land, Quaternary aged sediments and dolerite of Jurassic age. Micaceous quartz sandstone and white felspathic sandstone and micaceous mudstone of Triassic age are located to the north and west of the overall site.

The Precinct South Local Geology

The local geology is described in Section 3 of AECOM (2026d). This report identified that the Precinct South has been subject to significant filling since the early 1800s with up to 600 m of land reclaimed from the original 1800s shoreline (Department of the Environment, *Australian Heritage Database,* 2007).

Fill material has been encountered across the Site to depths of up to approximately 11.0 metres below ground level (mbgl). Fill material has been encountered in the 20 m buffer zone to depths of up to approximately 13.0 mbgl. Fill material has been described as generally containing a combination of clays, sands, gravels, cobbles and bricks. The thickness of fill is variable across the Precinct South generally increasing from northwest to southeast across the Site consistent with historical land reclamation activities. Deeper fill material generally consists of silty sands, similar to the underlying natural estuarine/marine estuarine deposits, indicating that the deeper fill material may be associated with reworked natural material or dredged material.

Two main natural soil types have been encountered during previous investigations, consisting of estuarine/marine deposits (silty sands) and weathered dolerite including clays, gravels, and cobbles. Estuarine/marine deposits have generally been encountered in the Precinct South, ranging in depth from 2.2 to 15.0 mbgl. Weathered dolerite typically underlies the estuarine/marine deposits from 4.2 to 21.5 mbgl.

Dolerite bedrock, described as high strength and slightly fractured (Douglas Partners, 2015), underlies the fill and natural soils at the Site. Dolerite has been encountered at near surface in the northern portion of the overall site (outside the Precinct South) and slopes down in a southerly and southeasterly direction. Within the Precinct South, the top of dolerite has been encountered as shallow as 0.6 mbgl (in BH150), although this is considered likely to be due to a dolerite boulder floating in fill. The surface of fractured dolerite has more frequently been encountered at 6.5 to >13 mbgl in other bores.

The Site is mapped as having a low probability (6-70%) of Potential Acid Sulfate Soils (PASS), as indicated on LISTmap's Coastal Acid Sulfate Soils (0 – 20 m AHD) layer[5], and assessment of PASS or ASS presence in accordance with the *Tasmanian Acid Sulfate Soil Management Guidelines* (DPIPWE, 2009) is required before any development which may disturb greater than 100 m^3 of PASS.

3.4.2.2 Hydrogeology

Regional Hydrogeology

Regional groundwater flow is inferred to be in a general easterly direction toward the Derwent River and is encountered in coastal deposits, alluvial sediment, sandstone and in fractured dolerite (Department of Infrastructure Energy and Resources, *Southeast Tasmania Groundwater Map*; DIER, 2006).

Regional groundwater yield generally ranges from 0.77 to 3.78 L/s in the varying aquifer types, and salinity ranges from 70 – 8,290 mg/L (DIER, 2006).

The Precinct South Local Hydrogeology

The local hydrogeology is detailed in Section 3.3 of AECOM (2026d). The Derwent River is located approximately 190 m east and 350 m north northeast of the Precinct South boundary, and Sullivans Cove is located approximately 160 m to the south. No surface water is present on the overall site generally, including within the Precinct South.

The overall site is underlain by a single aquifer unit (within multiple lithological units) extending to depths greater than 25.0 mbgl (the maximum depth assessed). Groundwater has generally been encountered in fill material in the central, southern and eastern portions of the Site, extending into the underlying natural material including estuarine/marine deposits, weathered dolerite and fractured dolerite.

The average Standing Water Level (SWL) in shallow wells in the Precinct South is approximately 2.15 mbgl. Groundwater elevations in shallow groundwater in the Precinct South were measured between 0.637 mAHD and 1.208 mAHD (MW126B and MW154 respectively) in June 2025.

The inferred shallow groundwater flow direction in the Precinct South is generally southerly and easterly. Some interpretations of groundwater contours indicate possible westerly flow components in the northern and central parts of the eastern boundary of the Precinct South, inferred to be associated with off-Site groundwater mounding. For the overall MPDC site, groundwater flow is inferred to be generally southeasterly, with elements of southwesterly flow north of the Red Shed, and with the inferred discharge point being Sullivans Cove, in the vicinity of off-Site wells MW151 to MW153 (refer Figures F5a to F5d). Contours for December 2023 (Figure F5b), February 2025 (Figure F5c) and June 2025 (Figure F5d) indicate an element of off-Site flow south of LNAPL Plume B (around MW16), but when off-Site wells PC13, PC08 and PC14 were able to be gauged, the groundwater elevations support off-Site mounding within the TasPorts land and indicate that the flow reverts to a likely discharge point around MW151 to MW153 (the elevation of 0.931 mAHD at PC08 was higher than the 0.437 mAHD at PC14 and the 0.359 mAHD at MW153).

Section 3.3.2 of AECOM (2026d) discusses the range of groundwater gradients across the site, and how there is variation in different parts of the Precinct South.

The Auditor generally agrees, but notes that the overall gradient inferred from MW192 to MW125A in June 2025 may be misleadingly flat, because there is a groundwater mound midway along that path, such that groundwater would not flow from MW192 to MW125A.

[5] https://data.thelist.tas.gov.au/datagn/srv/eng/metadata.show?id=613&currTab=simple

The groundwater gradient is relatively flat in the central and southern parts of the overall site (the Auditor considers the gradient to be approximately 0.004 m/m based on contours for the southern part of Precinct South), but, as noted by AECOM, there are steeper gradients in the north and west, at The Gateway and The Promenade and Underground Carpark. This gradient change is likely caused by greater depth to the lower permeability bedrock in the eastern part of the Site – so the water table is within higher permeability fill material, and consequently groundwater gradients are flatter. Effects from the Main Hobart Pipeline sewer, which runs approximately south/southwest to north-northeast through the overall site, may also contribute.

There are several former sea walls located beneath and surrounding the overall site. The sea walls were associated with the progressive stages of land reclamation, and are likely to influence localised groundwater flow direction, and contribute to inferred steeper gradients in the areas off-Site from the Precinct South, potentially from the effect of some sea wall elements locally restricting flow.

The site specific hydrogeology is based on information from the following groundwater wells/bores which are depicted on Figure F5b and lie either directly within the Precinct South or within the 20 m buffer zone.

- AA5:
  - RN4 (northwest corner of the Precinct South)
  - MW162, MW163, and MW164 (west, east and southeast of the Precinct South)
  - MW146 (in the 20 m buffer zone just northwest of the Precinct South)
  - MW176 and MW175 (in the 20 m buffer zone just west and southwest of the Precinct South)
- AA3:
  - S4 and S6 (southeast of the Precinct South, north of LNAPL Plume B)
  - MW06 (west of the Precinct South, north of LNAPL Plume B)
  - MW03 (southwest of the Precinct South and located at the Site boundary, north of LNAPL Plume B)
  - PW02, S8, and MW05 (within LNAPL Plume B in the southeast of the Precinct South)
  - MW154, MW16, MW60, and MW126B (south of LNAPL Plume B in the southeast part of the Precinct South)
  - MW125A and MW125B (south of the Precinct South, near to the Site boundary to Evans Street)
- Evans Street:
  - MW150 (in the 20 m buffer zone within Evans Street and south of the area)
  - MW151 (in the 20 m buffer zone and south of the area)
- Further Surrounding Areas Beyond the 20 m buffer zone monitored during the targeted Precinct South GME:
  - MW152 and MW153 (outside of the 20 m buffer zone, south of the area and within carpark)
  - MW155 (outside of the 20 m buffer zone, north of the Precinct South and within AA7)
  - MW55 (outside of the 20 m buffer zone, central east of the Precinct South and within AA1)
  - MW127A, MW127B, MW124A, and MW124b (outside of the 20 m buffer zone, west of the Precinct South within AA1
- TasPorts Area:
  - PC13 (in the 20 m buffer zone and east of the Precinct South)
  - MW135 and MW136 (in the 20 m buffer zone and southeast of the Precinct South, east of LNAPL Plume B)
  - MW134 (in the 20 m buffer zone and southeast of the Precinct South)

The purpose of each of these wells is described in Table T2 of *The Precinct South - Well Maintenance and Targeted GME* (AECOM, 2024d), along with other details such as coordinates, screen depths, gauging dates, TOC elevation, LNAPL thicknesses (where relevant), and water quality parameters.

Evidence of tidal influence on groundwater levels has been identified to the south of the Site (and the overall site) within the inferred groundwater flow path at MW151, where tidal variations of approximately 0.1 m have been noted. Tidal influence (i.e., increasing SWL variations) has been noted to increase toward Sullivans Cove.

Hydraulic conductivity testing undertaken on the southern part of the overall site (AECOM, 2016a) has estimated the hydraulic conductivity of the different lithological units as follows, although this is likely to be subject to highly localised variability, given the uncertainty of consistency of material used to reclaim the area. Table 14 of AECOM (2026d) summarise the range of inferred hydraulic conductivity, including values assessed by GHD (2015) and SKM (2001). Table 15 (*ibid.*) records the hydraulic conductivity values estimated by AECOM based on their own testing (in 2016).

Table 3-3 below describes the site-specific hydrogeology as assessed during the various stages of investigation, noting that in some instances, 'local' refers variously to conditions within the overall site, and where noted applies to the Precinct South specifically.

Table 3-3: Summary of local hydrogeology

Depth to Groundwater	Depth gauged in wells in June 2025 ranged between 1.477 mbgl (MW164) to 3.170 mbgl (RN4) with an average depth of ~2.2 mbgl in shallow wells.
Groundwater Elevation	The regional groundwater elevations in June 2025 averaged approximately 0.8 mAHD, ranging from 0.637 mAHD (MW126B) to 1.208 mAHD (MW164). Groundwater elevations in up-gradient wells (for example, MW155) are slightly higher than in wells located within Precinct South and at down-gradient locations. This pattern is expected because land surface elevations fall from the Hobart Cenotaph area at the north-northwest down toward AA4, and then continue to decline toward AA2/AA7 and on to AA5/AA3. The higher ground and recharge area upslope of the escarpment allow infiltrating water to recharge groundwater, producing naturally higher groundwater levels in the up-gradient wells relative to the down-gradient wells in Precinct South.
Hydraulic Gradients	Hydraulic gradients are described in AECOM (2026d) as steep in the northern and western part of the overall site, and flatter in the east, attributed to an increased depth to the lower permeability bedrock in the eastern portion of the overall site, and possibly effects from the Main Hobart Pipeline sewer. AECOM (2021a) and AECOM (2021b) note the same effects, as well as noting that groundwater modelling by GHD (2016) indicated an easterly flow component to the south of the overall site, caused by groundwater flows deflecting off Hunter Island (a basaltic high located west of the Precinct South).
Hydraulic Conductivity	Hydraulic conductivity is estimated to range as follows: • Fill Material – 0.14 - 50 m/day • Alluvial/ Marine Deposits – 0.27 – 5.1 m/day • Slope Deposits – 0.16 – 0.56 m/day • Dolerite Bedrock – 5.3 x 10^{-3} – 1.4 m/day In general, this indicates relatively high permeability of fill and sedimentary materials overlying (relatively) lower permeability bedrock, which is as expected, and is consistent with the representations of groundwater elevation and flow direction.
Total Dissolved Solids (TDS)	In the Precinct South, Total Dissolved Solids (TDS) concentrations in shallow groundwater (<10.0 mbgl) during the 2023 GME ranged from 190 mg/L (MW16) to 1,810 mg/L (MW162), with an average of 1,000 mg/L. In June 2025 the range was 1,100 mg/L to 13,605 mg/L. There is likely limited estuarine/marine water intrusion on-Site within shallow groundwater (<10.0 mbgl). The higher TDS (of 13,605 mg/L) was reported in MW153, within a carpark approximately 60 m south of the Precinct South, where higher interaction with estuarine/marine water is inferred, although

	TDS at MW152, located north of MW153 approximately 40 m south of the Precinct South, was lower (2,140 mg/L). Based on TDS concentrations, there is inferred to be limited marine water intrusion beneath the Precinct South, and groundwater has been classified as Category A in accordance with the Tasmanian *State Policy on Water Quality Management* (SPoWQM). This is consistent with fresher water recharging shallow groundwater from the Hobart Cenotaph area to the north, and from the west, while the overall site to the south and east displays seawater intrusion associated with land reclamation.
Groundwater Flow Direction	Figures F5a-F5d (November 2019 – June 2025), reproduced from AECOM (2026d), indicate the groundwater flow direction at the Precinct South varies mainly from southwest in some areas to southeast in other areas. Contours which include gauging data from off-Site wells including PC08 and PC14 (Figure F5a) indicate that the flow direction turns towards Sullivans Cove to the south around wells MW151 - MW153. Some elements of westerly flow are indicated along the eastern boundary of the Precinct South, causing by inferred mounding of groundwater in TasPorts land.
Nearest Down Gradient Surface Water Receptor	Sullivans Cove to the south/southwest is at a distance of approximately 160 m from the Site. The Derwent River is at approximately 190 m to the east, but based on contours noted above, discharge is inferred to Sullivans Cove.

3.4.3 Registered groundwater bores

The *Soil, Groundwater and Soil Vapour Investigation 2025 report* (AECOM, 2025a) noted that a search of the Tasmanian Government Groundwater Information Access Portal did not identify any groundwater wells within 500 m of the boundary of the overall site, including the area hydraulically down-gradient of the Precinct South.

4. SITE HISTORY

Previous site uses are indicated on Figure F3 of this audit report (reproduced from AECOM, 2026d). The site history as presented in AECOM (2021a, 2025a, and 2026d) was informed by the following Austral Tasmania Pty Ltd (Austral) documents:

- Austral (1998) - *Hobart Rail Yards Railway Workshop Building, Extant Recording,* unpublished report prepared for the then DELM, January 1998.
- Austral (2013) - *Macquarie Point Development Project, Historical Summary* dated 15 January 2013.
- Austral (2015) - *Evans Street Historical Research Report* dated 11 June 2015.

AECOM (2026d) also presented some site history information, which drew from Austral Tasmania Pty Ltd *Built Heritage Assessment for the Macquarie Point Site* (Austral, 2014) and AECOM site observations.

4.1 HISTORY – ON-SITE

AECOM (2021a, 2025a, and 2026d) collectively provide a detailed site history for the Site. Included among other things is a detailed review of historical aerial photography which supports the findings in relation to historical use of the Site.

Key historical uses and features within Precinct South are as follows:

- Land reclamation
    - The Precinct South was built up/filled during reclamation from the 1830s to the 1900s. It is unclear what was used to backfill the Site. AECOM cited '*Macquarie Point Development Project, Historical Summary'* (Austral, 2013) as suggesting that material used to fill the Site consisted of rubble, waste and dredged material from the adjacent former Hobart Rivulet and Derwent River.
- Bulk fuel terminals and fuel infrastructure (eastern portion of the Precinct South)
    - From the 1920s until the early 1970s, the eastern part of the Precinct South formed part of a bulk fuel terminal. Multiple aboveground storage tanks (ASTs) and drums held various petroleum products (kerosene, diesel, fuel oil, motor spirit, white spirit) and ancillary chemicals such as caustic soda. The image in Figure 4 below shows the location of the former bulk terminal infrastructure in relation to the Precinct South, including that bulk storage tanks were outside the current-day Precinct South boundary, indicating that sources associated with bulk storage were predominantly in off-Site areas.

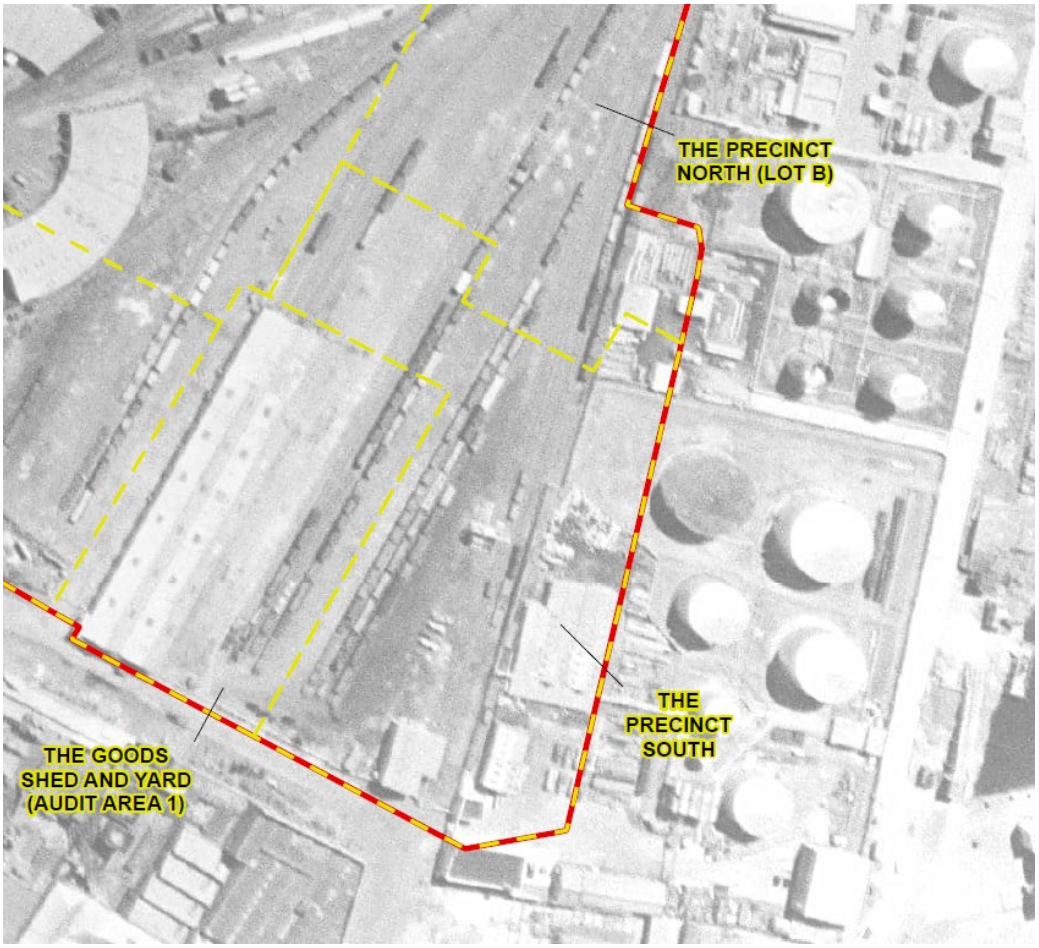


Figure 4 - Aerial photograph 1957 showing location of Bulk Fuel Terminal (source: AECOM, 2026d)

- Fuel (diesel) and oil transfer underground pipelines ran along the western side of the former SeaRoad Shed slab. These pipelines were removed as part of remediation works in 2020 and 2023. The locations of the remediation areas are shown on Figures F7a) to d).
- Two underground storage tanks (15 kL diesel and 5.4 kL Unleaded Petrol (ULP)) were formerly located adjacent to the southwest corner of the former SeaRoad Shed; these were reported to have been removed prior to management of the overall site by MPDC (although no removal/validation documentation relevant to that time was available for review and later investigation indicated residual impacted soil).

- Freight handling and rail activities
  - Freight handling and rail operations were carried out across the Precinct South from the early 20th century to 2014. The former SeaRoad Shed located in the southeast corner of Precinct South, was used for freight storage and handling. The SeaRoad Shed was demolished in late 2022, leaving only a concrete slab. The location of the SeaRoad Shed (before demolition in 2022) is shown in the southeast corner of the Site, in Figure 5 below.

Figure 5 - Aerial photograph 2011 showing location of former SeaRoad Shed and Goods Shed Annex (source: AECOM, 2026d)

  - Rail spurs and yard activities supported uses associated with general freight and industrial cargo, including oils and degreasers. Historical uses included locomotive servicing and associated fuel handling in adjacent areas.

- Goods Shed Annexe and ancillary buildings
  - The Goods Shed Annexe formerly adjoined the northern end of the Goods Shed; remediation to remove remnant above and below ground infrastructure in this area was undertaken in early 2020. The former below ground infrastructure included a Truck Washbay, a Triple Interceptor Trap and a Mechanics Pit.
- Red Shed and ancillary uses
  - The Red Shed (constructed circa 1953) has been used for a range of activities including a waste paper depot (Boy Scouts) and, more recently, short-term truck repair and maintenance (1990s), which likely involved use and storage of small quantities of fuels and oils, and workshop activities such as painting and welding.
- Mechanics workshop and temporary uses
  - Small-scale workshop activities have occurred intermittently within the Precinct South (e.g., truck repair), with associated localised storage and handling of fuels, oils and workshop chemicals.
- Other subsurface features
  - A trunk sewer (the Main Hobart Pipeline)

Plates in AECOM (2021a) and AECOM (2022) show detailed photographs of some of the key features, including the ASTs, and support the above description of historic uses on the Site.

The Precinct South, being strongly associated with reclaimed land, has limited potential for First Nations cultural heritage.

4.2 HISTORY – SURROUNDING AREA

A range of activities were historically conducted in the area surrounding the Precinct South. The key uses associated with potential for contamination at the Precinct South are noted below. More detailed descriptions of the surrounding use history are presented in AECOM (2025a and 2026d), but the Auditor does not consider there is a need to recount some details which are unlikely to have contributed to potential contamination affecting the Precinct South. As well, many of the details regarding history of surrounding areas have been mentioned above in relation to the Precinct South and are not repeated.

- Land reclamation occurred in surrounding areas from 1828 to the 1900s.
- Rail operations and freight handling occurred adjacent to the Precinct South from the late 19th century until around 2014. The former SeaRoad Shed, located in the southeast corner of the Precinct South, was used for freight storage and was demolished in late 2022, leaving a concrete slab.
- TasPorts operations, east of the Precinct South, occurs on the main part of the former bulk fuel terminals footprint (including all bulk storage tank locations). It is understood that TasPorts took possession of the former terminal area following decommissioning in the early 1970s.
- Two fuel pipelines ran on the western side of the former SeaRoad Shed slab to the Ocean Pier[6] and other locations; these pipelines extended into the area north of the Precinct South and were removed as part of remediation works in 2020 and 2023.
- The former Roundhouse, immediately west of the northern part of the Precinct South (part of Audit Area 5), functioned as a locomotive maintenance facility centred on a large turntable, with workshops, offices, stores, an electrical/boiler shop and a blacksmith. The Roundhouse was constructed in the mid-1910s and dismantling began in the early 1980s.
- The Roundhouse Refuelling Area (northwest of the Precinct South) contained multiple large ASTs and an underground diesel line and operated until the late 1980s. Pits and service trenches within the Roundhouse precinct were backfilled during dismantling; building rubble and trench fill are reported to have been used in places and may anecdotally have include asbestos containing material (ACM).
- Coal storage sheds, engineer's yards and drill yards occupied parts of the overall site in the 19th century.
- The Hobart Rivulet, formerly south of the Site (beneath present-day Evans Street), was backfilled; historical dredging associated with nearby industrial activities (gasworks, slaughterhouses, tanneries, soap works) contributes to the local history of contaminated sediments and imported fill.
- A portion of the former Hobart Gasworks lay to the west of the Precinct South in the Gateway area and operated from 1857 to 1978.

The uses of the areas surrounding the Precinct South indicate the potential for contaminants from rail and general industrial uses, including refuelling, pipelines, ASTs and maintenance works. The Auditor considers that the history review for both the Precinct South and the surrounding areas allows for appropriate consideration of contaminants of concern and other aspects of the associated Conceptual Site Model (CSM) described in the following section.

[6] Ocean Pier was located in the position of the former waste water treatment plant.

5. CONCEPTUAL SITE MODEL (CSM)

A Conceptual Site Model (CSM) has been developed by AECOM to evaluate potentially complete exposure pathways between sources of contaminants and the receptors that may be exposed.

The existence of a potential receptor does not imply the existence of a complete exposure pathway. Receptors are identified with respect to on-Site areas, based on PEVs considered to be applicable to the Site and based on the current and proposed land use scenarios.

Section 3 of the CUTEP Report (AECOM, 2025d) describes the CSM prepared by AECOM for the Precinct South. Geology and hydrogeology for the area is described above in Section 3 of this audit report.

An overview of the CSM relating to sources, pathways and receptors is provided in Table 5-1 below.

Table 5-1: Conceptual Site Model Overview (Summarised from AECOM (2026d))

Aspect	Considerations
Known/ Potential Sources	• Fill placed during land reclamation (1830s–1900s). • Former bulk fuel terminals and associated infrastructure in the eastern area of the Site. • Historic fuel transfer pipelines and fuel/oil lines near the former SeaRoad Shed. • Freight handling, rail yards and locomotive servicing in and adjacent to the Site (including the former Goods Shed Annexe, Red Shed and Roundhouse complex). • Former SeaRoad Shed (freight storage), mechanics workshop activities and small-scale vehicle repair areas. • Backfilled Roundhouse pits and service trenches containing building rubble and possible ACM. • Former Hobart Rivulet and adjacent historical industrial activities.
Potential Impacted Media	• Soil • Groundwater • Soil vapour
Potential Exposure Pathways	• Direct contact and/or ingestion of soil and groundwater • Vapour inhalation • Groundwater migration to ecological receptors • Preferential pathways (to areas not previously impacted)
Potential Receptors	Human Health: • Residents • Recreation/Open Space Users • Commercial Workers • Intrusive Maintenance Workers • Off-Site workers and visitors in adjacent commercial/industrial areas. Ecological: • Plants and Gardens • Aquatic Ecosystems (Derwent River and Sullivans Cove)

Details of the potential sources of contaminants, contaminants of potential concern, transport and exposure mechanisms and potential receptors are detailed in the following sections.

5.1 POTENTIAL SOURCES OF CONTAMINANTS

There have been potential sources of contamination both at and close to the Site as described in the sections below. Figure F3 shows previous Site uses.

5.1.1 On-Site primary and secondary sources of pollution

Potential sources of soil, groundwater and soil vapour impact associated with historical activities at the Site include:

- **Potentially contaminated fill:** As shown in the cross-sections in Figures F9A-F9C, fill is present across the entire Precinct South area, associated with land reclamation. Along the whole southern and eastern parts of the Site, the fill is shown to be above marine sediments, excepting a small area in the northern part of the eastern boundary, where the fill overlies dolerite rock. The cross-section in Figure F9B indicates that in the northern part of the Precinct South, marine sediments are less ubiquitous.
- **Former fuel storage and transfer infrastructure:** part of the former bulk fuel terminal operations extended into the eastern part of the Precinct South (1920s–1970s), although the ASTs were located to the east of the Site boundary (off-Site), as shown above in Figure 4. Two USTs were historically located adjacent to the southwest corner of the former SeaRoad Shed; documented fuel transfers and pipeline corridors are known to have traversed the Precinct South. The pipelines were removed during remediation in 2020 and 2023.
    - The previous location of the USTs (southern part of the Site around the southwest corner of the SeaRoad Shed slab) can be discerned in Figure 6 below, which is extracted from Figure F7a, and shows the location of all validation samples recovered during excavations at the Site.

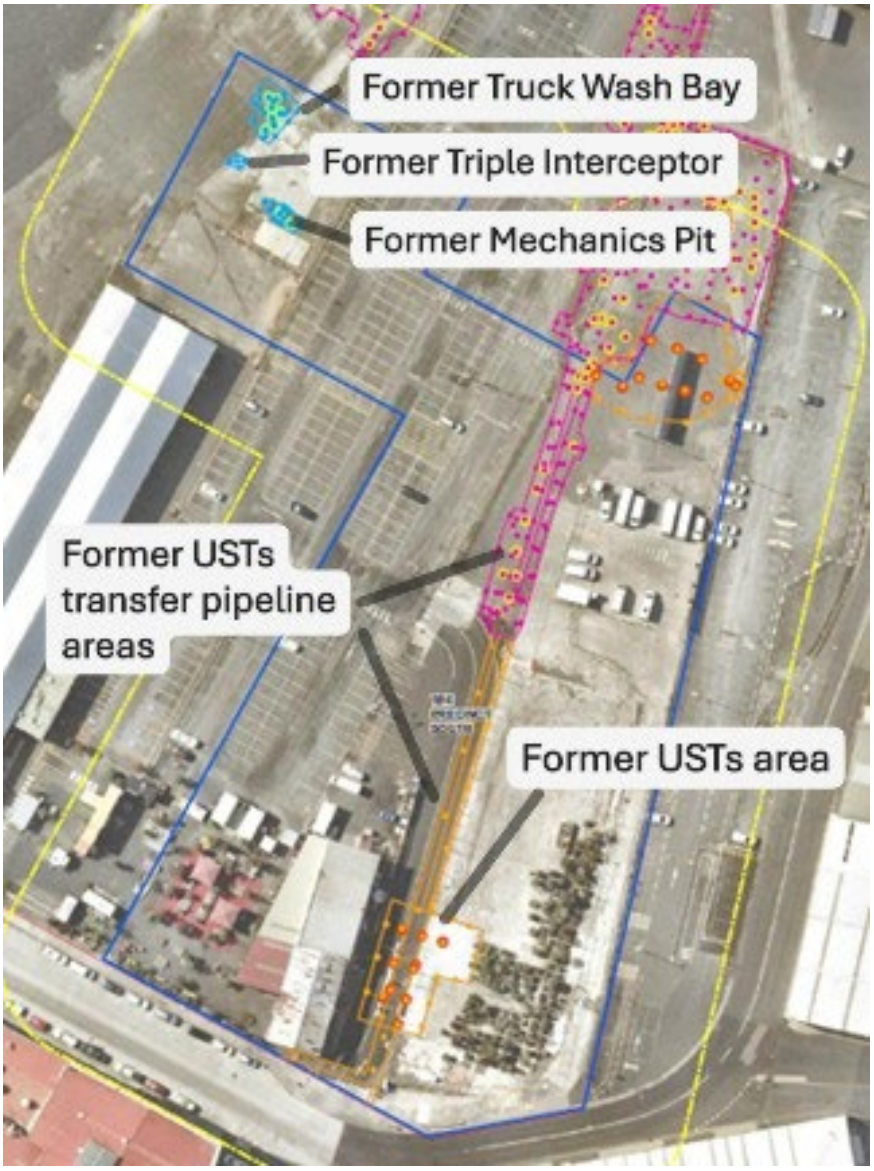


Figure 6 - Remediation Validation Locations indicating source areas (Source: AECOM, 2026d)

- Freight handling, workshops and truck repair/maintenance (painting, welding, degreasing).
- LNAPL Plume B (within and beneath the Precinct South and extending east into TasPorts land) and other nearby LNAPL plumes are established source zones of residual NAPL and dissolved hydrocarbon contamination. The approximate location and extent of LNAPL Plume B is shown below, in Figure 7, an extract from Figure F4, from AECOM (2026d).

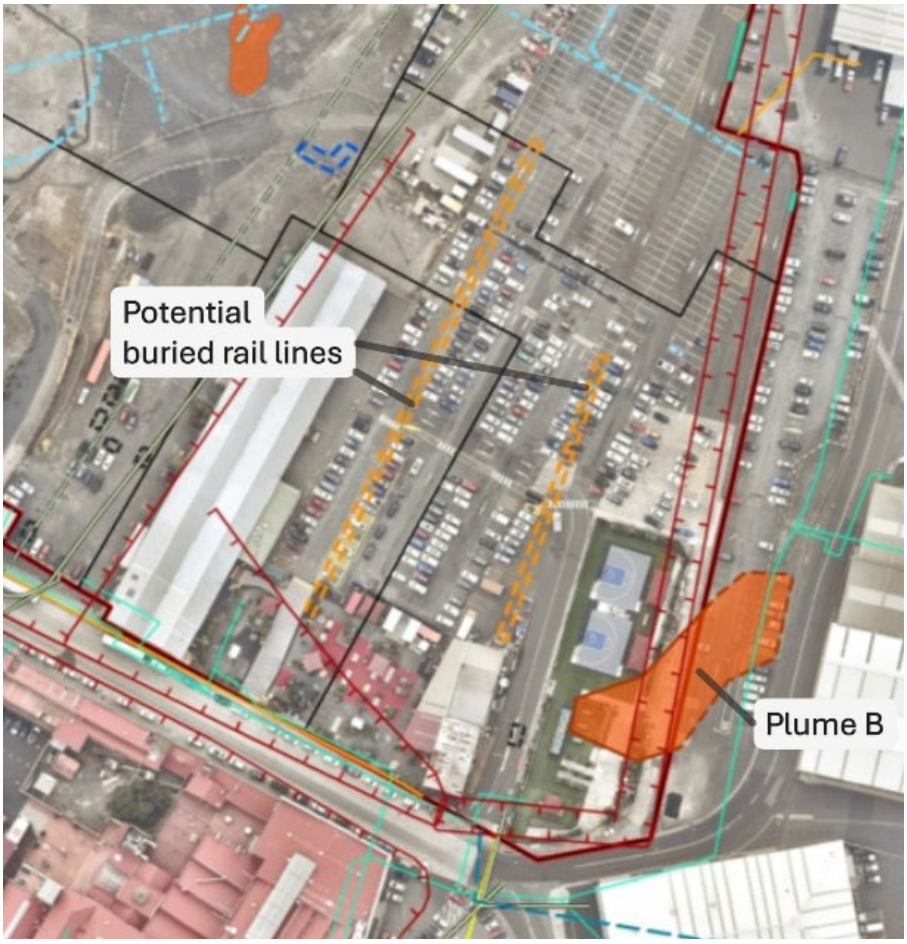


Figure 7 - LNAPL Plume B and potential buried rail lines (Source: AECOM, 2026d)

- **Buried infrastructure and service trenches:** The location of former fuel transfer lines is shown in Figure 6 above, and the locations of potential buried rail lines are shown in Figure 7 above.
- **Other historical chemical storage:** documented bulk and drums storage (paints, oils, caustic soda, solvents) in buildings such as the former SeaRoad Shed.

Construction activities associated with the proposed sewage pumping station (involving excavation below the water table for the storage/internment basin, removal and replacement of the Main Hobart Pipeline, and associated dewatering and material handling) represents a plausible future source and/or potential for transient mobilisation of contamination at the Precinct South.

5.1.2 Potential sources – off-Site

The Site is situated within an industrial area with several potential off-Site sources of contamination:

- **North:**
  - AA7 (the Precinct North (Lot B)).
  - AA5 and AA2 (The Promenade and Underground Carpark), including residual LNAPL Plumes A1 and A2, and former LNAPL Plume A3, broadly up-gradient of the Precinct South, although some groundwater contour plans indicate groundwater flows from these plumes may be slightly to the west of the Precinct South.
  - AA4 – former Concrete Batching Plant, former Main Workshop.

- **East:**
  - TasPorts operations currently located to east of the Precinct South occupies the former bulk fuel terminal footprint.
  - Bulk fuel terminal ASTs and the great majority of operational areas of the former terminal were present immediately east of the Precinct South (1920s–1970s), as shown above in Figure 4.
- **South:**
  - The Hobart Rivulet was formerly located south of the Site beneath the existing Evans Street, and is understood to have routinely contained wastes including gasworks waste, slaughter yard waste, and tannery and soap-making waste (AECOM, 2026d). The timber and stone walled channel was eventually backfilled and Evan Street formed. Based on this history it is likely that the filled former rivulet course is a source of gasworks and other contaminants, separate to any contamination which may have continued to migrate from the overall site.
  - Commercial/industrial buildings located further south which are likely associated with the former IXL building.
- **West:**
  - AA5 (Lot E and Underground Carpark) - the former Roundhouse used for freight and rail transport.
  - AA1 – the Goods Shed and Yard.
  - A part of the former Hobart Gasworks was located within the Gateway area, to the west of the Precinct South beyond the Goods Shed and Yard.

Soil contamination has limited potential to migrate from off-Site areas to affect the Precinct South. Key contamination issues with potential to affect the Precinct South from off-Site are associated with contaminants likely to migrate via groundwater and include:

- LNAPL Plumes A1 and A2, and former LNAPL Plume A3, associated with historical rail activities in the Promenade and Underground Carpark area, north and northwest of the Precinct South.
- The portion of LNAPL Plume B that exists off-Site to the east.

Tar impacts in the Gateway (AA6) are considered unlikely to affect the Precinct South based on groundwater flow directions from that area being inferred to pass to the west of the Precinct South.

5.2 CONTAMINANTS OF POTENTIAL CONCERN (COPC)

Section 3.5 of AECOM (2026d) describes contaminants of potential concern (CoPC) presented by historical activities at the Site and in the areas surrounding the Site and indicates there are no potentially contaminating activities currently being conducted. Soil, groundwater and soil vapour are listed by AECOM as media potentially impacted by the CoPC. Also, similar activities have historically been undertaken both at the Site and adjacent to the Site, so all CoPC are potentially present in both on and off-Site areas.

The land uses, CoPC, and potentially impacted media, both at the Site and the adjacent land, are listed in Table 14 of AECOM (2026d) along with potential contaminant from various past uses, as summarised in Table 5-2 below.

Table 5-2: Land uses and contaminants of potential concern (CoPC)

Activity	Contaminants of potential concern (in soil and groundwater)
The Precinct South	
Land reclamation/filling	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, SVOC, VOC, OCPs, methane[4]
Freight Handling	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, SVOC, VOC, pH
Fuel Storage and locomotive fuelling	Lead, TRH, PAH, BTEX, phenolic compounds, ACM, methane[4]
Mechanics Workshop (former Goods Shed Annexe)	Heavy metals[2], TRH, PAH, BTEX, phenolic compounds
Adjacent Area	
Land Reclamation	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, SVOC, VOC, OCPs, methane[4]
Roundhouse (Locomotive maintenance and refuelling)	TRH, BTEXN, PAHs, phenolic compounds, chlorinated hydrocarbons, SVOC, VOC
Railyards (including fuel storage) and Freight Handling	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, SVOC, VOC
Port Operations	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, SVOC, VOC
Gasworks	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, cyanide, ammonia, ACM
Fuel Storage and former Bulk Fuel Terminal	Lead, TRH, PAH, BTEX, PFAS[3], ACM, methane[4]
Former Hobart Rivulet	Heavy metals[1], TRH, PAH, BTEX, phenolic compounds, cyanide, ammonia, SVOC, VOC, OCPs
Sewer (Main Hobart Pipeline)	Heavy metals[1], TRH, PAH, BTEX, VOC, SVOC, nitrate, ammonia, faecal coliforms [*Escherichia coli* (*E. coli*)]

Notes: SVOC: Semi-Volatile Organic Compounds; VOC: Volatile Organic Compounds; OCP: Organochlorine Pesticides; PFAS – Per and Poly-fluoroalkyl Substances; ACM – Asbestos Containing Material Heavy metals: 1 – aluminium, arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc; 2 - lead and arsenic; 3. A review of historical information has not identified the use of products containing PFAS, however there is potential for firefighting foams containing PFAS to have been applied as part of emergency response operations or for training purposes during bulk fuel storage in the short period between the adoption of PFAS-containing firefighting foam in the USA in 1967, and the cessation of bulk fuel storage in the 1970s. 4. The source of methane in soil vapour and groundwater is considered likely to be due to the anaerobic degradation of hydrocarbon contamination or organic materials in buried estuarine material or fill.

Although not originally identified as a CoPC (in the overall site investigation program), per- and polyfluoroalkyl substances (known as PFAS) were included in the soil and groundwater sampling program and have been considered by the Auditor. As indicated in the notes to the table above, a review of historical information has not identified the use of products containing PFAS, however there is potential for firefighting foams containing PFAS to have been applied as part of emergency response operations or for training purposes during bulk fuel storage in the short period between the adoption of PFAS-containing firefighting foam in the USA in 1967, and the cessation of bulk fuel storage in the 1970s.

5.3 TRANSPORT MECHANISMS

The CoPC identified at the Site may be transported by several primary transport mechanisms, as follows:

- leaching of contaminants in imported fill to the underlying soil, rock and groundwater due to rainwater infiltration;
- mobilisation of contaminants laterally via groundwater flow;
- spills or leaks of hydrocarbons and other chemicals associated with storage and/or handling of fuel and other dangerous goods;
- migration of volatile contaminants in the soil or groundwater upward into indoor and outdoor air spaces (including into trenches and other excavations); and
- leaking and seepage from underground services and infrastructure such as sewers and pipelines in addition to former fuel infrastructure at the Site.

Secondary transport mechanisms of lesser importance include airborne dust and vertical movement through water table fluctuations in the vadose zone.

Although current activities at the Site are not considered to present a risk of future contamination, sources in soil and groundwater remain and can potentially continue to contribute to exposure pathways.

5.4 EXPOSURE MECHANISMS/POTENTIAL RECEPTORS

Exposure mechanisms for human receptors include dermal contact, ingestion and inhalation as follows:

- dermal contact with contaminated soil or groundwater;
- ingestion of contaminated soil or groundwater;
- inhalation of dust or airborne particles derived from contaminated soil;
- inhalation of soil derived vapours in trenches or subsurface maintenance works; or
- inhalation of soil derived vapours in indoor or outdoor spaces.

Ecological exposure mechanisms include uptake by biota within terrestrial ecosystems and uptake by biota in aquatic ecosystems.

Potential receptors and potentially complete exposure pathways, based on the current and proposed land use and the current condition of the Site, include the following:

- residents – direct contact or vapour inhalation;
- recreational and public open space users - direct contact or vapour inhalation;
- commercial workers - direct contact or vapour inhalation;
- construction and future maintenance workers – ingestion, direct contact or vapour inhalation;
- any extractive users of groundwater – ingestion, direct contact or vapour inhalation;
- terrestrial ecosystems (including plants/gardens) – direct contact; and
- aquatic ecosystems (in receiving surface waters) – direct contact.

The risk presented by potentially complete exposure pathways at the Site can be mitigated by the implementation of control measures outlined in the SEMP (AECOM, 2026c), as discussed in Section 9 of this audit report.

6. RELEVANT ELEMENTS OF THE ENVIRONMENT AND ASSESSMENT CRITERIA

The proposed use of the overall site, as described in Section 3.3 of this audit report and shown on Figure F2a, includes the following:

- Mixed-use development – commercial/industrial uses at ground level (visitor accommodation, retail, arts and institutional functions) with podium and above-podium mixed residential use (medium–high density) in parts of the overall site.
- Public open space – significant landscaped public realm integrated with the mixed-use development and stadium concourse.
- Multipurpose stadium and associated concourse functions.
- Pedestrian and light vehicle access links.
- Surface hardstand and managed public car parking.
- Basement (underground) car parking has been considered in the design for the northeast portion of the overall site but is generally regarded as unlikely across much of the Precinct South due to the shallow groundwater table and residual LNAPL (LNAPL Plume B).

It is understood that no basements are currently proposed for the Precinct South.

While not all these proposed uses will be applicable to all areas, for the purposes of this contaminated land audit all Protected Environmental Values (PEVs)[7] for all relevant elements associated with a range of possible site uses have been conservatively considered. Elements forming part of the Site (land, groundwater and air) have been evaluated as described in the following sections. Although no surface water is present at the Site, the presence of the Derwent River and Sullivans Cove has been considered with respect to conditions at the Site impacting upon off-Site uses.

6.1 LAND

Identified PEVs relating to land at the overall site have been referenced using the Victorian regulatory framework for the prevention and management of contaminated land. The *State environment protection policy (Prevention and Management of Contamination of Land)* 2002 (the 'Land SEPP') has been adopted. The Land SEPP applied to audits conducted under the Victorian Environment Protection Act 1970 ('Old Act'). As mentioned in Section 2.2.2, this audit was able to continue under the 'old Act'. In any case, the PEVs ('beneficial uses' in the Land SEPP) are effectively the same under the two regimes.

The Land SEPP identifies and defines specific land use categories as well as a range of protected beneficial uses associated with each of the land use categories. Those beneficial uses are effectively the PEVs to be considered in the Tasmanian setting. Application of the Land SEPP intends to maintain and maximise (to the extent practicable) the quality of the land environment at the overall site in order to protect its existing and potential PEVs.

The Auditor considers that land (soil) is contaminated where current and/or future PEVs for the relevant land use categories are precluded. The PEVs are precluded when relevant soil quality objectives set out in the Land SEPP for those PEVs have been exceeded.

[7] In a Victorian setting, PEVs are known as 'beneficial uses'. The term 'beneficial use' is defined in the *Environment Protection Act 1970* ("the Act") and those beneficial uses to be protected for the various elements are set out within *State Environment Protection Policies* (SEPPs) established pursuant to the Act.

Although the overall site is intended to be redeveloped for a mixture of uses, all PEVs have been conservatively considered in the context of assessing whether the overall site would also be suitable for PEVs relevant to a type of development different than that proposed. Note that exceedance of PEV criteria for non-proposed sensitive uses does not indicate the overall site would not be suitable for a proposed use, and exceedances of criteria applicable to the proposed use may still be subject to management measures to ensure any health or environmental risks are adequately managed.

Table 6-1 below has been adapted from Table 1 of the Land SEPP to consider the PEVs to be protected in accordance with the range of land uses.

Table 6-1: Protected Environmental Values of Land

Protected Environmental Values	Land Use						
	Parks & Reserves	Agricultural	Sensitive use		Recreation / Open Space	Commercial	Industrial
			High density residential	Other (lower density)			
Maintenance of Ecosystems: Natural Ecosystems	✓						
Modified Ecosystems	✓	✓		✓	✓		
Highly Modified Ecosystems		✓	✓	✓	✓	✓	✓
Human Health	✓	✓	✓	✓	✓	✓	✓
Buildings & Structures	✓	✓	✓	✓	✓	✓	✓
Aesthetics	✓		✓	✓	✓	✓	
Production of Food, Flora & Fibre	✓	✓		✓			

Notes: Shading denotes beneficial uses/PEVs to be protected for the overall site.

6.1.1 Adopted Tier 1 criteria – soil

Assessment criteria were adopted based on environmental indicators and objectives listed in Table 2 of the Land SEPP. The Land SEPP refers to the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended 2013 (NEPM (2013)).

Specific Tier 1 criteria for soil adopted by AECOM for the assessment of soil at the Site are presented in Appendix N of AECOM (2026d), reproduced as Appendix F of this audit report.

The tables appended in Appendix F of this audit report include the following:

- Table S1 – Tier 1 Soil Criteria - Low Density Residential (not a planned use)
- Table S2 –Tier 1 Soil Criteria - Medium to High Density Residential (not a planned use)
- Table S3 –Tier 1 Soil Criteria - Recreational and Open Space
- Table S4 - Tier 1 Soil Criteria - Commercial/Industrial
- Table S5 –Tier 1 Soil Criteria - Direct Contact Intrusive Maintenance
- Table S6 –Tier 1 Soil Criteria - Modified Ecosystem

- Table S7 –Tier 1 Soil Criteria - Highly Modified Ecosystem
- Table S8 –Tier 1 Soil Criteria - Buildings and Structures
- Table S9 –Tier 1 Soil Criteria - Vapour Intrusion (Residential)
- Table S10 –Tier 1 Soil Criteria - Vapour Intrusion (Open Space)
- Table S11 –Tier 1 Soil Criteria - Vapour Intrusion (Commercial / Industrial)
- Table S12 –Tier 1 Soil Criteria - Vapour Intrusion (Intrusive Maintenance Worker)

6.1.1.1 Maintenance of Ecosystems

The Land SEPP states that *'contamination must not adversely affect the maintenance of ecosystems'*. Although the Site is located on reclaimed land and is considered highly modified, with minimal potential for any terrestrial ecosystem to be present in an unmanaged scenario, the PEV of Maintenance of Ecosystems has been considered on a conservative basis. Terrestrial ecology is likely to be largely absent at the Site as the proposed use will include coverage by pavement, hardstand and buildings, with landscaped areas constructed over a suitable engineered barrier.

The PEV of Maintenance of Ecosystems is assessed with reference to the Ecological Investigation Levels (EILs) for metals and Ecological Screening Levels (ESLs) for petroleum hydrocarbons provided in Schedule B1 of NEPM (2013).

Although AECOM has listed criteria for both 'modified' (Table S6 – based on Urban Residential and Public Open Space) and 'highly modified' (Table S7 – based on Commercial and Industrial) scenarios, it is considered that the 'highly modified' criteria are more applicable, because the Site setting will not allow open garden areas with access to the existing soil as would typically occur in the Urban Residential and Public Open Space scenario.

Table S7 is based on

- NEPM (2013) EIL, Commercial and Industrial
- NEPM (2013) ESL, Commercial and Industrial

Table 6 of the PFAS NEMP 3.0 (2025) notes a criterion value of up to 0.14 mg/kg for PFOS for assessment of ecological indirect exposure may be appropriate for intensively developed sites with no secondary consumers and minimal potential for indirect ecological exposure. Based on the SEMP requirement for maintenance of hardstand across the Site the setting is considered consistent with this value, which has been adopted in Table S7.

The Tier 1 criteria adopted for soil ecological receptors are considered to be appropriate.

6.1.1.2 Human Health

The Land SEPP states that *'contamination must not cause an adverse effect on human health'.* The protection of the beneficial use Human Health is assessed with reference to the NEPM Health Investigation Levels (HILs), interim soil vapour health investigation levels (interim HILs) and health screening levels (HSLs) provided in Schedule B1 of NEPM (2013). Other guidance used includes CRC CARE and US EPA RSLs, for chemicals without NEPM screening values.

As noted above, Tier 1 criteria have been included in the criteria tables to assess for a broad range of possible uses, including those not intended, consistent with the approach to conducting audits under the S53X system which prevailed when auditing on the overall site commenced. Tables S1 and S2 for low and medium density residential uses are not applicable to the proposed Site development but are considered for completeness.

- ASC NEPM (1999) HILs:
  - HIL A, for low density residential (Table S1)
  - HIL B, for medium/high density residential (Table S2)
  - HIL C, for recreation and open space (Table S3)
  - HIL D, for commercial and industrial (Table S4)
- CRC CARE (2011) Vapour Intrusion HSLs
  - HSL A and B for residential (Table S9)
  - HSL C, for recreation and open space (Table S10)
  - HSL D, for commercial and industrial (Table S11)
- CRC CARE (2011) Vapour Intrusion Shallow Trench Worker (Table S12)
  - PFAS NEMP 3.0 (2025)
  - HIL A, for residential with garden/accessible soil (Table S1)
  - HIL B, for residential with minimal opportunities for soil access (Table S2)
  - HIL C, for recreation and open space (Table S3)
  - HIL D, for commercial and industrial (Table S4)

The Tier 1 criteria adopted for soil impact to human health are considered to be appropriate.

6.1.1.3 Buildings and Structures

The Land SEPP states that '*contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials*'. AECOM have utilised pH as an indication of the risk of corrosion/durability based on AS 2159-2009 *Piling – Design and Installation* (Australian Standard, 2009), which the Auditor considers appropriate.

6.1.1.4 Aesthetics

The Land SEPP PMCL states that *'contamination must not cause the land to be offensive to the senses of human beings'*. Currently there are no concentration-based aesthetic criteria for soil. While aesthetic observations are subjective, it is considered that if there is discolouration, noticeable odour from the soil on the Site or if there are obvious components of waste, such as rubble, slag, bagged waste or similar, then there is a potential for detriment to the PEV of 'aesthetics', which the Auditor considers appropriate.

6.1.1.5 Production of food, flora and fibre

AECOM has noted that production of food, flora and fibre is not likely to occur and has limited consideration of impacts to modified and highly modified ecosystems. This is considered reasonable.

6.1.2 Management limits

In addition to appropriate consideration and application of the HSLs and ESLs, the NEPM (2013) provides '*management limits*' for petroleum hydrocarbons, which reflect the nature and properties of petroleum hydrocarbons as follows:

- Formation of observable light non aqueous phase liquids (LNAPL);
- Fire and explosive hazards; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons.

Where management limits are exceeded, further site specific assessment and management may enable risks to be addressed. It is noted that management limits would be inferred to be exceeded where there is known LNAPL at the water table.

6.1.3 Site Specific Remediation Criteria – soil

AECOM prepared Site Specific Remediation Criteria (Remediation Criteria) for soil and groundwater to inform potential remediation/management works required at the Site for the protection of human health (*Macquarie Point Development Project – Derivation of Remediation Criteria* (AECOM, 2016c)).

The Remediation Criteria were subsequently reviewed in *Review of Site-Specific Remediation Criteria 2025* (AECOM, 2025c) and have been updated to consider changes since the Remediation Criteria were initially derived, including changes in:

- Proposed Site development.
- Relevant Australian or international guidance used to assess potential risks and derive Remediation Criteria.

The review of Remediation Criteria concluded that the AECOM (2016c) Remediation Criteria are overall appropriate for ongoing assessment of potential human health risks which may arise from the land uses proposed in the *Mac Point Precinct Plan* (MPDC, 2024), including stadium construction, in areas where groundwater will be one metre below the final surface or deeper. Updates were included for some adopted Remediation Criteria to align with the updated tolerable concentration in air (TC) adopted for ethylbenzene in the HSLs from the ASC NEPM (noting that these updates resulted in the Remediation Criteria being less stringent) and also to clarify where Remediation Criteria based on the vapour inhalation pathway exceed the maximum possible concentration.

As Tier 2 criteria the Remediation Criteria apply to specific land use scenarios on the basis of generic assumptions. The generic assumptions relate to the presence of an engineered barrier and the implementation of the SEMP. A copy of the SEMP prepared for the overall site and including this Site is presented in Appendix A (attached to the Site Suitability Statement). The engineered barrier prevents access to soil by occupiers/users (receptors) of the Site, with the exception of intrusive maintenance workers (who may be required to penetrate the barrier).

The specific land use scenarios include residential; commercial; recreational; public open space; and intrusive maintenance workers (those undertaking excavation to depths up to 1.0 mbgl). With respect to residential and commercial use scenarios, the Remediation Criteria have been developed on the assumption that buildings will be slab-on-grade or will include basement car parks.

The specific values for each of the Remediation Criteria derived by AECOM for soils are detailed in Table S13 reproduced in Appendix F of this audit report as taken from Appendix N of the CUTEP Report (Table S13 - Soil Criteria - Remediation Criteria).

The remediation criteria were developed assuming management controls that would be protective of receptor health, and so in many instances the Remediation Criteria are much higher than the corresponding Tier 1 criteria or have no limit (where no concentration of the contaminant would pose a risk for certain receptors).

The Remediation Criteria are also considered to be protective of receptors adjacent to the Site.

The Auditor has reviewed and accepted the Remediation Criteria, noting that their application requires application of the Site Environment Management Plan (AECOM, 2026c).

6.2 GROUNDWATER

In the Precinct South, historic total dissolved solids (TDS) concentrations in shallow groundwater (<10.0 mbgl) ranged from 150 mg/L (MW163, 18 November 2019) to 6,420 mg/L (MW06, 23 March 2001). Higher TDS concentrations are present in off-Site wells towards Sullivans Cove, indicating mixing with seawater from Sullivans Cove in that direction, within the reclaimed land.

TDS concentrations reported by laboratory analysis for shallow groundwater in the Precinct South during the most recent GME in June 2025 were reported between 170 mg/L (MW16) and 1,110 mg/L (MW126a), with an average concentration of ~740 mg/L and a mean of 855 mg/L.

Based on the average TDS concentrations, shallow groundwater is placed within Category A of Tasmanian Government (1997) (the '*State Policy on Water Quality Management (1997)*' as reproduced in Table 6-2 below.

Table 6-2: Protected Environmental Values of groundwater

Protected Environmental Values (PEVs)	Groundwater TDS Category (mg/L)			
	A < 1,000	B 1,000 – 3,500	C 3,500 – 13,000	D >13,000
Drinking Water	✓			
Irrigation	✓	✓		
Industry	✓	✓	✓	
Stock	✓	✓	✓	
Ecosystem Protection	✓	✓	✓	✓

Based on salinity, all PEVs are protected for groundwater in the Precinct South, notwithstanding the low plausibility of any actual extractive groundwater use. The PEV for Industry is excluded from consideration for acceptable use criteria because of the highly industry-specific (use-specific) nature of the required water.

Beyond the uses listed in the *State Policy on Water Quality Management*, Recreational Contact (Primary and Secondary) was considered a relevant PEV, and a PEV for Buildings and Structures was considered relevant, given the potential for building foundations etc to intersect the groundwater beneath the Site. Aesthetics was included as a PEV because of the potential for groundwater to discharge to surface waters. The protection of human health was also considered with respect to vapour intrusion from groundwater beneath the Site.

In summary, the PEVs for groundwater are as follows:

- Drinking Water;
- Irrigation;
- Stock (generally referred to as Stock Watering);
- Ecosystem Protection;
- Recreational Contact (Primary and Secondary);
- Buildings and Structures;
- Aesthetics; and
- Human Health (Vapour Intrusion).

6.2.1 Adopted Tier 1 criteria – groundwater

Specific Tier 1 criteria for groundwater adopted by AECOM for the assessment of groundwater at the Site are presented in Appendix N of AECOM (2026d) and reproduced as Appendix F of this audit report.

The Auditor notes that the consideration of groundwater criteria for extractive use is undertaken for completeness whether or not the groundwater conditions require management (by not extracting groundwater for the uses precluded by contaminants). It is recognised that extractive use of groundwater is extremely unlikely and may be managed by including a preclusion of such use in an adopted management plan.

The tables appended in Appendix F of this audit report include the following:

- Table GW1 – Tier 1 Groundwater Criteria - Drinking Water (Health)
- Table GW2 – Tier 1 Groundwater Criteria - Drinking Water (Aesthetics)
- Table GW3 – Tier 1 Groundwater Criteria - Drinking Water (Primary / Secondary Contact)
- Table GW4 - Tier 1 Groundwater Criteria - Vapour Intrusion (Commercial / Industrial)
- Table GW5 – Tier 1 Groundwater Criteria - Vapour Intrusion (Intrusive Maintenance Worker)
- Table GW6 – Tier 1 Groundwater Criteria - Vapour Intrusion (Recreation / Open Space)
- Table GW7 – Tier 1 Groundwater Criteria - Vapour Intrusion (Residential)
- Table GW8 – Tier 1 Groundwater Criteria - Ecosystem Protection
- Table GW9 – Tier 1 Groundwater Criteria – Irrigation
- Table GW10 – Tier 1 Groundwater Criteria - Stockwatering[8]
- Table GW11 – Tier 1 Groundwater Criteria - Buildings and Structures

6.2.1.1 Drinking water/Aesthetics

Drinking Water Guidelines – Health were derived from the following sources:

- NHMRC (2011) Australian Drinking Water Guidelines (amended 2025) Human Health
- WHO (2011) Drinking Water Guidelines
- US EPA RSLs (2024) Tap Water Quality
- Health Canada (2020)
- NZMH Drinking Water (2018)
- PFAS NEMP 3.0 (2025)
- NHMRC (2011) Australian Drinking Water Guidelines (amended 2013) Aesthetic

The adopted drinking water criteria are considered appropriate, noting that such use is unlikely and may be managed to protect the PEV, by not extracting groundwater for use.

[8] Table GW10 presented in Appendix N of the CUTEP Report refers to ‘Stockwatering’, however throughout this audit report we refer to this PEV as ‘Stock Watering’.

6.2.1.2 Recreational Contact (Primary and Secondary)

Primary contact criteria (Table GW3) were derived from the following sources:

- Drinking water guidelines (various sources per Table GW2) multiplied by a value of ten.[9]
- PFAS NEMP 3.0 (2025).

The recreational contact criteria are considered appropriate, although it is noted that extractive use for filling pools/spas is highly unlikely and may be managed to protect the PEV, by not extracting groundwater for use.

6.2.1.3 Human health (Vapour intrusion)

Tier 1 vapour intrusion criteria were adopted based on CRC CARE 2011 HSL D values for sand at a depth of 2-4 m

- Commercial/Industrial workers (Table GW4)
- Maintenance Worker values for intrusive maintenance workers (Table GW5)
- Recreation/Open Space (Table GW6)
- Residential - not a planned use – (Table GW7)

It is noted that the depth scenario is considered appropriate for existing groundwater conditions and Site levels, but that excavations to allow buildings to be less than 2 m above the water table would mean that the Tier 1 criteria are not necessarily appropriate. In that instance, consideration of relevant vapour conditions against remediation criteria, and consideration of management measures to protect against potential vapour risks may be required.

6.2.1.4 Ecosystem Protection

The assessment of potential ecosystem impacts has been conducted on the basis of the inferred discharge zone being to a high-traffic port zone. While the broader Derwent estuary would warrant being considered a slightly to moderately disturbed ecosystem, the immediate discharge areas in the port zone is consistent with the ANZG description (ANZG, 2018) of a waterway that is 'highly disturbed' (which is also consistent with the earlier ANZECC 2000 guidelines). ANZG describes '*shipping ports and sections of harbours serving coastal cities'* as being 'highly disturbed'. This is considered to appropriately represent the scenario in the area of Macquarie Point; refer Figure 8 below.

[9] The Auditor notes that the drinking water guidelines for non-volatiles can be multiplied by a factor of 10 if toxicity data is available and allows this approach to be used. This is based on an assumed contribution by ingestion during swimming of an equivalent to 10% of the assumed volume of drinking water consumption per day (10% of 2 litres).

Figure 8 - TasPorts Macquarie Point showing shipping use[10]

Accordingly, the following have been used for criteria to consider potential ecosystem impacts (Table GW8)

- ANZG (2018) 90% of species guidelines for Ecosystem Protection, with 95% values adopted for bioaccumulative contaminants (marine water)
- AECOM also considered 95% of species guidelines for Ecosystem Protection, with 99% values adopted for bioaccumulative contaminants for comparison and sensitivity analysis related to observations of critically endangered spotted handfish in the vicinity of the Site.
- US EPA (2013) Ambient Water Quality Criteria (chronic – Marine)
- US EPA (2006) Region 3 Mid-Atlantic Biological Technical Assistance Group (BTAG) Screening Benchmarks.
- RIVM (2001) Dutch Intervention Values (DIV) for TPH.
- The PFAS NEMP 3.0 (2025) Interim Marine 95% (slightly to moderately disturbed) level of Ecosystem Protection (interim marine). As noted above, the 99% PFAS value exceedances in on-Site groundwater were also considered in the context of potential risks posed to the receiving water.

Criteria adopted for Ecosystem Protection are considered appropriate.

6.2.1.5 Irrigation

Irrigation criteria (Table GW9) were derived from the following.

- ANZECC (2000) Short-term Trigger Values for Agriculture - Irrigation Water

The irrigation criteria are considered appropriate, although it is noted that use of groundwater for irrigation is highly unlikely and may be managed to protect the PEV, by not extracting groundwater for irrigation use.

6.2.1.6 Stock Watering

Stock Watering criteria (Table GW10) were derived from the following.

- ANZECC (2000) Livestock Drinking Water Quality
- NHMRC ADWG (drinking water) guidelines for organics where no Stock Watering criterion was available.

[10] Source: https://tasports.com.au/macquarie-wharf/macquarie-wharf

The Stock Watering criteria adopted are considered appropriate, although it is noted that use of groundwater for stock watering is highly unlikely and may be managed to protect the PEV, by not extracting groundwater for stock watering use.

6.2.1.7 Buildings and structures

Buildings and structures criteria (Table GW11) were derived (to assess for possible impacts to building elements) from the following.

- SAI Global (2009) - Australian Standard AS 2159 (2009) Piling – Design and installation – 2009

This is considered appropriate, noting also that specific assessment for acid sulfate potential has also been undertaken (albeit that acid sulfate conditions are not strictly 'contamination', and more likely related to natural marine sediments).

6.2.2 Site Specific Remediation Criteria – groundwater

As introduced in Section 6.1.3, Remediation Criteria have been developed by AECOM as reported in the following:

- AECOM (2016c) - *Derivation of Remediation Criteria, 9 August 2016*
- AECOM (2025c) - *Review of Site Specific Remediation Criteria, 10 October 2025*

The Remediation Criteria have been developed for both soil and groundwater for the protection of human health. Tier 2 groundwater criteria relate to the implementation of the Site Environment Management Plan , AECOM (2026c). A copy of the SEMP prepared for this Site is presented in Appendix A (attached to the Site Suitability Statement).

The specific values for the Remediation Criteria derived by AECOM for groundwater are detailed in Table GW12, reproduced in Appendix F of this audit report, as taken from Appendix N of the CUTEP Report (Table GW12 - Groundwater Criteria - Remediation Criteria).

No basement structures are understood to be planned for the Precinct South. However, it is noted that a limitation for the Remediation Criteria is that the derivation assumed the removal of NAPL, and so excluded the potential for residual NAPL to remain present such that it could enter a basement (or other non-basement structure, for scenarios where the Site surface was lowered). Although the Remediation Criteria did allow for some level of vapour contamination in groundwater (with separation from basement users by mechanical controls), the Remediation Criteria also assumed no odour issues, and that *"a SEMP during future Site occupation will mitigate potential odour exposure issues."* Based on these assumptions, the Auditor considers that where odorous groundwater or NAPL has the potential to enter any planned basement, management measures in the SEMP must prevent such entry to ensure there are no unacceptable health or aesthetic risks (unassessed vapour concentrations or odorous water entering the structures including basements). As noted, this is not expected to occur on the Precinct South where groundwater is not expected to enter proposed structures. In any scenario in which a basement below the water table was to be proposed, mitigation would be required that would prevent ingress.

The Remediation Criteria were developed assuming management controls that would be protective of receptor health, and so in many instances the Remediation Criteria are much higher than the corresponding Tier 1 Criteria or have no limit (where no concentration of the contaminant would pose a risk for certain receptors).

The Remediation Criteria are also considered to be protective of receptors adjacent to the Site.

The Auditor has reviewed and accepted the Remediation Criteria, noting that their application requires implementation of the Site Environment Management Plan (AECOM, 2026c).

6.3 AIR – VAPOUR CRITERIA

Specific Tier 1 criteria for soil vapour and indoor air adopted by AECOM for the assessment of the Site are presented in Appendix N of AECOM (2026d) and reproduced as Appendix F of this audit report as follows.

- Table SV1 - Tier 1 Soil Vapour Criteria – Residential
- Table SV2 - Tier 1 Soil Vapour Criteria - Recreational / Open
- Table SV3 - Tier 1 Soil Vapour Criteria - Commercial / Industrial
- Table SV4 - Tier 1 Soil Vapour Criteria - Intrusive Maintenance Workers
- Table A1 - Tier 1 Indoor Air Criteria – Residential
- Table A2 - Tier 1 Indoor Air Criteria - Commercial / Industrial
- Table A3 - Tier 1 Target Air Criteria - Recreation / Open Space

These criteria represent direct (measured) vapour concentrations (rather than soil or groundwater concentrations that may give rise to a vapour risk), and relate to direct vapour data criteria adopted for the protection of human health via vapour inhalation taken from the following:

- CRC CARE (2011) - Cooperative Research Council for Assessment and Remediation of the Environment (2011) Technical Report No. 10, *Health Screening Levels for petroleum hydrocarbons in soil and groundwater*.
    - HSL A/B for Residential use (sand 0-1 m), and CRC CARE methane action level for subsurface near a foundation (Table SV1)
    - HSL C for Recreation and Open Space (sand 0-1 m), and CRC CARE methane action level for subsurface near a foundation (Table SV2)
    - HSL D for Commercial and Industrial workers (sand 0-1 m), and CRC CARE methane action level for subsurface near a foundation (Table SV3)
    - HSLs for Maintenance workers (sand 1-2 m), and CRC CARE methane action level for subsurface near a foundation (Table SV4)
- Indoor target air concentration criteria were also adopted from CRC CARE (2001) as follows.
    - Residential indoor target air concentrations (Table A1)
    - Commercial/Industrial indoor target air concentrations (Table A2)
    - Recreation/Open Space target air concentrations (Table A3)

AECOM also used NSW EPA (2020) *Assessment and management of hazardous ground gases* as a reference for evaluating ground gas risk and gas protection value requirements, for detected methane concentrations.

The criteria adopted for target air concentrations are considered appropriate.

7. ENVIRONMENTAL ASSESSMENT WORKS

A series of field investigations, including investigations associated with remediation, have been undertaken at the Precinct South to provide data to support the environmental audit. Desktop assessments were also completed. Section 2.2.3 of this audit report lists the key documents reviewed by the Auditor, copies of most of which are presented in Appendix D. Note that it is not the purpose of the environmental audit to recount all details of the very extensive investigations, but rather to summarise the approach taken, the findings made, and the considered acceptability of the final characterisation, as a basis for determining the suitability of the Site and any conditions which may apply in regard to that suitability. However, a review of the overall reports, focusing on the key issues, is presented in the following sections.

Many progressive assessment and remediation validation phases have been undertaken on the Site over the period 2015 to 2026. While DSI reports were prepared for AA3 and AA5 respectively, these reports have been effectively superseded by additional data collected since their completion, and so while those DSI reports provide an important record of previous assessment, the *Precinct South -Clean Up to the Extent Practicable Report* (AECOM, 2026d) presents the consolidated data.

The locations of sampling undertaken as part of Site assessment phases, or as validation sampling from remediation phases are all shown in the figures, and the tabulated results are appended to this audit report.

7.1 GROUNDWATER WELL INSTALLATION AND MONITORING 2019 (AECOM, 2020A)

Previous environmental investigations at the Site identified that historical activities including land reclamation, locomotive maintenance and refuelling, bulk fuel and oil storage and transfer, and operation of the former Hobart Gasworks resulted in groundwater impacts.

The report *Groundwater Well Installation and Monitoring 2019* (AECOM, 2020a) was prepared to provide a factual overview of the groundwater well installation program and GMEs at the overall site in 2019 (including at AA2 to AA7).

Thirteen groundwater wells were installed across the overall site in June and July 2019. The following was observed during groundwater well installation for the wells (MW162, MW163 and MW164) installed within the Precinct South:

- Hydrocarbon odours were noted in soils at MW163 and MW164.
- Detectable volatile organic compound (VOC) concentrations were observed during field screening ranging from 0 ppm up to 184.2 ppm (at MW164, 1.5 mbgl).
- Select soil samples were analysed for a combination of inorganics (including ammonia and total cyanide), metals (including lead, manganese, vanadium, arsenic, cadmium, chromium, copper, nickel, zinc and mercury), total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene (BTEX), polycyclic aromatic hydrocarbons (PAH), and phenols.

Wells located across the Site and in the land to the south (in the University of Tasmania car park and on Evans Street) were sampled in GMEs conducted in August 2019 and in November 2019. The following is noted regarding the GMEs completed:

- Depth to groundwater across the Precinct South ranged from 0.60 mbgl (MW126A) to 3.193 mbgl (MW162) during the 2019 GMEs.
- LNAPL was observed at MW03, MW05, and PW02 in both August and November 2019.
- Hydrocarbon odours were noted at MW06, MW125A, MW126A, MW154, MW162, MW163, MW150 – MW152, RN4, and S4).
- Measurable Dense Non-Aqueous Phase Liquid (DNAPL) was not encountered at any of the locations assessed.

- An LNAPL sample was also taken from PW02 during the August 2019 GME for 'fingerprinting' analysis which indicated the LNAPL consisted of predominately diesel.
- At the time of both the August 2019 and November 2019 GMEs, groundwater flow was inferred to be east towards the Derwent River in the northern portion of the Site, and to the south towards Sullivans Cove in the southern portion of the Site. Localised mounding was observed in the southeastern extents of the Site in 2019.

7.2 ASSESSMENT OF POTENTIAL OFF-SITE ECOLOGICAL IMPACTS (AECOM, 2020B)

While the impact to on-Site receptors is assessed through the various reports described elsewhere in this audit report, the potential for impact to off-Site ecological receptors is critical for determining the reasonable basis for considering CUTEP to have been achieved.

The potential for off-site ecological risks to occur from areas of the overall site, including the Precinct South, is in respect of discharge of contaminated groundwater to the nearby receiving waters – the Derwent River to the east and Sullivans Cove to the south.

In order to address this potential risk, AECOM undertook an investigation and prepared this assessment of off-Site ecological risks in 2020, which was based on the following scope:

- Installation of groundwater wells addressing data gaps.
- Completion of two GMEs.
- Review of groundwater data from 2015 through to 2018.
- Evaluation and description of adjacent aquatic habitats.

Groundwater analytical results from monitoring associated with this investigation identified groundwater concentrations within the Precinct South exceeding marine ecosystem criteria (90% of species protection values) at several wells within the Precinct South for manganese, ammonia, phenanthrene, zinc, TRH C10-C36, and TRH >C10-C40.

While the *Assessment of Potential Off-Site Ecological Impacts* report does not recount the specific groundwater conditions which exist across the Precinct South, these are summarised in Table 23 of the CUTEP Report.

The *Assessment of Potential Off-Site Ecological Impacts* report concluded that while groundwater wells across the overall site contained contaminants associated with petroleum hydrocarbons, including BTEX and PAH species, these did not persist towards the inferred points of discharge. For other CoPC there were exceedances of Tier 1 screening criteria for Ecosystem Protection towards inferred discharge areas for manganese, copper and vanadium towards the north east of the Site (in wells MW159, MW160 and MW161) near the Derwent River, and for manganese, copper and ammonia towards Sullivans Cove (MW151, MW152 and MW153).

CoPC concentrations which persisted towards the receiving waters were considered either to be natural background (manganese and copper) or likely subject to further attenuation prior to discharge and at the points of discharge into the Derwent River and Sullivans Cove. Elevated salinity within the zone of reclaimed land indicates significant mixing/dilution of groundwater prior to emergence into the receiving waters, which is to be expected given the reclaimed nature of the land, and the flushing effects of tidal movement, which is inferred to result in a 'mixing zone' within groundwater under the Site. Investigations of the zones of discharge through concrete walls under the wharf areas (to both the Derwent River and Sullivans Cove) indicated that discharge is through cracks and protrusions in the sea walls. Significant further mixing will occur immediately beyond this point of emergence, within the water column. Observations of the adjacent aquatic habitats were that they are generally artificial, of low ecological value and considered to be 'highly disturbed' environments.

Using multiple lines of evidence and updated Site data/CSM, the *Assessment of Potential Off-Site Ecological Impacts* report concludes that groundwater emanating from the Site boundary is unlikely to pose an unacceptable ecological risk to the marine receptors.

The Auditor agreed with the findings of this assessment at the time it was produced. An Addendum to this report was produced in 2025 (AECOM 2025e) and is discussed below.

7.3 ASSESSMENT OF POTENTIAL OFF-SITE ECOLOGICAL IMPACTS – 2025 ADDENDUM (AECOM, 2025E)

After the AECOM (2020b) assessment described in the section above, further investigations and remediation were undertaken at the Site, and changes occurred in the Site conditions and proposed development plans. This *Assessment of Potential Off-Site Ecological Impacts - 2025 Addendum* assessed whether the assumptions and outcomes of AECOM (2020b) remained applicable, based on the current conditions and additional information. The review incorporated updated Site setting, changes to the proposed development plans, updated Site data, recent remediation activities, and ecological considerations relevant to the receiving environment.

AECOM considered there were no substantial changes since the AECOM (2020b) assessment that would influence the off-Site ecological risk profile. This conclusion was based on the following:

- Proposed changes in Site layout, setting and development plans since the AECOM (2020b) assessment, including modification of Site title and boundaries, resurfacing works, planned re-levelling of the Site and proposed stadium development, and infrastructure upgrades at and surrounding the Site, were considered unlikely to adversely impact off-Site aquatic ecological receptors.
    - Development works were noted to potentially influence groundwater levels and flow patterns. Ongoing groundwater monitoring was therefore recommended for the Site in accordance with the SEMP, to assess if any adverse changes are caused by development, which could require action.
- Separate investigations confirmed PASS presence in estuarine soils across parts of the Site, although no AASS were identified. Disturbance of PASS without appropriate management could lead to acidification and increased mobilisation of metals, increasing the potential risk to off-Site aquatic ecological receptors. However, implementation of an ASSMP in accordance with the SEMP is expected to mitigate this risk, as further described in Section 7.14 of this audit report.
- Groundwater levels and inferred flow directions and discharge points were considered by AECOM to be consistent with those in AECOM (2020b). Groundwater continues to flow generally in a south to southeast direction across the overall site, discharging to the Derwent River and Sullivans Cove.
    - The Auditor notes that groundwater flow directions appear complex along the eastern boundary with TasPorts. Groundwater elevation contours in AECOM (2026d) indicate variable possible flow directions around LNAPL Plume B across the various GMEs, with flow direction arrows inferred by AECOM sometimes suggesting flow from TasPorts onto the Precinct South, while at other times flow is inferred to be off-Site towards TasPorts. This appears to result from a degree of groundwater mounding around PC13 (on TasPorts), which has only been gauged irregularly (2019 and 2025). Gauging of PC08 and PC14 in 2019 indicates that off-site groundwater discharge is likely to be towards MW151-MW153.
- Targeted remediation and validation work across parts of the overall site since 2020, including removal of contaminated soil and infrastructure, and In Situ Stabilisation (ISS) of DNAPL impacts is expected to reduce overall contaminant mobility and reduce potential contaminant migration toward the Derwent River and Sullivans Cove. As a result, groundwater contaminant concentrations are expected to decline over time, and reduce potential risks to off-Site aquatic ecology.

  - The Auditor notes that this is a broad statement but would not affect all areas of the Site, for example the part of LNAPL Plume B on the Precinct South, and localised PFOS contamination in groundwater at MW16.
- Residual NAPL (including at LNAPL Plume B in the Precinct South) remains in parts of the overall site subsurface after what AECOM has considered remediation to the extent practicable. AECOM noted:
  - LNAPL plumes are considered stable, with no evidence of recoverable free-phase LNAPL or unacceptable vapour risks, and no indication of ongoing migration or unacceptable risk to off-Site ecological receptors.
  - DNAPL in the Gateway has been treated via ISS where practicable. While this should reduce ecosystem risk, it is not likely to affect risks at the Precinct South.
- The receiving environment remains classified as a 'highly disturbed' marine ecosystem. The adopted 90% species protection level (or 95% for bioaccumulative chemicals) remains appropriate and protective for the current and ongoing ecological context of the receiving environment.

Following consideration that no substantial changes to the CSM have occurred, a Tier 1 screening and further assessment were undertaken to evaluate the ecological risk profile taking into consideration the updated understanding of the groundwater conditions. The following conclusions are noted:

- Contaminants based on Tier 1 screening were consistent with the 2020 assessment, albeit with cadmium noted to have increased to above criteria, and PFOS added to the assessment.
- Although most contaminants had concentrations similar to those considered in the earlier study, concentrations increased by more than 20% for cadmium, copper, lead, zinc, and 2,4-dimethylphenol. AECOM did not consider these increases to change ecological risks to off-Site aquatic receptors, based on:
  - Cadmium, copper, lead, and zinc concentrations in MW180 in at Regatta Point (to the north of the Precinct South) were considered to be caused by localised fill.
    - This is not directly relevant to the Precinct South, but the argument is considered reasonable to include in considering the Precinct South, as wells screened in fill can cause elevated metals in groundwater locally that may not be more broadly present.
  - 2,4-dimethylphenol at MW132_GHD (December 2022) and MW120A were not considered to pose risks, but are in any case not directly relevant to the Precinct South.
    - The Auditor notes that MW120A is very distant from the receiving water, and MW132_GHD is likely to be affected by wastes in the off-Site filled former channel that runs under Evans Street.
- Concentrations of PFOS have been detected in 10 wells across the overall site: BG1, MW06, MW16, MW60, MW120, MW120A, MW121, MW126A, MW193, MW194. Of these, MW06, MW16, MW60, MW126A and MW193 are located within the Precinct South. Monitoring well MW16, in the Precinct South on the eastern boundary south of LNAPL Plume B reported PFOS concentrations ranging from 0.09 µg/L to 0.38 µg/L over the period 2016 to 2025.
- The highest concentration 0.38 µg/L at this well was from a sample taken in 2017, with the concentration similar in 2025 at 0.3 µg/L. This is the only concentration found on the overall site that exceeded the 95% of species protection value for any PFAS species (0.13 µg/L). 11Although this value is considered appropriate, based on the highly disturbed port environment to which groundwater discharges, AECOM

[11] A highly disturbed ecosystem criterion for PFOS per the PFAS NEMP 3.0 (2025) is 2 µg/L. Although the PFAS NEMP 3.0 (2025) at Table 8 specifies in the footnotes only that slightly-to-moderately disturbed systems (95% of species protection for slightly-to-moderately disturbed systems) should be assessed against the next level of species protection criteria to account for bioaccumulation, and is silent on similar 'bumping up' for the other levels of disturbance, AECOM has applied the 95% criterion (0.13 µg/L) to assess bioaccumulation in a highly disturbed port system, and this is considered appropriately conservative.

also considered the highly conservative 99% of species protection level based on the reported sightings within the estuary of critically endangered spotted handfish. AECOM's consideration of the potential risk to off-site ecological receptors for PFOS in MW16 is as follows:

- Other concentrations of PFOS found on the Site (including wells proximal to MW16) were at least an order of magnitude lower than at MW16, suggesting the concentration found is in broad terms isolated. AECOM noted that PFOS was reasonably delineated on-Site, although the Auditor notes that this means delineation in on-Site areas, rather than that delineation sampling indicates no off-Site PFAS. As AECOM has noted in the CUTEP Report with limited access off-Site to sample existing wells or install new wells, there is limited potential for finer-grained delineation in the immediate off-Site area.
- AECOM noted that the bulk fuel terminal tanks were located off-Site from the MPDC boundary, indicating that if PFAS was associated with the former terminal, it is likely that sources would have been present off-Site. This means that if PFOS was found off-Site, it would have been reasonably likely to have originated from an off-Site PFOS source. AECOM noted that groundwater contours indicate potential for PFAS off-Site to the east to have migrated onto the overall site in at least some areas, although the Auditor considers that groundwater flow at MW16 is from on-Site to off-Site.
- AECOM noted that AFFF containing PFAS (including PFOS) was only in use for a short time before the terminal was decommissioned in the 1970s, indicating a limited period in which PFAS sources could have been present.
  - The Auditor notes that while this does not mean that PFAS could not have been lost to the environment, the potential for significant extent is reduced.
- AECOM noted that the single on-Site detection above the 95% species protection value was by approximately a factor of 3, requiring minimal dilution to reduce to compliance with that criterion at a point of discharge, estimated to be 180 m away at that point.
  - Although the possible presence of off-Site sources of PFAS cannot be discounted, and off-Site sourced impacts could reduce dilution potential, it is considered likely that attenuation would occur. The Auditor notes that Table T2 shows that MW16 has routinely reported a TDS of approximately 500 mg/L (231 mg/L at last sampling in June 2025). This suggests that by the time of mixing into the water column of the estuary, by simple dilution alone there would be a dilution of in the order of 60:1, compared with conditions at MW16. This would easily account for the modest exceedance of the 0.13 µg/L criterion adopted.
- While not accepted at this time, ANZG published a public consultation draft raising the 95% of species protection value for PFOS from 0.13 µg/L to 0.48 µg/L, in which case, the highest on-Site PFOS concentration would be below the criterion before any dilution. Although AECOM did note several lines of evidence to indicate that the raised level should be considered scientifically valid, based on applicability of software models as presented by AECOM at the Australasian Land and Groundwater Association Ecoforum conference in 2025, the values in the PFAS NEMP 3.0 (2025) have not yet changed.
  - The Auditor notes that in March 2026, ANZG default Guideline Values for PFOS in freshwater ecosystems were updated. These updated ANZG values are not explicitly for marine ecosystems, although the marine guideline values in the existing PFAS NEMP 3.0 (2025) are noted to be interim values based on the ANZG freshwater guideline values that were listed at that time. The recent ANZG freshwater value for 95% of species protection value was increased from 0.13 µg/L to 0.9 µg/L, and the 99% of species protection value increased 0.00023 µg/L to 0.02 from µg/L. Whether or not the PFAS NEMP 3.0 (2025) will be updated to incorporate the recent ANZG values, and whether the PFAS NEMP 3.0 (2025) marine ecosystem criteria will adopt the updated freshwater ecosystem criteria (as PFAS NEMP 3.0 (2025) does on an interim basis) is not known, but the freshwater value update is considered to support AECOM's position that the existing 0.13 µg/L value for 95% of species protection may be overly conservative. If the recent ANZG freshwater guideline value for PFOS was adopted for marine ecosystems, the detections at MW16 would not exceed the 95% of species value, and the exceedance of the amended 99% of

species value would be by one order of magnitude, which would be easily accounted for by mixing and dilution before discharge to the surface water.

- AECOM also considered the 99% of species protection value. This included non-PFAS contaminants found in several wells not proximal to the Precinct South, although the arguments are considered relevant and indicate that those contaminants do not pose a risk. The PFOS 99% of species protection value of 0.00023 µg/L was exceeded in MW16, and marginally exceeded in MW126A, MW193, MW06, and MW60. AECOM considered these exceedances not to represent an unacceptable risk to the receiving environment based on:
  - The limited spatial extent of exceedances of the 95% of species protection value,
  - Indistinct source, with low but detectable PFAS concentrations in the most up-gradient well in The Escarpment (to the north of the Precinct South and considered to represent 'background' conditions), and
  - Overconservatism of the 99% of species protection value.
    - The Auditor considers that the strongest of the arguments is that the spatial extent of exceedances of the existing 95% of species value is small. Even though the additional wells did exceed the 99% of species protection value, there would be expected to be significant dilution, including mixing with tidally-pumped water under the wharf area. As well, the point of discharge is likely to be a covered over wharf area with low ecological value. There would be likely to be several orders of magnitude of mixing between the broader estuary and the point of discharge in the covered wharves of the port area. While AECOM did not calculate a PFOS flux towards the down-gradient groundwater, based on the flat groundwater gradients and small concentrations present, the total mass of PFAS present under the Precinct South, and the mass flux towards the receiving environment is likely to be extremely low.
    - AECOM suggested that concentrations in on-Site wells were the same as concentrations entering the Site. Although this was not discussed in detail, AECOM is referring to the 0.014 µg/L of PFOS at BG1 in the northern part of The Escarpment in 2025. AECOM appears to be suggesting that all groundwater concentrations on the Site other than those at MW16 may be associated with up-gradient groundwater flowing onto the Site. The Auditor considers this unlikely, but does note that the concentration found at BG1 shows that low concentrations of PFAS can be found anywhere, because of their ubiquitous use and widespread presence at low concentration in the environment.
    - While the likely overconservatism of the 99% species protection value is accepted based on the type of modelling used to develop the conservative value (particularly in light of recent changes in March 2026 to the ANZG freshwater guideline values), this is nevertheless the value remaining in the PFAS NEMP 3.0 (2025).
- Overall, the Auditor accepts that PFOS in the southeast of the Precinct South is unlikely to pose an unacceptable risk to off-Site ecosystems, including to the broader estuary where higher levels of species protection values would apply (differently than for the immediate area of the active port).

Overall, based on the review of updated Site data and information, the outcomes of the AECOM (2020b) assessment remain valid and risk to ecological receptors in the port area, Derwent River, Sullivans Cove, and the broader estuary, remains low.

7.4 SOIL VAPOUR AND INDOOR AIR INVESTIGATIONS 2019 (AECOM, 2021C)

Assessment of the potential risk to human and ecological receptors from petroleum vapour intrusion (PVI) was undertaken to assess risks from NAPL plumes at the overall site.

This assessment, undertaken at locations within former AA2, AA3, AA5 and AA7, was reported in *Soil Vapour and Indoor Air Investigations 2019* (AECOM, 2021c), and included:

- Installation of two sub-slab vapour pins and 18 soil vapour wells (across the overall site area).

- Excavation and sampling of three (3) test pits to assess shallow soil impacts.
- Soil sampling and laboratory analysis during soil vapour well installation.
- Two (2) rounds of sampling and laboratory analysis of new and selected existing sample locations, including:
  - Five (5) sub-slab vapour pins.
  - Sixteen (16) soil vapour wells.
  - Three (3) indoor air locations.
  - One (1) background ambient air location.

The following key conclusions and recommendations were made:

- LNAPL Plume B and overlying SeaRoad Shed (noting that the SeaRoad Shed has since been demolished and only the slab remains):
  - The indoor air, sub-slab and soil vapour sampling results at the assessed locations did not identify unacceptable risk to human health from vapour intrusion from the LNAPL source zone which would preclude the SeaRoad Shed being used for commercial activities as an interim use or potential future commercial or residential use.
  - Potential risks to current and future occupants of the SeaRoad Shed were considered low and acceptable at the time of sampling.
- Potentially hazardous concentrations of methane were detected in soil bores in Audit Areas 2, 3, 5 and 7:
  - The risk from soil methane was assessed as Characteristic Situation 3 (CS3) – Moderate Risk (EPA NSW, 2020), and appropriate mitigation measures were required to be included in future building design.
- Based on assessment of soil results, the following conditions should be applied to future development in order to prevent soil vapour from presenting an unacceptable risk to future users of AA2, AA3, AA5 and AA7:
  - All planned mixed use buildings in the area of assessment must have a ground floor which consists of commercial use only. Further assessment would be required to assess soil vapour risk from shallow impacts if ground floor residential use was to be considered.
  - No vapour risk was present for future development based on the site surface level at that time. Further assessment to determine soil vapour risk from shallow impacts would be required if the site surface was changed for a basement or similar development.

The Auditor reviewed this report and considered the findings reasonable, noting particularly that the findings were relevant for the proposed use only, that methane protection to CS3 would be required, and that basements would require additional consideration.

7.5 AUDIT AREA 3 - DETAILED SITE INVESTIGATION (AECOM, 2022)

The AA3 DSI was prepared to support MPDC obtaining a Site Suitability Statement for AA3, which was at the time a standalone audit area.

At the time, the anticipated future land uses for AA3 were mixed commercial uses. The DSI sought to address the following.

- Update the CSM for AA3.
- Assess whether contamination precluded Protected Environmental Values.
- Assess if remediation and/or management measures were required for intended future uses.
- Generate sufficient data to inform an Environmental Audit and Site Suitability Statement.

The DSI summarised information from previous environmental investigations undertaken at AA3, including:

- GHD soil investigations completed in 2014 and 2015.
- AECOM soil, soil vapour and groundwater investigations completed over the period 2015 – 2020.
- AECOM LNAPL investigation and remediation activities completed over the period 2015 – 2019.

7.5.1 Conceptual Site Model

The CSM was described in very broad terms in a simple diagram in Appendix E of the AA3 DSI report, describing the contamination of soil, groundwater and soil vapour, with potential exposure for users of AA3 (considering a range of possible uses), including through extractive use of groundwater, and for aquatic ecosystems.

Through various sections of the document, the key factors describing the CSM in terms of potential for exposure and transport of contaminants to occur are as follows:

- Sources of on-site contamination in soils, groundwater and soil vapour included:
  - Filling (land reclamation – potential for contamination to be present in historically used fill soils).
  - Freight handling.
  - Fuel storage and handling.
  - Mechanics workshop.
- In terms of exposure the following relevant factors applied:
  - Groundwater salinity ranged from 70 mg/L to 8,290 mg/L at the wells sampled but less than 2,272 mg/L for wells located on AA3. The salinity range indicates likely significant dilution between groundwater conditions in the area of AA3 and the indistinct discharge areas to the Derwent River and Sullivans Cove, where seawater salinity of around 30,000 mg/L would be expected in the surface water. This is supported by the reported tidal fluctuation of groundwater elevations close to Sullivans Cove (0.1 m at MW151, which is just south of Evans Street, and some 120 m to the waterline).
  - Groundwater depth was generally in the range 1.9 mbgl to 2.5 mbgl, indicating:
    - Unlikely direct contact with groundwater for intrusive maintenance workers.
    - An unsaturated vadose zone for on-grade buildings, with potential for vapours to accumulate in that zone where contaminants were present in groundwater or vadose zone soils.
  - Hydraulic conductivity of the groundwater was estimated by AECOM to be typically 0.6 m/day for fill materials and alluvial deposits, approximately 0.3 m/day in the underlying slope deposits, and approximately 5 x 10^{-3} m/day in the deeper bedrock. For the hydraulic gradient of approximately 0.004 m/m (based on contours in the southeast part of the site), the groundwater seepage velocity may range from approximately 0.003 (bedrock) to 3 m/year in the fill material. As noted in Section 3.4.2.2 above, the hydraulic conductivity and therefore inferred flow velocity may vary locally. The steepening groundwater contours beyond the site boundary (as indicated on Figure F5d) are inferred to arise because of the effect of sea walls acting to constrain groundwater flow between on-site and off-site areas in the southeast.

  Although not included in the AA3 DSI report, an earlier *Conceptual Site Model and Tier 1 Ecological Risk Assessment* by AECOM (2015) included the depiction of the retaining walls and sea walls around the former Hobart Rivulet which ran down Evans Street, shown in Figure 9 below. The former Hobart Rivulet has been filled and is potentially a preferential pathway for groundwater flow. AECOM noted the former Hobart Rivulet may have been filled with soft rock, but AECOM also noted the filled former Hobart Rivulet may also be a source of contamination. The buried walls of the former Hobart Rivulet structure and nearby sea walls may also act in places as barriers to groundwater flow, although AECOM (2015) indicated the retaining structures may not extend below the water table.

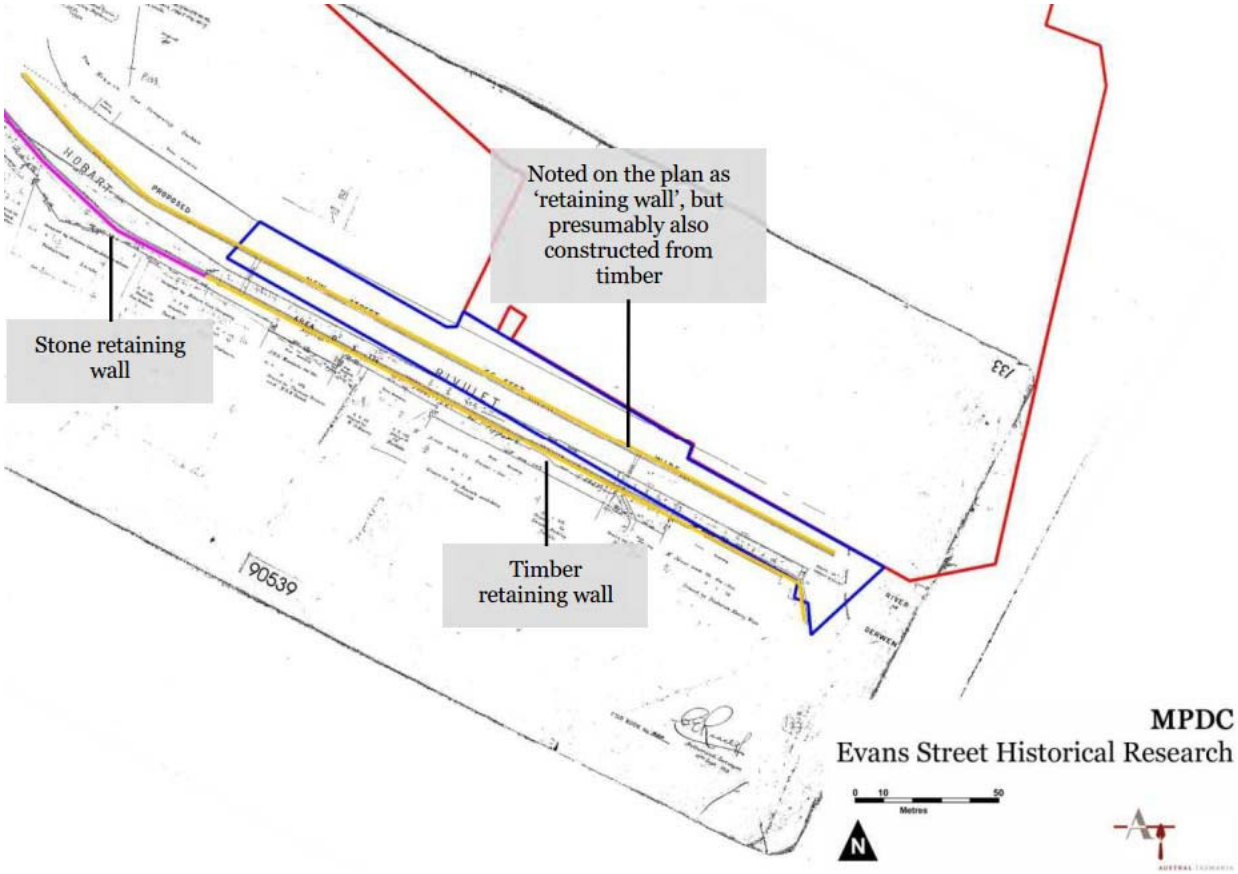


Figure 9 - Former Hobart Rivulet Structures Under Evans Street

Although not a part of the AA3 DSI, the following notes are included regarding the Hobart Main Sewer here, because it forms a part of the CSM. AECOM considered the potential impact of the relocation of the Hobart Main Sewer on the CSM (AECOM, 2026d). The proposed sewer relocation as part of site development is depicted below in Figure 10. The existing sewer, seen crossing the site from south-southwest to north-northeast, just west of the Goods Shed currently runs to a sewage treatment plant. The plant is to be replaced by the new sewer (bold red line) just outside the MPDC site boundary, installed by trenchless construction. The new (replacement) sewer will run to a pump station with an associated emergency storage basin.

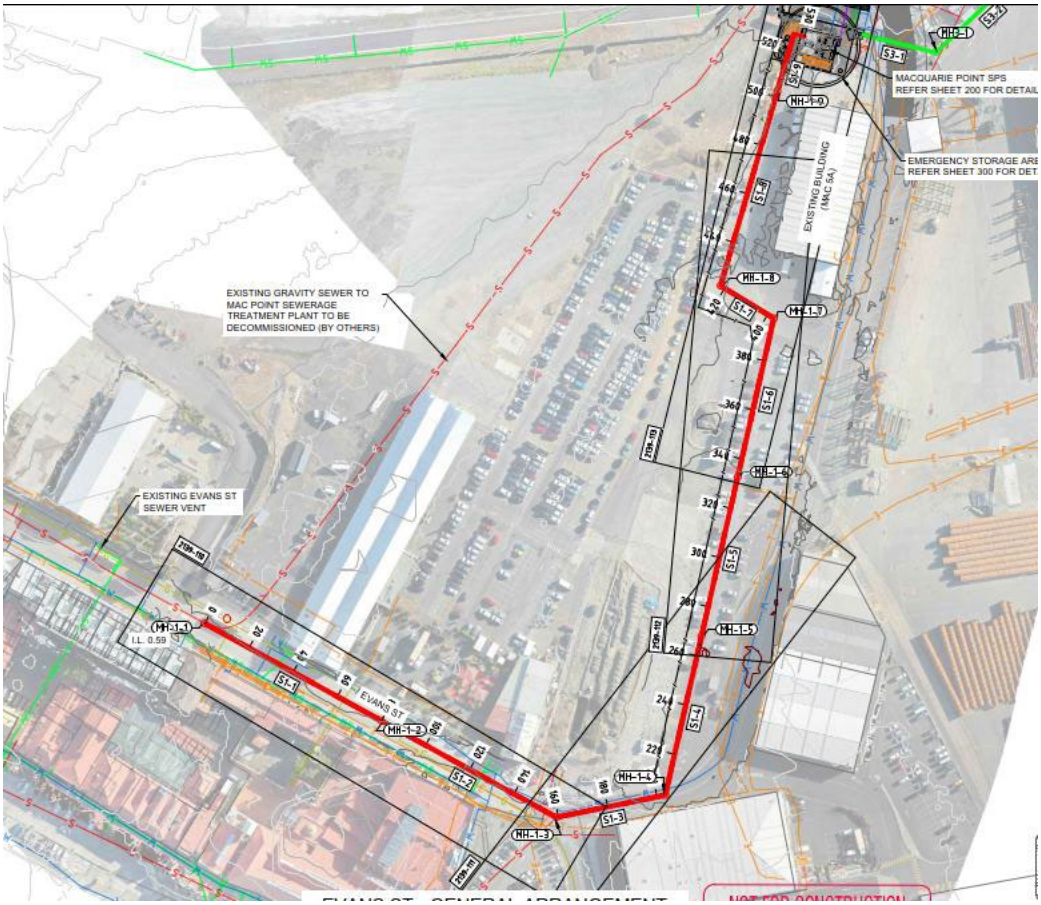


Figure 10 - Proposed Sewer Relocation (source: AECOM, 2026d)

AECOM considered that the removal and relocation of the sewer were unlikely to affect the hydrogeology in terms of groundwater elevation and flow patterns, and contaminant migration, based on their reporting of the following.

- The replacement sewer is to be constructed by trenchless construction, with surrounding bentonite, so that the sewer will not cause a preferential flow path. Although not discussed by AECOM, the potential for the sewer to represent a barrier on groundwater is likely to be similar to effects already caused by sea walls inferred to exist in the area (steeper gradients are indicated around the site boundary).
- Up-gradient groundwater is likely to be drained as part of the lowering of the site surface to accommodate the proposed development, which is likely to have a greater influence on groundwater flow patterns than the removal of the sewer.

AECOM also provided an addendum (AECOM, 2026e) to the CUTEP Report (AECOM, 2026d). The addendum established a requirement for backfill material to be used to fill the void left following removal of the existing sewer to do either of the following.

a. Have a hydraulic conductivity no greater than the estimated hydraulic conductivity for the existing fill soils across that part of the Site. The hydraulic conductivity value nominated was 2 m/day.
b. Have another documented removal methodology which prevents creation of a preferential pathway for groundwater flow, approved by an Environmental Auditor.

The Auditor considers that by requiring backfill material to have similar properties to the surrounding existing soils (or be removed by another Auditor-approved method that prevents the creation of a preferential

pathway), the sewer removal will not introduce a preferential pathway that would materially affect the hydrogeology. A copy of the addendum letter (AECOM, 2026e) is provided in Appendix D.17.

AECOM considered the exposure pathways for users of AA3 to be as depicted in Figure F9 of the AA3 DSI report, reproduced below in Figure 11. This figure assumed management measures to prevent direct contact with soil or groundwater, or dust inhalation for commercial workers or outdoor open space users. AECOM noted that basement car parking was unlikely because of the shallow groundwater (although a basement across the water table was depicted on the CSM figure).

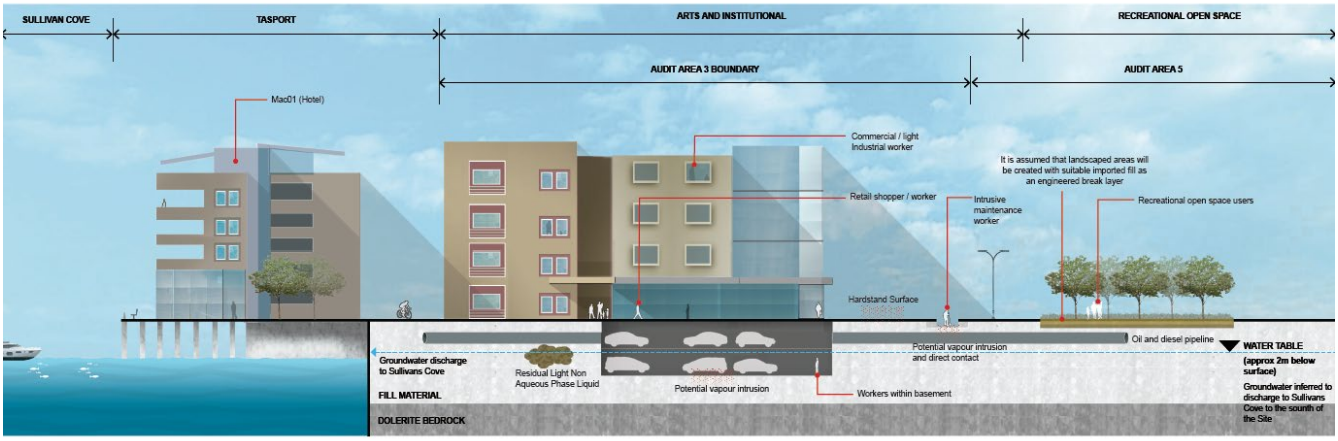


Figure 11 - AA3 CSM Cross Section

AECOM considered that the following were complete exposure pathways, for a development expected to include commercial buildings and open space.

- Commercial Workers:
  - Inhalation of soil and groundwater derived vapour.
- Intrusive Maintenance Workers:
  - Inhalation of soil and groundwater derived vapour.
  - Inhalation of Site derived dust.
  - Dermal contact and incidental ingestion of soils.
- Aquatic Ecosystems (the Derwent River and Sullivans Cove)

The CSM and potential exposure pathways are considered reasonable, noting that the assumption that no basement car parks would extend below the water table is important, because any such basement would be at risk of allowing groundwater containing dissolved methane or hydrocarbon contaminants into an un-tanked basement space.

7.5.2 Soil sampling

Soil sampling was undertaken at 33 locations where samples were analysed (a further four locations had no samples analysed).

The approximate 20 m grid spacing for sample locations was considered appropriate for the area of 0.81 ha. Sample locations are shown in Figure 12 below. Some variation in distances between sample locations exceeded 20 m, but the overall coverage is considered acceptable by the Auditor.

Samples were mainly analysed at depths 1 mbgl to 4 mbgl, with 5 analyses from more than 4 m depth.

Some 100 samples were analysed from AA3, with a further 39 samples analysed in the immediately adjacent area.

A further 13 locations (11 sampled and analysed) were located in the immediately surrounding area, shown by the yellow line in the figure.

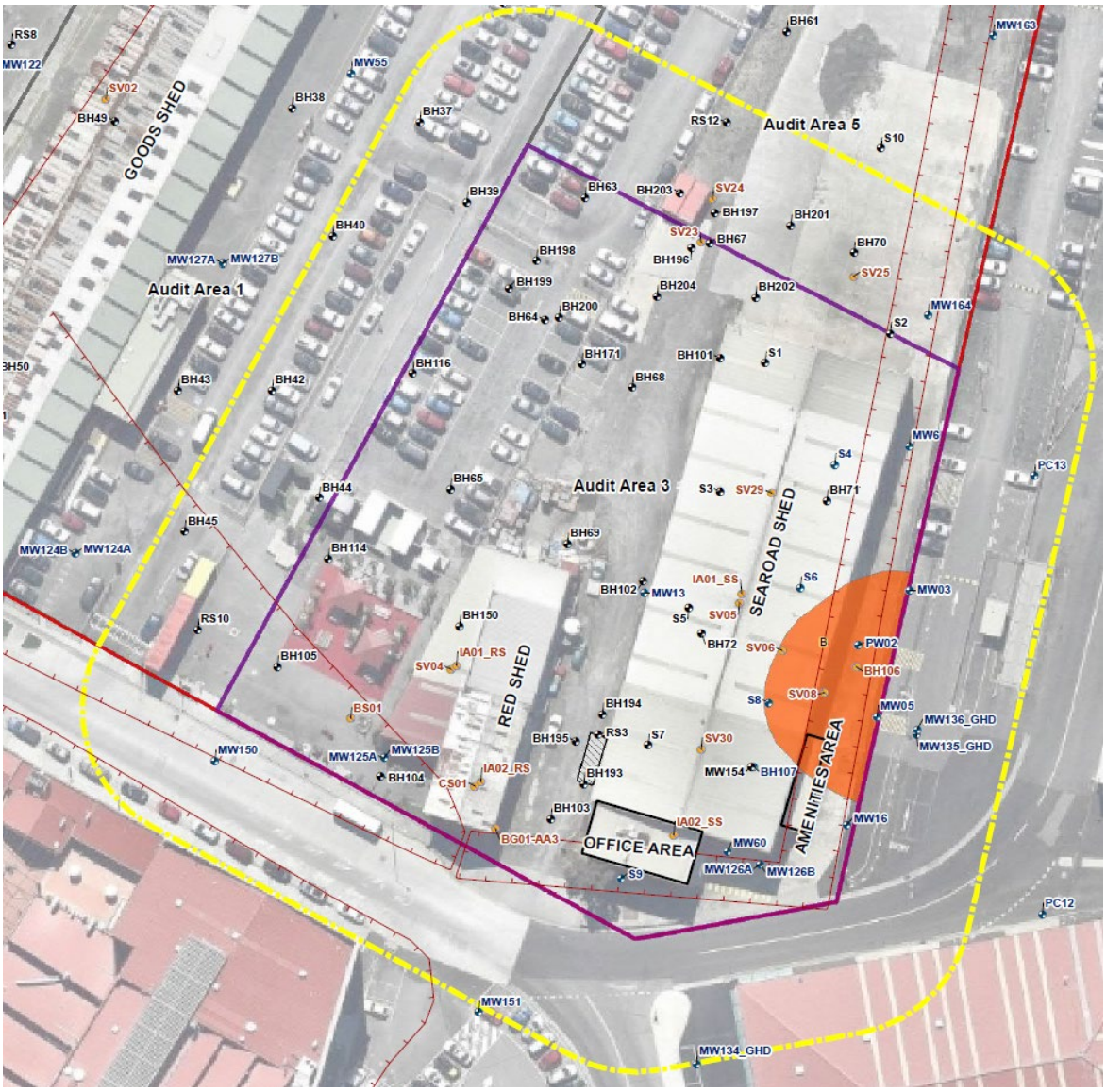


Figure 12 - AA3 DSI Sample Locations

7.5.3 Groundwater sampling

Fourteen groundwater monitoring wells were sampled across AA3 and the surrounding area: MW06, MW13, MW16, MW60, MW125A, MW125B, MW126A, MW126B, MW154, PW02, S4, S6, S8 and S9. These locations are shown in Figure 12. As can be seen, the wells are mainly around the known areas of impact in the southeastern quadrant of AA3 (LNAPL Plume B) and the down-gradient areas, including S9 inferred down-gradient of the USTs (between the Red Shed and the SeaRoad Shed), and four wells within the extent of LNAPL Plume B (as understood at that time).

The well number and spacing is considered to have been reasonable for assessing the area, noting that the USTs area was at that time subject to later excavation and soil validation sampling.

7.5.4 Impacts to Protected Environmental Values

Impacts to PEVs based on the AA3 DSI assessment are considered in the later Precinct South CUTEP Report, including review of conducted remediation that occurred later in time, and so are not detailed here. However a brief summary of management/remediation recommended at the time is presented below.

7.5.4.1 Remediation and Management Requirements

Management/remediation was proposed for AA3:

- Soil assessment and remediation to the Remediation Criteria so far as practicable (which later occurred) to allow for the following commercial development scenarios:
  - Slab on-grade with unknown construction or multi-storey building
  - Low rise slab-on-grade
  - Working within a basement car park
- Additional engineering controls will be required as part of AA3 development to mitigate vapour intrusion risks with methane (e.g. vapour mitigation barrier).
- AA3 should retain barrier layers to soil exposure and include specific considerations for any deep-rooted plants.
- A Site Environmental Management Plan (SEMP) to be implemented.

7.5.4.2 Groundwater Modelling

Groundwater modelling was suggested in the event of major changes to groundwater dynamics, such as Hobart Main Sewer removal or removal of sea walls. AECOM (2026d) considered that groundwater modelling would not be beneficial because of uncertainties associated with heterogeneous materials and sea wall influences, and their consideration that the proposed sewer installation method (trenchless tunnelling) would not introduce preferential flow paths likely to change the groundwater flow regime.

7.6 AUDIT AREA 5 - DETAILED SITE INVESTIGATION (AECOM, 2021A)

Although the AA5 DSI works occurred before the AA3 DSI works, the AA3 DSI has been discussed first in this audit report, because it is considered to represent the greater degree of risk issues, given the existence of the residual LNAPL Plume B, and the proximity of the receiving water of the Derwent River and Sullivans Cove. Groundwater from the AA5 area migrates through AA3 towards the receiving surface water.

As for the AA3 DSI, the results of soil, groundwater and vapour sampling relevant to the Precinct South are summarised in the Precinct South CUTEP Report (AECOM, 2026d).

7.6.1 Source areas

The Precinct South does not extend into the western part of AA5, nor a strip of approximately 20 m width along the north edge of AA5, which borders AA7. AA5, being centrally located within the overall site, shares a boundary with all of the other audit areas (AA1, AA2, AA3, AA4, AA6 and AA7). The part of AA5 that is within the Precinct South boundary excludes key areas of interest for the AA5 DSI – the Roundhouse (and associated fuel and servicing uses) and LNAPL Plume A2.

Key potential sources of contamination in the part of AA5 within the Precinct South at the time of the AA5 DSI are shown in Figure 13 below. Note that the Truck Washbay area is just inside The Precinct South, and the brown line depicting the Hobart Main sewer can be seen running at an angle immediately west of the Truck Washbay, Mechanics Pit and Triple Interceptor Trap, which were all subject to excavation to remediate

impacts. The Oil Pipeline (yellow) and Diesel Pipeline (brown) can be seen in the eastern part of AA3. These pipelines and associated impacted soils were later removed and the excavations validated.

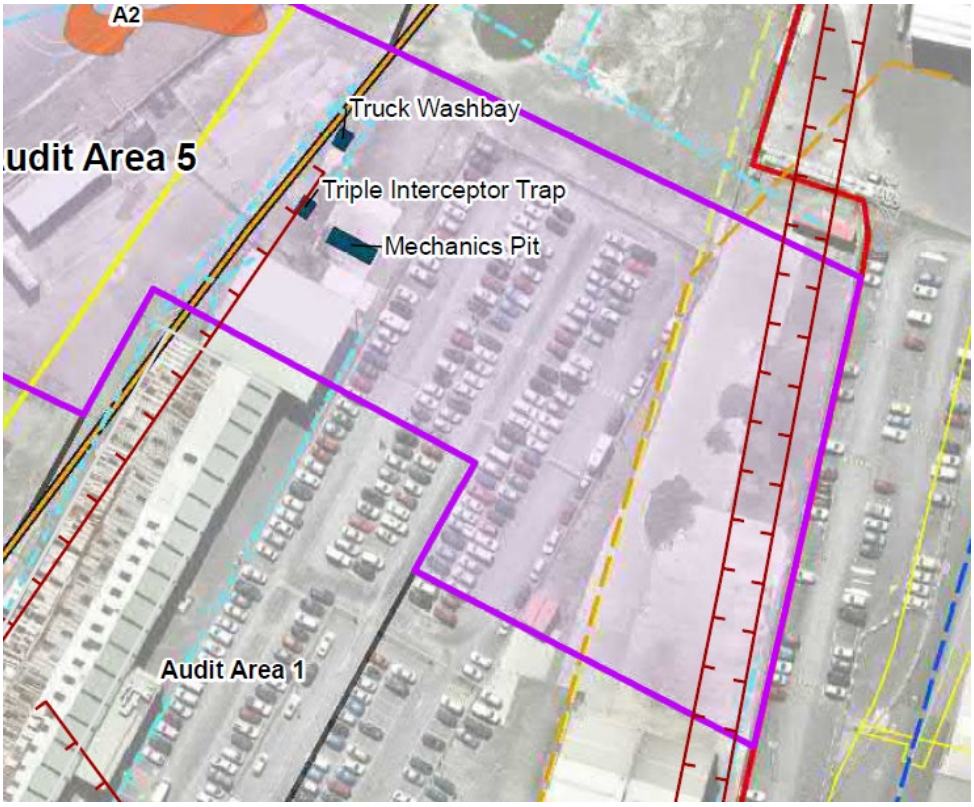


Figure 13 Source Areas in Eastern Part of AA5

7.6.2 Sampling locations

Soil and groundwater sampling locations adopted for the eastern part of AA5 can be seen in Figure 14 below.

Figure 14 - AA5 East Sampling Locations

This shows some 16 soil sampling locations within the Precinct South (indicted by the blue line). The soil sampling locations in the area approximate a 20-30 m grid, which is considered reasonable for sampling density, noting that the Diesel Pipeline and Oil Pipeline and the Truck Washbay, Triple Interceptor Trap and Mechanics Pit were all later subject to validation sampling associated with remediation.

The only groundwater well at the time of the AA5 DSI in this area was RN4 adjacent to the Truck Washbay, although this was later augmented by wells MW162, MW163 and MW164.

7.6.1 Impacts to Protected Environmental Values

Impacts to PEVs based on the AA5 DSI assessment are considered in the Precinct South CUTEP Report, including review of conducted remediation that occurred later in time, and so are not detailed here. However, a brief summary of management/remediation recommended at the time is presented below.

7.6.1.1 Remediation and Management Requirements

The AA5 DSI recommended remediation and management measures relevant all parts of AA5 but more relevant is the remediation and management measures relevant to the part of AA5 now within the Precinct South. The recommendations were as follows:

- Further investigation or soil remediation should be undertaken in the Open Space area in the eastern section of AA5 due to lead impact (this was later carried out and subject to validation sampling, see Section 7.11).
- Management of barrier layers to prevent contact with residual contaminated soils.
- Methane protection for Characteristic Situation 2 (CS2), based on (EPA NSW, 2020).
    - The Auditor notes that AECOM has considered nearby areas to represent CS3. In any case, both CS2 and CS3 require the same gas protection value.

- The Auditor notes that while the AA5 DSI report did not state a requirement for remediation of the Diesel Pipeline and Oil Pipeline, this was nevertheless also later undertaken.

7.7 ASSESSMENT OF LNAPL REMEDIATION END-POINTS (AECOM 2021B)

7.7.1 LNAPL Remediation Options

LNAPL remediation was undertaken at the overall site involving several separate LNAPL plumes in two periods, during 2000 to 2001 and during 2015 to 2017. Historical remediation of LNAPL Plume B was undertaken by Sinclair Knight Merz (SKM) in 2000 to 2001, as described in Section 3 of AECOM (2021b).

A Fluid Recovery System (FRS) was initially installed but recovery was low and the system was decommissioned. An LNAPL skimming system was subsequently installed in 2000, at wells MW03, MW05 and MW16 associated with LNAPL Plume B. The system recovered 500 L of LNAPL over one year. The LNAPL skimming system was then considered no longer effective for smaller LNAPL thicknesses, and a program of skimming and pumping was implemented over one year. Passive skimmers were installed in MW03, MW05 and MW16 in 2001. A total of 14.5 L of LNAPL was removed over one year. AECOM reports that SKM stated that measured LNAPL thickness reduced by approximately 66% during this period.

The historical remediation recovery declines are considered to indicate relatively limited free LNAPL was available for straightforward recovery at LNAPL Plume B.

Further LNAPL remediation options were considered in a *LNAPL Remediation Action Plan* (AECOM, 2017a). Options included:

- Skimming
- Total Fluids Extraction (TFE)
- Excavation
- In-Situ Chemical Oxidation (ISCO)

Total Fluids Extraction (TFE) was chosen as the preferred technology, and the Auditor agreed with this as an appropriate technology. In many instances of NAPL remediation, a technology based on multiple phases of contamination including vapours is preferred, but the nature of the LNAPL (relatively low volatility) did not favour such an approach. Initial trials were conducted in 2015 and 2016, using a Mobile LNAPL Remediation Unit (MLRU).

7.7.2 LNAPL TFE Recovery to Practicable Extent

For the Precinct South, LNAPL Plume B well PW02 produced 3.5 L of LNAPL. Volume of total LNAPL and groundwater recovered in LNAPL Plume B were reported as 6.4 L of LNAPL and 2,560 L of groundwater. Overall, LNAPL recovery was very low as a proportion of the total fluid extracted (0.25%).

Following the initial TFE trial, a TFE system was installed utilising three wells in LNAPL Plume B and commissioned for ongoing operation in March 2017.

The TFE System used top-loading total fluid pumps, with a treatment process used to separate out LNAPL from and treat the water before discharge of the water to sewer. The LNAPL was removed to a licensed waste facility for disposal.

The TFE system operated from August 2016 to May 2017, and again for a period in October 2017 to November 2017, with the latter period used to assess whether further LNAPL removal was practicable.

There was also opportunistic extraction using the MLRU and manual bailing in LNAPL Plume B, during August 2016 and October 2016.

For all LNAPL plumes (across the overall site) the initial 2000 to 2001 efforts removed over 5,000 L of LNAPL (this was reportedly mostly from LNAPL Plume A2), while the TFE system (and associated MLRU and bailing) achieved a smaller degree of recovery.

AECOM (2021b) reported that total recovery for LNAPL Plume B over the period 2000 to 2017 as shown in Table 7-1below.

Table 7-1: LNAPL recovery - LNAPL Plume B

Period	LNAPL recovery (L)	Water extracted (kL)	Method	Wells
2000-2001	515	0	Active skimming	MW03, MW05, MW16
2001	14.5	0	Passive skimming	MW03, MW05, MW16
2015 to 2017	42.5	7	TFE	MW03, MW05, PW02
Total	572	7	Per above	Per above

Over the period 2015 to 2017, some 7,000 kL of water was recovered, treated and disposed. LNAPL recovery was approximately 0.6% of this volume. This was slightly higher than the noted ratio for the initial trial but still a low proportion of LNAPL, and a very low total recovery compared with that achieved in the earlier 2000 to 2001 period when active skimming was undertaken. Overall, in terms of LNAPL to water recovery ratio and the total quantity recovered, the remediation over the period 2015 to 2017 represented a high degree of overall remediation effort to recover a small quantity of LNAPL (less than 50 L).

From May 2017 to October 2017 the system was paused and then reactivated to assess whether there may be a ‘rebound’ in LNAPL, which might allow further practicable LNAPL recovery.

The reactivation in October/November 2017 (up to the second shutdown in November 2017) extracted some 182 kL of water with no LNAPL able to be recovered across all LNAPL plumes.

The gauging results in Table T2 of this report (through to 2025, beyond the period that AECOM (2021b) discussed) show that since 2015, LNAPL presence in some wells at LNAPL Plume B has been intermittent. Consideration of LNAPL presence after the period covered by AECOM (2021b) is discussed to consider the reasonability of the remediation end-point assessment in 2021. For reference, LNAPL presence/extent, as assessed at November 2019, is shown by the orange shading in Figure 15 below (note the values shown in blue type are groundwater elevations in mAHD, and not LNAPL thicknesses).

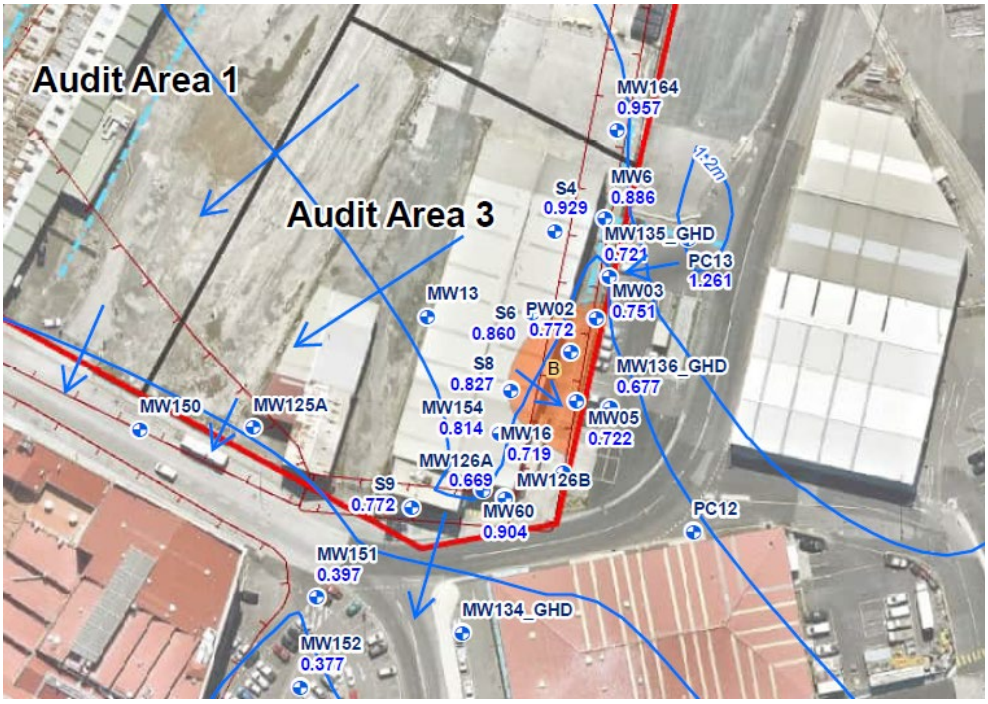


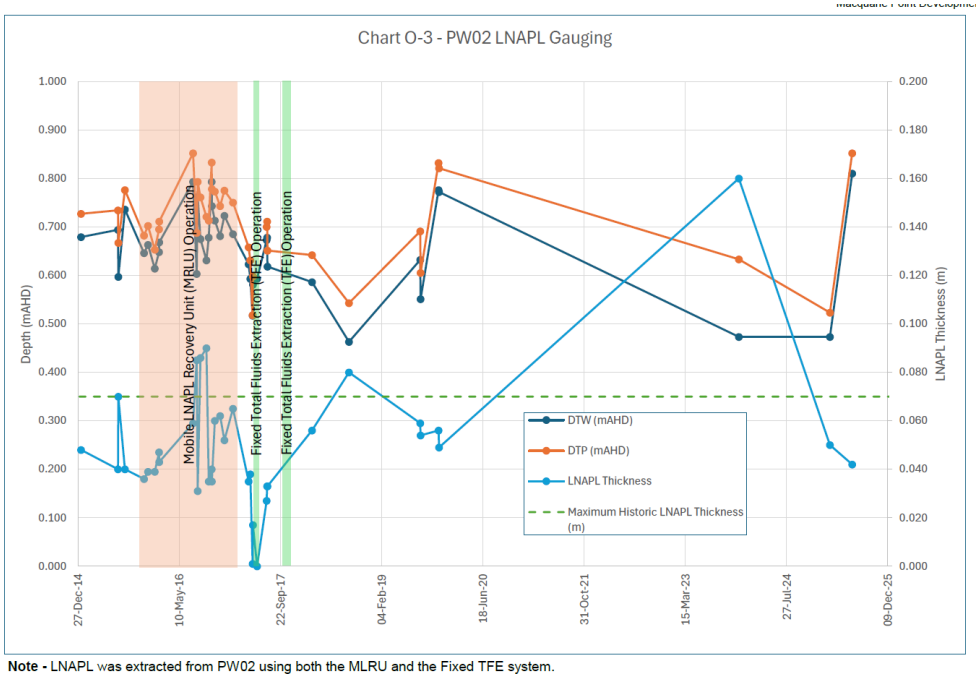
Figure 15 - LNAPL Extent November 2019 (AECOM, 2021b)

7.7.3 LNAPL Hydrographs

Hydrographs for LNAPL in key wells were provided in Appendix O of AECOM (2026d). Although these were not included in AECOM (2021b), they are relevant to the consideration of LNAPL remediation extent, and so are reproduced and discussed below.

Well PW02 (located in the central portion of the plume, refer to Figure 16 below):

- Pre-remediation thickness of 70 mm LNAPL.
- Reduction to 1 mm of LNAPL in May 2017.
- Rebound to pre-remediation thicknesses fluctuating between 40 mm and 80 mm in the period 2017 to 2025, except for an isolated reading of 160 mm in December 2023.
- More recent readings in February 2025 and June 2025 are similar to the longer term typical LNAPL thicknesses.

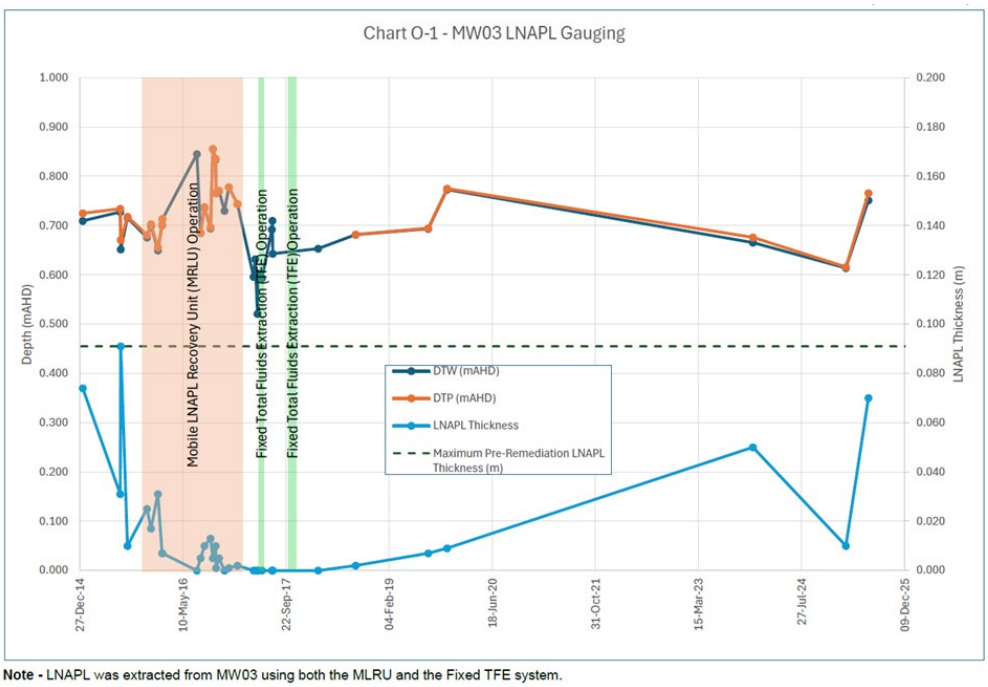


Note - LNAPL was extracted from PW02 using both the MLRU and the Fixed TFE system.

Figure 16 - Hydrograph for PW02 (source: AECOM, 2026d)

Well MW03 (located at the northern edge of the plume, refer to Figure 17 below):

- Pre-remediation greatest LNAPL thickness (in 2015) of 91 mm.
- Reduction by LNAPL remediation efforts to less than 20 mm of LNAPL.
- Slow rebound of LNAPL thickness, remaining below pre-remediation thicknesses.

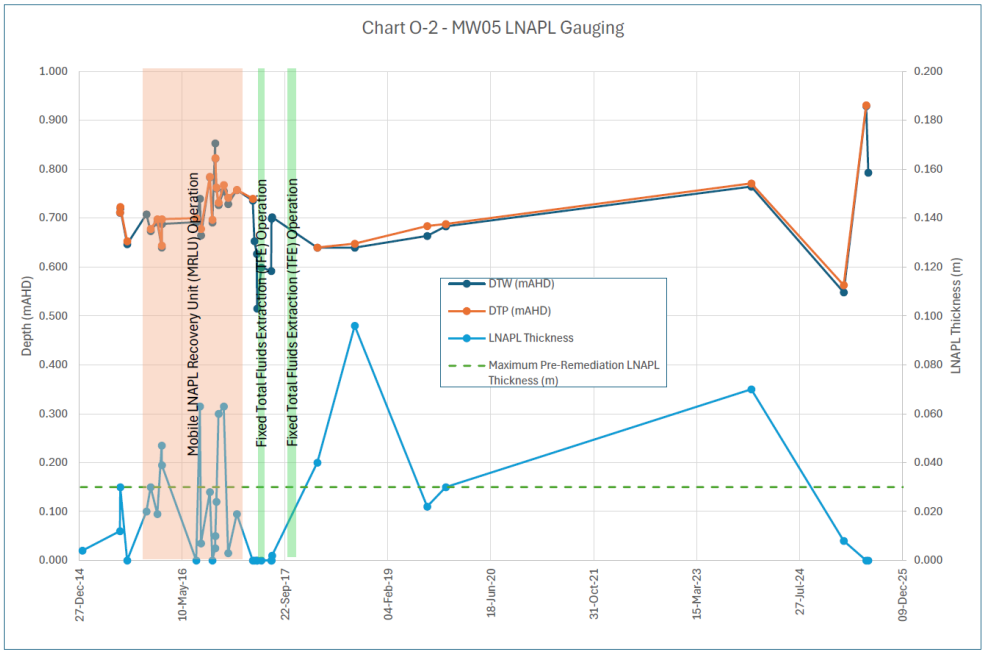


Note - LNAPL was extracted from MW03 using both the MLRU and the Fixed TFE system.

Figure 17 - Hydrograph for MW03 (source: AECOM, 2026d)

Well MW05 (located at the southern edge of the plume, refer to Figure 18 below):

- Pre-remediation LNAPL thickness of 30 mm in July 2015.
- Fluctuating LNAPL thickness from 0 mm to 63 mm during remediation efforts.
- Zero LNAPL from July 2016 to July 2017.
- Fluctuating LNAPL thicknesses post remediation, with a highest reading of 96 mm in August 2018.
- Zero LNAPL in two separate gauging events in June 2025.

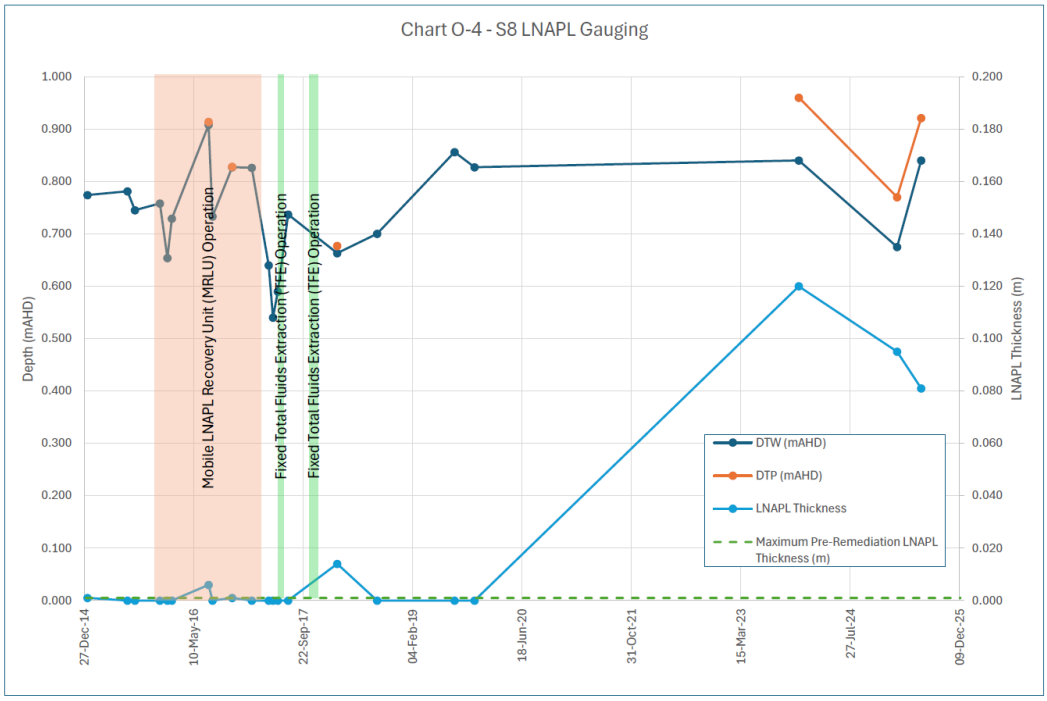


Note - LNAPL was extracted from MW05 using both the MLRU and the Fixed TFE system.

Figure 18 - Hydrograph for MW05 (source: AECOM, 2026d)

Well S8 (located at the western edge of the plume, refer to Figure 19 below):

- Zero LNAPL from August 2015 to February 2016.
- LNAPL in July 2016 (6 mm) during remediation.
- Zero LNAPL in July 2017.
- LNAPL thickness in February 2018 of 14 mm)
- Zero LNAPL from August 2018 to November 2019.
- LNAPL present between December 2023 and June 2025 (decreasing from 120 mm to 81 mm)



Note - LNAPL was extracted from S8 using both the MLRU and the Fixed TFE system.

Figure 19 - Hydrograph for S8 (source: AECOM, 2026d)

MW154 had an isolated LNAPL detection in February 2025 but has otherwise recorded zero LNAPL in gauging events.

7.7.4 Delineation and risk assessment

LNAPL Plume B has typically been delineated by wells S6, S8, MW06, MW16, MW135_GHD, MW154 and PC13. Limited access has been available for monitoring east of the Site boundary to facilitate close-spaced assessment locations to the east, and to confirm the presence/absence of LNAPL at PC13. Data at PC13 is only available for 2 rounds of monitoring: February 2017 (zero LNAPL), and February 2025 (10 mm). The observance of LNAPL in February 2025 has been adopted in the June 2025 plume extent, although the detection of measurable LNAPL was marginal (only 10 mm) and it may be that LNAPL is not in fact continuous over the off-Site extent depicted.

The inferred source of LNAPL Plume B was historic bulk fuel storage associated with the former fuel terminal located both within the Precinct South and also in the TasPorts land adjacent to the east. There is some potential for on-Site USTs to have also contributed. The bulk storage tanks of the terminal were in the current TasPorts area, not in the Precinct South, and so potential exists for a source outside the boundary of the overall site, although it is noted that LNAPL has been absent in MW135_GHD, opposite on-Site well MW05, and has only been measured at 100 mm once in PC13, opposite on-Site well MW03.

Further LNAPL delineation in the TasPorts area is understood not to have been possible, as access was not granted by TasPorts for further installation of wells. The assessment of the stability and practicability of further remediation of LNAPL Plume B on the Site has therefore been conducted with respect to the available data. LNAPL impacts within TasPorts land are considered the responsibility of TasPorts to assess and manage.

The assessment included review of impacts to groundwater. Recreation (Primary and Secondary Contact) and Aesthetic uses of groundwater were considered precluded by the presence of LNAPL, where the LNAPL plume exists, and it was noted this could be controlled by on-Site management under a SEMP. There was no inferred impact to the PEV of Recreation (Primary and Secondary Contact) down-gradient at the receiving surface water.

It was noted that the assessment of ecological risks off-Site AECOM (2020b) considered the LNAPL did not pose an unacceptable risk to off-Site aquatic ecological receptors at the Derwent River and Sullivans Cove (see Section 7.2). (An addendum to the *Assessment of Potential Off-Site Ecological Impacts* (AECOM, 2025e) also concluded that there was no risk to off-Site ecological receptors as described in Section 7.3.)

Based on the soil vapour analytical results collected from above the residual LNAPL plume, no potentially unacceptable risks associated with hydrocarbons in LNAPL Plume B were identified for:

- Commercial/Industrial users (slab-on-grade)
- Recreation/Open Space users
- Intrusive Maintenance Workers.

The Auditor notes that vapour monitoring was not comprehensive, and notes that the assessment by vapour monitoring depends on the vadose zone remaining as it was during sampling – and deep excavations in the future could change the vapour CSM.

7.7.5 LNAPL Remediation End-Point

AECOM assessed that a reasonable end-point to LNAPL remediation (effectively a CUTEP achievement) had been reached, based on the following (as taken from the CUTEP Report):

- *LNAPL recovery rates have reached asymptotic levels, and demonstrate marginal recovery rates, such as less than 5% of initial recovery volumes. Further recoverability of residual LNAPL is demonstrated to be impractical within the constraints of the adopted technology, reasonable timeframes and with consideration of the net environmental benefit.*
- *The residual LNAPL plume is shown to be stable or decreasing, including demonstration that LNAPL is not observed in wells where LNAPL has historically been absent.*
- *No unacceptable risks to current and future human-health or environmental receptors based on the proposed future land uses.*

The Auditor considered that these findings were reasonable, based on the ability to manage on-Site risks (controls for methane vapour, and for extractive use or contact with groundwater).

7.8 WELL MAINTENANCE AND TARGETED GROUNDWATER MONITORING EVENT (AECOM, 2024D)

A well maintenance program was carried out from September to December in 2023, and a targeted GME at and surrounding the Precinct South was undertaken from 29 November to 6 December 2023, as documented in the report titled *Well Maintenance and Targeted Groundwater Monitoring Event*.

The outcomes were:

- Well maintenance involved inspection of the condition of 38 groundwater wells across the overall site including the Precinct South. Some wells required action to locate or repair. Seven wells were identified within the Site as lost/destroyed: MW13, MW137, MW142, MW143, R4, S9, and TW03.
- Some 31 groundwater wells at the Precinct South and the overall site were gauged and sampled using low flow sampling for this GME. The outcomes of the GME were:
  - Depth to groundwater ranged from 1.582 mbgl (MW164) to 3.250 mbgl (MW176) in wells screened in the shallow aquifer, and from 2.281 mbgl (MW126B) to 3.056 mbgl (MW124B) for wells screened in the deeper aquifer (top of screened interval >9 mbgl).
  - Shallow groundwater contours indicated a generally southwesterly groundwater flow direction across much of the Precinct South, with some southerly components in the southern part of the Site, and easterly flow components in the eastern part, although lack of access limited the ability to obtain gauging data in the TasPorts area.
  - Hydrocarbon odours were noted during gauging at monitoring wells MW03, MW05, PW02 and S8.
  - Measurable LNAPL was observed at MW03, MW05, PW02 and S8 in the southeastern corner of the Precinct South, with thickness ranging from 50 mm to 160 mm. Recorded LNAPL thickness was within historic recorded ranges in MW03 and MW05, while above historical recorded thicknesses in PW02 and S8.
  - The Auditor notes gauging results beyond the time of the investigations in AECOM (2024d) (see Table T2) and associated hydrographs (Appendix O of the CUTEP Report) and plume maps show LNAPL extent based on measured thickness in wells over time. This includes readings after the time of the December 2023 GME, but provides context to the rationale regarding the need to reconsider NAPL mobility. A summary of LNAPL thicknesses (including the more recent readings in June 2025 for context is presented below in Table 7-2.

Table 7-2: NAPL Thickness Observations

Well ID	LNAPL Thickness Dec 2023 (mm)	LNAPL Thickness June 2025 (mm)	Maximum recorded LNAPL thickness
MW03	50	70	70 (June 2025)
MW05	70	nil	96 (Aug 2018)
PW02	160	42	160 (Dec 2023)
S8	120	81	120 (Dec 2023)

  - While LNAPL Plume B was considered by AECOM to remain delineated on Site and unlikely to be migrating further into the Site, additional monitoring to confirm LNAPL thicknesses and assess mobility via LNAPL baildown testing was recommended.

    No LNAPL was encountered in wells where it had not previously been reported, and no groundwater samples were collected from wells with LNAPL present.

    The extent of LNAPL was not able to be delineated (due to access restrictions) at/beyond the eastern boundary of the Precinct South and is considered likely to extend to TasPorts land to the east. The Auditor notes that while LNAPL Plume B is the secondary source of hydrocarbon contamination which has been subject to remediation and monitoring, the primary source is uncertain but is inferred to be associated with former bulk storage tanks in the current TasPorts area, not within the Precinct South. There were USTs on the western edge of the former SeaRoad Shed, although these present a less likely primary source.

- DNAPL was not encountered at any of the groundwater wells monitored.
- Concentrations of CoPC were above adopted Tier 1 criteria for Drinking Water (Health and Aesthetics), Recreation (Primary/Secondary Contact), Vapour Intrusion (Residential), Ecosystem Protection (90%), and Buildings and Structures for the following contaminants:
  - Benzene
  - TRH >C10-C40 (sum); TRH >C6-C10 (minus BTEX) (F1),TRH >C10-C16 (minus naphthalene) (F2)
  - Metals (aluminium, arsenic, copper, lead, manganese, zinc)
  - PAHs (naphthalene, anthracene, phenanthrene, fluoranthene, benz(a)anthracene, benzo(a)pyrene)
  - Inorganics (chloride, sodium, total cyanide, ammonia)
- Concentrations of the following CoPC were reported in excess of the Remediation Criteria for Potential Future Residents for slab-on-grade buildings with unknown construction or multi-storey building:
  - TRH >C6-C10 (minus BTEX) (F1)

  Residential use of the Precinct South is not planned for future development and is not considered likely to occur due to currently planning limitations on residential occupancy near an active port (i.e., TasPorts land to the east of the Precinct South).

In general, it was considered that the groundwater conditions were consistent with previous assessments of groundwater, although the greatest LNAPL thicknesses were recorded in the December 2023 GME. The Auditor notes that simple in-well LNAPL measurements may not always reflect a direct measurement of the quantity of LNAPL present in the subsurface, and minor fluctuations in observed LNAPL thickness are commonly made without a new source of LNAPL being present. In this case, AECOM noted that both the USTs within Precinct South and the bulk fuel tanks in the former terminal (off-Site to the east) have been removed, and so no ongoing primary source of LNAPL remains.

7.9 LNAPL GAUGING AND TRANSMISSIVITY TESTING, MARCH 2024 (AECOM, 2024B)

Following the 2023 GME, where measurable LNAPL was recorded in MW03, MW05, PW02, and S8 as described above, LNAPL mobility was assessed on 21 March 2024 based on gauging and LNAPL baildown testing in the Precinct South.

The results are summarised below:

- LNAPL thicknesses were consistent with, or less than, those in December 2023, and no new LNAPL detections occurred between December 2023 and March 2024.
- Very limited LNAPL rebound occurred after baildown of PW02, S8, and MW05 by LNAPL-selective bailers. AECOM considered that the relatively small rebound was from LNAPL in the well or surrounding packing sand rather than the surrounding formation. MW05 had no measurable LNAPL through the test and so was not assessed for calculated transmissivity.
- LNAPL transmissivity (Tn) values were calculated for PW02 (0.002 m^2/day to 0.020 m^2/day, with an average of 0.013 m^2/day) and S8 (0.0004 m^2/day to 0.009 m^2/day, with an average of 0.004 m^2/day).
- The graphed baildown test for PW02 is shown in Figure 20 below as an example. The graph shows the following all on the left hand scale: depth to product (DTP), depth to water (DTW), standing water level (SWL), initial depth to product (DTPi), initial depth to water (DTWi), along with progressive LNAPL thickness which is relative to the right hand scale.

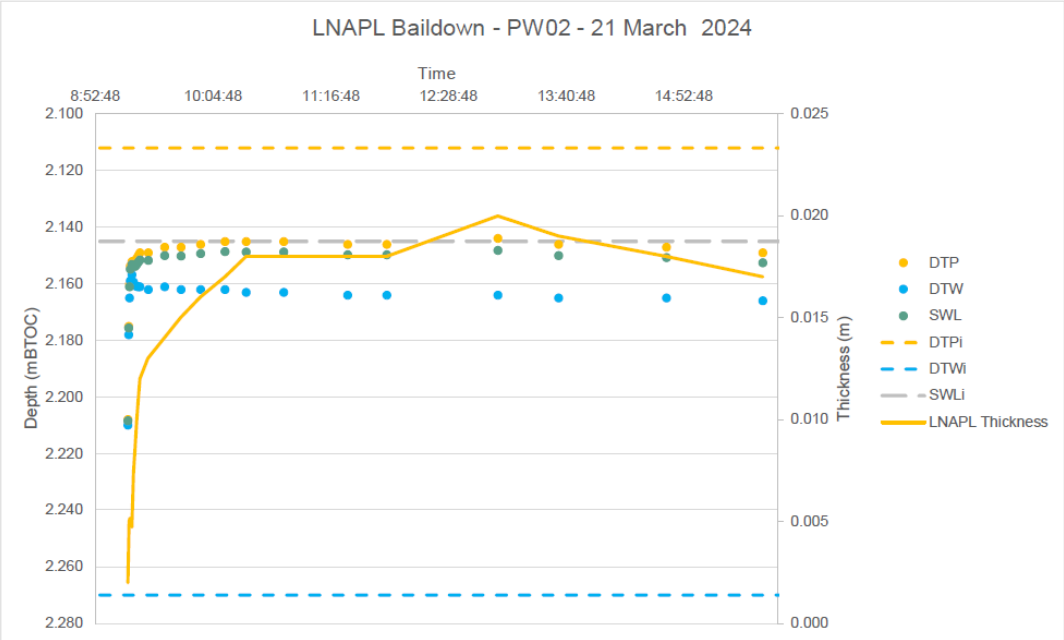


Figure 20 - LNAPL Baildown PW02

The calculated co-efficient of variation for each well suggested low reliability for the average Tn value. However, Tn values, including the highest for each well, were within or below the range (0.009 m^2/day to 0.074 m^2/day) specified in *Evaluation of LNAPL Remediation Technologies for Achieving Project Goals* (ITRC, 2009) as representing the point at which further LNAPL recovery would be impracticable.

Based on the above, further remediation of LNAPL Plume B was not considered likely to have a practicable effect on Site condition or achieve significant LNAPL recovery rates or reduction in LNAPL volume on the aquifer, and further remediation was not recommended.

The Auditor agrees that based on the transmissivity testing, further active recovery of LNAPL from LNAPL Plume B is reasonably considered to be impracticable.

7.10 THE PRECINCT SOUTH - REMEDIATION VALIDATION REPORT (AECOM, 2024C)

Remediation of soils in the Precinct South was undertaken to remove below-ground pipelines and associated soils, guided by the following documents.

- *The Precinct South – Remediation Work Plan* (AECOM, 2023a)
- *The Precinct South – Technical Specification* (AECOM, 2023b).

Excavation of soils and infrastructure was conducted by BlackCap, with excavation validation sampling conducted by AECOM between February 2023 and June 2023.

An overview of works conducted is as follows.

- Excavation and removal of:
  - Two disused fuel pipelines (Diesel Pipeline and Oil Pipeline).
  - Two areas of contaminated soil (the Northern Excavation Area and the Former UST Area) where previous assessments had identified soil impacts which could represent unacceptable risks to future Site uses and development.
  - Features uncovered during excavation of soil, including a former boiler within the Northern Excavation Area, and a buried railway in the Former UST Area.

- Validation of excavations.
- Backfilling of excavations with a combination of Virgin Excavated Natural Material (VENM), reused Site soil (including remediated Site soil where appropriate), and road base material followed by reinstatement of Site surfaces.
- Investigation of potential risks to future Site uses which may exist due to changes in the proposed future development of the Site.

Remediation areas in the northern part of the Precinct South are shown in Figure 10 below, including the Northern Excavation Area (associated with lead impacts), and the pipeline trench running south-southwest from the western edge of the Northern Excavation Area to the northern edge of the former SeaRoad Shed (blue outline in the extreme south of this figure). The green line is the Diesel Pipeline, and the yellow line is the Oil Line.

Figure 21 - Location of Remediation Areas in Northern Part of the Precinct South

Remediation areas in the southern part of the Precinct South are shown in Figure 21 below consisting of:

- the Former UST Area on the southwest corner of the SeaRoad Shed slab,
- a buried railway to the west of the former SeaRoad Shed slab, and
- the pipeline trench running south-southwest to north-northeast through the Former UST Area, extending north beyond the northern extent of the former SeaRoad Shed, and turning west near the southern boundary, just south of the Red Shed.

Figure 22 - Location of Remediation Areas in Southern Part of the Precinct South

7.10.1 Extent of remediation excavations

Soil and pipeline excavations were undertaken to remove the remnant pipelines and the identified soil impacts. Excavation was to a depth of 1 mbgl in the pipeline trenches, and approximately 2 mbgl in other soil excavations (where groundwater was encountered). The extent of excavation in each area was determined by:

- The initial estimates of appropriate excavation areas.
- Field observations of the locations and routes of pipelines, and field indications of soil impact (staining or odours) reported by AECOM and BlackCap.
- Results of soil validation samples against Remediation Criteria.
- Physical restrictions to further excavation, including:
  - The Site boundaries.
  - LNAPL Plume B to the east (for the Former UST Area work).
  - Groundwater at approximately 2 mbgl – as it was not considered practicable to extend excavations through the water table.

7.10.1.1 Removal of pipelines

The two pipelines (and surrounding soils) were removed to reduce risks from residual liquids within the pipelines and contamination in adjacent soils as outlined below:

- The Diesel Pipeline (green line in the above figures). A length of approximately 110 m was excavated and removed. Testing indicated the cladding of the Diesel Pipeline contained asbestos. A section approximately 5 m long remained on the Site where services under Evans Street made removal impractical. The pipeline was sealed with a concrete cap where cut.

- The Oil Pipeline (yellow line in the above figures). This steel pipe with bituminous cladding was removed over a length of approximately 90 m. Testing found no asbestos in the cladding. Removal of the pipeline was stopped approximately 2 m from the southern Site boundary due to the presence of services under Evans Street, and sealed with a concrete cap.
- Approximately 120 m^3 of soil surrounding the Oil Pipeline north of the Former UST Area, and 205 m^3 of soil surrounding the Diesel Pipeline were removed. The 205 m^3 surrounding the Diesel Pipeline was treated and removed from Site. The 120 m^3 was used as backfill in the Northern Excavation Area (discussed separately in Section 7.10.1.2 below).
- No staining or indicators of leaks from either the Diesel Pipeline or the Oil Pipeline were noted in soil surrounding the pipelines during removal. Potential indicators of hydrocarbon/fuel impact were observed in the soil at the Former UST Area, considered to be associated with former UST impacts.
- Contaminant concentrations with the potential to represent unacceptable risks to the proposed future uses of the Site were reported within the surrounding soil during validation of excavations consisting of the following: (Refer to Figure F13a to Figure F13d for Remediation Criteria exceedances).
    - Potential ACM fragments (cladding fragments) in the soil removed from around the Diesel Pipeline. This soil, and fragments, were removed from Site.
    - Concentrations of TRH >C10-C16 (minus naphthalene) (F2) exceeding the Potential Future Commercial (unknown construction or multi-storey building) Remediation Criteria at two locations (DL_23_1.0 and OL_17_0.6E). Speciation of the hydrocarbons indicated no exceedance of Remediation Criteria once an evaluation of aromatic versus aliphatic composition was considered.
    - Exceedances of Commercial/Industrial, and/or Intrusive Maintenance Worker Remediation Criteria were reported at four locations (DL_71_0.6E, DL_71_1.0, OL_77_0.6W and OL_77_1.0). However, soil at these locations was removed as part of the Former UST Area excavation, or as soil surrounding the Diesel Pipeline.
- The surface at the locations of pipeline excavation were sealed with bitumen following backfilling with a mixture of VENM, crushed concrete, and reinstated road base.

The Auditor accepts that the remediation excavations described above removed necessary material to conclude that the Site would be suitable for specified uses if an appropriate SEMP was applied to manage residual risks.

7.10.1.2 Soil excavation

Approximately 1,340 m^3 of soil was excavated from the Precinct South, including the pipeline materials described above. As well, the following volumes were removed.

- 650 m^3 of lead-impacted soil from the Northern Excavation Area. This soil was treated on Site to reduce lead leachability and then removed from Site.
- 360 m^3 of hydrocarbon-impacted soil from the Former UST Area. This soil was reused in the Northern Excavation Area.

Northern Excavation Area

Approximately 650 m^3 of soil was excavated from the Northern Excavation Area. Results of validation sampling indicated the following.

- There were no post excavation exceedances in the Northern Excavation Area of the Remediation Criteria for the Commercial/Industrial, Intrusive Maintenance Worker, and Open Space uses, which apply to possible future uses of the Precinct South. Some minor exceedances for Residential uses would not preclude proposed uses.

- The Northern Excavation Area was backfilled with VENM and with Site soil. A surface layer of VENM was placed to act as a barrier to casual/incidental access to reused Site soil (the reused Site soil was subject to verification of acceptability after the backfilling occurred, as discussed below in this audit report).

Excavated soil included:

- Two asbestos fragments which were found in stockpiled soils and removed, and blue staining was also tested but found no cyanide associated with possible Prussian Blue gasworks waste. (The volume of the blue staining was estimated to be less than 100 grams.)
- A boiler, filled with water, was uncovered in the eastern portion of the Northern Excavation Area, near the Site boundary. Although the water in the boiler contained detectable hydrocarbons, no exceedances of Remediation Criteria for hydrocarbons were found in surrounding/deeper validation samples, and no groundwater hydrocarbon impacts were detected in groundwater sampling from nearby monitoring well MW163 in December 2023.

Former UST Area

Approximately 360 m^3 of soil was excavated from the Former UST Area to remove hydrocarbon impacts associate with the former USTs which had already been removed historically.

The following exceedances of Remediation Criteria for future uses of the Precinct South were reported in validation samples collected from material which remained *in situ*, as follows: *(*Refer to Figure F13a to Figure F13d for locations).

- Concentrations of TRH >C6-C10 (minus BTEX) (F1) and/or TRH >C10-C16 (minus naphthalene) (F2) were reported above Commercial/Industrial Remediation Criteria at the following locations:
  - UST_77_SE_1.6 and UST_80_1.2_S (southern end of excavation). Speciation testing of the soil samples indicated no risks to Commercial/Industrial uses (risks were present for non-planned Residential use).
  - UST_EXT_59E_1.6 and UST_EXT_59N_1.6 (eastern part of the excavation). Speciation testing of the soil samples indicated a reduction in the risk scenarios for which criteria were exceeded but did not remove the exceedance of the Commercial/Industrial (working within a basement) Remediation Criteria for aliphatic TRH >C8-C10.
  - Sub-slab soil vapour assessment conducted in 2019 including sample locations at distances between 5 to 13 metres from the detected validation sample soil impacts had not reported hazardous concentrations of hydrocarbon vapour (Refer Figure F17). As well, AECOM anticipated the need for vapour protection for any future development. The Auditor notes that the remaining elevated concentration was present at only one location across the UST validation area. It is also noted that of methane concentrations in the Precinct South will require a level of protection, which should also mitigate against the low potential for a vapour risk occurring to a commercial worker working within a basement (a scenario unlikely to be realised).
  - The concentration of lead at 1.6 mbgl at validation location UST_66_E_1.6 exceeded the Intrusive Maintenance Worker Remediation Criteria. This lead concentration (of 621 mg/kg) exceeded the Intrusive Maintenance Worker criterion (of 620 mg/kg) by only 1 mg/kg and was an isolated result. It was also recovered from a depth not consistent with maintenance work (1.8 m compared with 1 m assumed for intrusive works). The isolated and modest lead concentration is not considered to represent a risk for the proposed development type.

No other exceedances of the Remediation Criteria for Commercial/Industrial, Intrusive Maintenance Worker, or Public Open Space uses were detected in the Former UST Area.

The Former UST Area was backfilled with a combination of VENM, crushed concrete from the SeaRoad Shed Slab, and reinstated road base, and the surface was sealed variously with bitumen or concrete.

The following was noted:

- A buried railway was uncovered in the western part of the Former UST Area and was removed by BlackCap. Historic aerial photographs suggest the railway was installed before 1946 and buried between 1984 and 1990. AECOM inferred the railway had been previously removed (at least partially) as it was not encountered in other earlier excavations. The railway sleepers (timber) did not appear, based on proximal soil testing, to have been creosote-treated, and AECOM concluded that the railway line was not a likely historic or ongoing source of contamination impact to the Site.
- Other railway lines are also likely buried in the Precinct South but are not considered to represent ongoing sources of contamination causing unacceptable risk to proposed future Site uses.

7.10.2 Change in use investigation

Previous assessment of the Precinct South had reported exceedances of the Commercial/Industrial Remediation Criteria for TRH >C10-C16 (minus naphthalene) (F2) in samples collected from the following locations:

- Soil bore BH62.
- Remediation validation samples OL-EX-107 and OL-EX-110.

The use had previously been planned as Open Space, and so the reported detections were not considered at that time to represent an unacceptable risk to future Site uses.

It was considered necessary to reinvestigate on the basis that Commercial/Industrial Use of this area may occur in accordance with the proposed (at that time) *Mac Point Draft Precinct Plan* (MPDC, 2023). With the current *Mac Point Precinct Plan* (MPDC, 2024) the proposed use has been confirmed as Commercial/Industrial Use.

The further investigations identified no impacts that would cause concern for the changed proposed Site use.

- AECOM concluded it likely that the impact previously detected was of limited extent (and was not identified on re-investigation).
- AECOM noted that in the event that the TRH was to pose any risk, vapour management measures (which would be required in any case for methane) would mitigate risks from hydrocarbons if they were in fact present.

7.10.3 SEMP requirements

AECOM noted that the areas where soil was remediated and validated were suitable for the proposed development subject to the implementation of a SEMP that requires engineered break layers to be installed and maintained to prevent direct soil contact. The SEMP needed to require a Work Health and Safety Plan (WHSP) for ground-breaking activities. The SEMP would also need to recognise specific elements of residual contamination in the Precinct South:

- Saturated soil (deeper than 2 mbgl) in the Former UST Area and Northern Excavation Area excavations, which may represent a risk to future Site users if exposed, excavated, or dewatered.
- Areas of potential vapour intrusion near OL-EX-107 and OL-EX-110, and on the eastern boundary of the Former UST Area excavation, which may require further mitigation or investigation if the vapour control measures are not adopted.
- Any changes to the assumptions of future use and conditions developed for the Remediation Criteria occur, for example a change in surface elevation, would require reassessment of identified impacts and exposure scenarios.

7.10.4 Auditor Conclusions on Remediation Validation Report

The remediation excavations addressed only known contamination considered likely to pose risks to future Site use, based on interpreted Site conditions at that time. However, conditions between sampling locations are not known. Therefore, as with any sampling program, it is possible that future excavations may identify further contamination, which would need to be managed at that time. The Auditor accepts the findings of the remediation validation report and considers that the conditions in remediated and validated areas are suitable for the proposed uses, subject to the implementation of the SEMP.

7.11 PRECINCT SOUTH LEAD EXCAVATION BACKFILL ASSESSMENT (AECOM, 2024A)

The *Precinct South Lead Excavation Backfill Assessment* (AECOM, 2024a) was produced as an adjunct to the remediation validation report described above in Section 7.10, specifically in relation to an area backfilled prior to approval (as described below). This report is reviewed separately to the remediation validation reporting for the Site, as it records the process for progressive approval of backfilling conducted at the time and provides context to the final Site conditions. The Lead Excavation Area is a sub-area of the previously described Northern Excavation Area.

In May 2023, BlackCap Group Pty Ltd (BlackCap) informed AECOM that soil from three stockpiles (UST_SP_0.5-1.0, UST_SP_1.0-1.5, and OL_SP) had been used as backfill in the 'Lead Excavation Area' (refer Figure 10 below). AECOM had indicated that the stockpiles were likely to be suitable for reuse based on preliminary results and field investigation, but required approval before this could occur.

EPA Tasmania Environmental Approval No. 10512/2 detailed requirements for reuse of waste material (excavated soil) from the Site. This included Auditor approval before reuse occurred.

The material was backfilled before Auditor approval, because of a miscommunication, but EPA advised (via telephone) on 18 May 2023 that, to avoid unnecessary disturbance of soil, post-backfill Auditor approval was acceptable in this case. An estimated 270 m^3 of soil excavated during remediation by excavation of the remnant Oil Line and the Former UST Area was used as backfill in an open excavation created by the removal of lead impacted soil referred to as the Lead Excavation Area. The locations of these areas are shown in Figure 10 below.

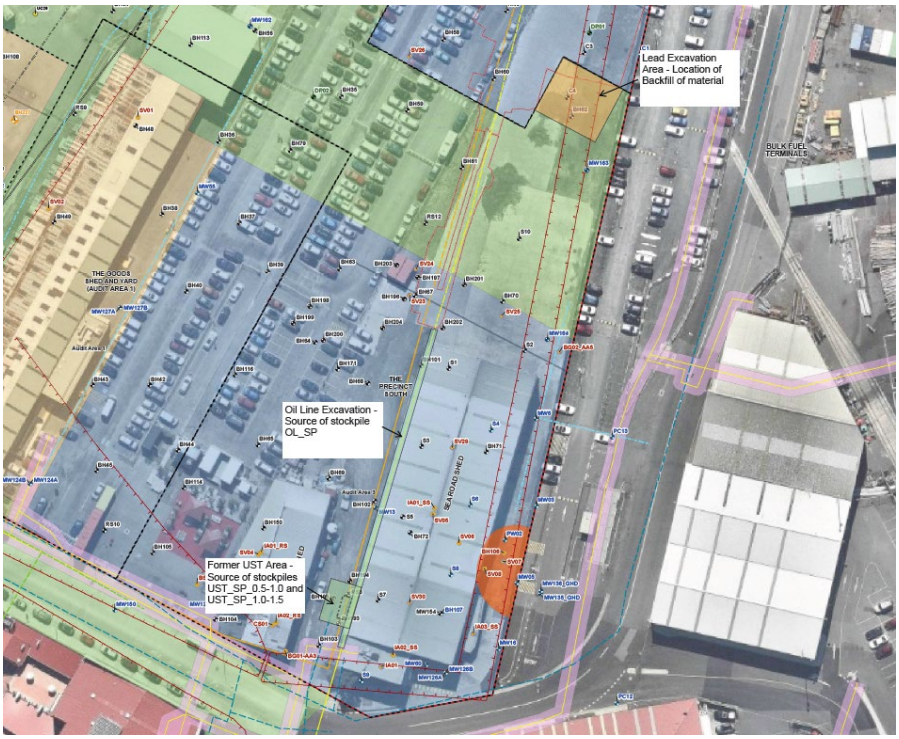


Figure 23 - Location of Lead Excavation Backfill and Sources of Stockpiles (source: AECOM, 2024a)

The available data for these stockpiles collected prior to backfilling and from investigation of the backfilled (placed) material in the Lead Excavation Area had been considered and the following conclusions had been reached:

- Soil used as backfill in the Lead Excavation Area was sourced from the following three stockpiles:
  - UST_SP_0.5-1.0, approximately 85 m^3 sourced from between 0.5 to 1 mbgl in the Former UST Area
  - UST_SP_1.0-1.5, approximately 65 m^3 sourced from between 1 to 1.5 mbgl in the Former UST Area
  - OL_SP, approximately 120 m^3 sourced from soil surrounding the remnant Oil Pipeline. (A section of soil at the end of the Oil Pipeline excavation, from chainage 77 to 80, was segregated and stockpiled separately based discolouration, odours, and PID readings noted by field staff).
- Sample density exceeded the minimum recommended rate in IB105 of one primary sample per 25 m^3.
- Exceedances of the following IB105 criteria were reported:
  - Concentrations of benzo(a)pyrene and Sum of PAHs in excess of the IB105 Level 1, Level 2, and Level 3 Total Contaminant Concentrations (TCC) criteria were reported soil from before backfilling and within in-place samples.
  - Soil samples from stockpiles UST_SP_0.5-1.0 and UST_SP_1.0-1.5, representing approximately 55% of the estimate volume of material used as backfill, were assessed for PAH leachate and reported all leachable concentrations (in seven samples subjected to Toxicity Characteristic Leaching Procedure (TCLP) analysis) as below LOR. In accordance with Section 2.2.4 of IB105, Leachable Contaminant Concentrations (LCC) values take precedence over TCC and are the sole determinant in final classification of material.
  - TCLP analyses were not conducted on soils representing the remaining 45% of source soils, however as noted by AECOM, the soils were from similar sources in terms of PAH contamination potential, and importantly no total PAH or benzo(a)pyrene LLC exceedances had been reported from approximately 13,000 m3 of PAH-impacted soils that had been tested and removed from the Site as Level 2 – Low Level Contaminated Soil.

  Based on the above rationale, AECOM classified the soils as Level 2 – Low Level Contaminated Soil.
- Exceedances of the following Remediation Criteria were reported in soil used as backfill as follows:
  - Commercial/Industrial
    - Pre-backfill - TRH >C6-C10 (minus BTEX) (F1), TRH >C10-C16 (minus naphthalene) (F2)
    - Post-backfill - TRH >C10-C16 (minus naphthalene) (F2)

    The TRH >C6-C10 (minus BTEX) (F1) exceedances pre-backfill were minor exceedances in two samples, and exceedances were not found in post backfill samples. Soils were subject to a period of storage allowing volatilisation before backfilling, so the lack of post-backfill exceedances is as would be expected.

    The exceedances of TRH >C10-C16 (minus naphthalene) (F2) criteria were subject to analysis by aliphatic/aromatic speciation and reported no exceedances of Remediation Criteria for the TRH fractions reported.

    As detected exceedances of these criteria have been assessed as not representing an unacceptable risk to future Site uses following further analysis, no unacceptable risk to future Commercial/Industrial use is considered to be presented by the backfill material.
  - Intrusive Maintenance Workers
    - Pre-backfill – lead

One sample (UST_SP_1.0-1.5_03) returned a minor lead exceedance (796 mg/kg compared with a criterion of 620 mg/kg).

There were no other exceedances in twenty other samples taken pre-backfill. Post-backfill samples (of which there were 23), were all below the adopted Remediation Criteria.

Based on the above consideration, lead concentrations above the adopted criteria are not considered likely to be widespread nor characteristic of the material used as backfill, and it is not considered that the reported detection (at UST_SP_1.0-1.5_03) represents an unacceptable risk to Intrusive Maintenance Workers at the Site.

- Use of the material as backfill met identified conditions for reuse under EPA Tasmania Environmental Approval No. 10512/2:
  - The soil was categorised as Level 2 – Low Level Contaminated Soil.
  - The material was to be managed under the conditions of the SEMP relevant at that time.

Based on the above, the Auditor approved the use of the material as backfill in the Lead Excavation Area, noting that this was a post-backfilling approval.

7.12 SOIL, GROUNDWATER AND SOIL VAPOUR INVESTIGATION 2025 (AECOM 2025A)

This *Soil, Groundwater and Soil Vapour Investigation 2025* report (AECOM, 2025a) documented a significant assessment phase undertaken across the overall site involving drilling and installation of:

- Nineteen new groundwater monitoring wells
  - Two of these, MW188 and MW193 were in the Precinct South - refer Figure F6a. These wells were installed with the purpose of delineating LNAPL Plume B to the west. The Auditor notes that both wells were proximal to the former USTs which had been removed previously at the western edge of the southern part of the former SeaRoad Shed. Therefore, these wells also served to assess possible impacts to LNAPL Plume B from the USTs.
- Fourteen new soil vapour monitoring wells
  - Most new locations targeted other parts of the overall site, particularly the Gateway in the southwest corner of the overall site, but SV46 was placed centrally in the Precinct South, while SV34 was just north of the boundary with the Precinct North – refer Figure F6a.
- Ten soil bores for the assessment of PASS in unsaturated soil (discussed elsewhere in this audit report). Soil samples were also collected and analysed from groundwater and soil vapour wells installed.
- Two sub-slab vapour pins above LNAPL Plume B in the Precinct South (SV37 and SV38).

The results from this investigation in May/June 2025 are incorporated into the CUTEP Report prepared by AECOM and described in Section 7.13 below. However, key findings in relation to the Precinct South are as follows.

- No LNAPL was found in MW188 or MW193, west of LNAPL Plume B and proximal to the former SeaRoad Shed USTs. No odour was noted during sampling, and groundwater in both wells contained non-detectable hydrocarbons.
- Soil analyses identified concentration exceedances for Tier 1 criteria:
  - Direct contact for lead at SV46, and for PAHs/Benzo(a)pyrene at SV34 (just outside the Precinct South northern boundary).
  - Vapour intrusion for TRH >C10-C16 (minus naphthalene) (F2) hydrocarbons at SV34 (just outside the Precinct South northern boundary). This also exceeded the Remediation Criteria.
- Groundwater results (other than as noted above) indicated:

  - Widespread exceedance various Tier 1 groundwater criteria, consistent with previous monitoring, and precluding extractive uses broadly across the Precinct South. One TRH >C6-C10 (minus BTEX) (F1) hydrocarbon concentration in groundwater also exceeded Tier 1 criteria for potential vapour risk for residential or commercial occupants.
  - Widespread dissolved methane posing a potential vapour risk.
- Soil vapour results indicated the following:
  - Methane in soil vapour ranged from 2.23% to 35.1% in the Precinct South, with 75.2% methane present at SV34 just beyond the north boundary of the Precinct South, within the Precinct North.
  - Measured soil vapour did not exceed vapour criteria for hydrocarbons within The Precinct South.

The conclusions of the report were that:

- Vapour risks from hydrocarbons were indicated at a Tier 1 level based on soil and groundwater concentrations, but in the Precinct South, direct (measured) vapour concentrations (including proximal to LNAPL Plume B did not indicate a vapour risk.
  - The Auditor notes that any significant lowering of the Site surface affecting the potential attenuation in the vadose zone could result in changed risk conditions, in which case the exceedances of Tier 1 vapour criteria for soil and groundwater concentrations may become relevant, and the actual vapour readings (in particular vapour pin readings immediately below sealed surfaces) would be less relevant in characterising vapour risks. In any case, methane mitigation is proposed by AECOM, which would also protect against hydrocarbon risks (see below).
- Vapour concentrations did indicate a hydrocarbon risk at The Gateway, to the west of Precinct South.
- Methane concentrations indicated a potential risk requiring management across the overall site excepting The Escarpment (also known as Audit Area 4 West), Audit Area 4 East and Regatta Point[12].
  - The Auditor notes that while further monitoring including flow measurements to obtain a flow-based GSV could have been pursued to reduce the CS value, this may not have made much practicable difference. Per the NSW guidelines Table 7, a CS value of 1 would apply to methane ‘typically’ below 1% v/v, with a consideration to change to CS2 in the event of higher readings. Methane readings in the Precinct South were universally above 1% v/v, and have been as high as 54% at SV25 (most recently 35.1%), and were 75.2% just beyond the Precinct South northern boundary (SV34). This suggests that a rating of CS2 at least is warranted. In the NSW guidelines, a CS2 rating indicates a required Gas Protection Guidance Value of 2 for standard Commercial buildings, which AECOM has adopted for the proposed Site development. This value is the same for CS2 or CS3, and it is considered unlikely that a change to CS1 would be justified by further analysis. In any case, AECOM has not pursued additional flow monitoring to attempt to downgrade the CS value.

The Auditor considers that the report provides useful further information to characterise the Site to identify issues that require management for future development.

[12] Regatta Point is currently not considered to be part of the overall site for auditing purposes.

7.13 CLEAN UP TO THE EXTENT PRACTICABLE REPORT (AECOM, 2026D)

This *Clean-Up to the Extent Practicable Report* (AECOM, 2026d) has been produced to provide available environmental data and to support the Auditor in preparing this audit report and associated Site Suitability Statement for the Precinct South.

Although a CUTEP report is often a report addressing groundwater conditions on a site subject to environmental auditing, and specifically to determine whether or not further groundwater remediation remains practicable, in this instance the CUTEP Report (AECOM, 2026d) is the primary/key document supporting the audit report where relevant soil groundwater and soil vapour data are consolidated for the Precinct South. This consolidated report combines the data from a range of assessment and remediation investigations in a single report.

Most of the information in the *Precinct South CUTEP Report* has been discussed above in earlier sections of this audit report. The key issues are summarised in the following sub-sections.

7.13.1 Background

The CUTEP Report recounts general Site location, geology and hydrogeology consistently with earlier studies.

Historical uses are described, as noted in Section 4 of this report, with uses on the Precinct South itself including land reclamation, bulk fuel terminals and UST fuel storage, fuel and oil transfer, freight handling (rail activities), waste paper handling, mechanics workshop and Goods Shed Annex uses.

Surrounding uses were also described, consistent with Section 4 of this report.

The report detailed the potential for chemical storage to have contributed to contamination, with key issues for the Precinct South noted as follows:

- Bulk Fuel Terminal fuel releases. Although the bulk fuel tanks were on TasPorts land to the east, part of the former fuel terminal extended into the Precinct South, such that there is a possibility of fuel releases having occurred both on and off-Site in the southeastern boundary area.
- The two removed USTs were present on the western side of the former SeaRoad Shed (the Former UST Area).
- The Red Shed had been used as a mechanics workshop where drummed fuels, and paint in containers were observed in 1996.
- The former SeaRoad Shed was observed to have been used for storage of a total of 504 containers (20 L each) of paint and lubricating oil, and 56 drums (205 L) of motor oil.

Subsurface features were described consistent with descriptions earlier in this audit report:

- Hobart Main Sewer in the far western part of the northern part of the Precinct South.
- Diesel Pipeline and Oil Pipeline (and associated ‘Naval Oil Pipeline’ – considered an extension of the removed Oil Pipeline).
- The removed USTs.
- Sea walls.
- Goods Shed Annex infrastructure (removed in 2020).
- Buried railway tracks.

Adjacent subsurface features were noted to include the infilled former Hobart Rivulet under Evans Street. This was noted to be a potential preferential groundwater pathway, and a potential source of contamination from waste materials withing the former channel.

Key known contamination source zones across the overall site were detailed. Of these, LNAPL Plume B, was noted to be located on the Precinct South, while LNAPL Plumes A1, A2 and A3 were off-Site from the Precinct South. The Auditor notes that while LNAPL Plumes A1, A2 and A3 are broadly up-gradient of the Precinct South, groundwater contours variously show possible flow paths towards the Precinct South, or in some instances to the west of Precinct South.

Widespread methane across the overall site was noted, from one or more of hydrocarbon degradation, or organic matter in fill material or natural estuarine soils. The Auditor notes that AECOM has not undertaken any investigations to attempt to differentiate whether the methane is from contamination or from natural sources.

Proposed future development was described, consistent with Section 3.3 of this audit report.

7.13.2 Conceptual Site Model

AECOM (2026d) described the CSM in terms of geology and hydrogeology as described in Section 3 of this audit report.

Based on a review of desktop information, available borelogs (Appendix H of AECOM, 2026d), and groundwater data, the Auditor considers the description of geology and hydrogeology to be appropriate, noting that the estimates of hydraulic conductivity are presented as a single average figure for the various units, whereas these are likely to vary widely – especially for the heterogeneous fill material used for reclamation. As well, sea walls are likely to have impacts on groundwater behaviour, which is difficult to predict accurately. In any case, there are groundwater wells across the overall site, and in key areas of contamination on the Precinct South, to address key contamination issues affecting the Site.

The CUTEP Report noted the CoPCs as described in Section 5 of this audit report. This list is considered appropriate for the Site uses that have been identified.

Table 15 of AECOM, 2026d identifies potential exposure of receptors to contaminants on the Site.

The Auditor accepts the evaluation, but notes that incomplete pathways in several instances are evaluated based on an assumption of management controls under a SEMP to be applied to the Site. Ideally, the evaluation would consider the potential for exposure without management controls initially and then use that to identify what management controls are needed in a SEMP. For example, inhalation of vapours from soil or groundwater are considered to be incomplete pathways, based on the SEMP requiring vapour mitigation. AECOM notes in the footnotes to their Table 15 that the risks have been considered in setting the requirement for the management measure.

7.13.3 Assessment criteria

Assessment criteria are detailed in the CUTEP report as described in Section 6 of this audit report. The Auditor considers the assessment criteria adopted by AECOM to be appropriate, noting that in some cases there is variable consideration of risks based on levels of assessment, and how management measures are used.

7.13.4 Nature and extent of contamination

7.13.4.1 Soil Investigation rationale for program

Soil assessment has been conducted over numerous phases of investigation within the Precinct South, including:

- 110 assessment locations advanced for a combination of soil bore sampling, groundwater well installation and soil vapour bore installation.

- 188 remediation validation samples taken in the base and perimeter of excavations associated with:
  - Removal of Goods Shed Annex features.
  - Removal of the Diesel Pipeline and Oil Pipeline.
  - Removal of lead contamination.
  - Removal of soils where USTs had previously been removed, as an extension to the area excavated for the pipeline removal (no sampling data was available from the historical removal of the actual tanks).
- A further 136 sample locations in areas within the 20 m buffer zone of the Precinct South were also considered.

Soil samples have been recovered from:

- Early GHD assessment borehole in 2014 (C4)
- Grid-based soil bores drilled by AECOM during DSI investigations in 2015, 2016 and 2018 (BH numbers between BH35-BH150)
- Boreholes by AECOM to assess the Former UST Area in 2019 (BH193-BH195)
- Boreholes by AECOM in 2018 for Goods Shed Annex (BH170) or data gap assessment (BH171), or in 2019 for data gap assessment (BH198 to BH204)
- Monitoring wells for groundwater or soil vapour, installed between 1997 and 2025
- In situ waste classification sampling bores, 2024
- Acid sulfate investigations 2024-2025

The sample numbers above exclude soil samples that represented conditions in soils that were later removed.

Soil bore sampling for *in situ* waste classification was undertaken in late 2024 as part of investigation associated with the proposed stadium. This sampling was separate from most of the sampling otherwise undertaken on the Precinct South. The basis of the investigation was that while the Site had been considered by AECOM to have been generally investigated to a point that would allow characterization, demonstration of CUTEP and definition of SEMP management requirements, the new proposal to conduct a bulk excavation to prepare the Site for a stadium had not been directly considered. Although the proposed uses could be managed with soils as assessed on the Site, the excavation plans meant that some soils would be removed (rather than staying in place under SEMP management conditions). Consequently, a grid-based additional assessment was undertaken, at locations shown on Figures F6c and F13d. Available bore logs for all bore-based sampling are appended in Appendix H of AECOM, 2026d.

The Auditor notes that the bore logs do not include the validation sampling locations which were recovered from open excavations. AECOM also noted that no bore logs were available for the early locations MW13, MW16, MW60, RS3 and RS12 on-Site, or RN6 off-Site.

Bore-based locations for contamination investigations are shown in Figure F6a and Figure F6c while Figure F6b details the locations of acid sulfate soil sampling (described in Section 7.14 below). Figure F7a to Figure F7d detail the locations of validation sampling associated with remediation excavations conducted at the Site.

AECOM's logic for the adequacy of soil sampling density was as follows:

- NSW *Sampling Design Guidelines* (NSW EPA, 2022) provide a basis for a sampling grid density to assess for unknown contaminant sources across a site. For a 1.4 ha Site, the guidelines indicated a minimum grid size of 24 m, and the resulting number is a requirement for 25 sampling locations.
- The overall density of grid sampling was noted to generally conform to the spacing to detect a possible 28.9 m circular hot spot.

  - It was noted that the shallow soil borehole assessment grid (noted above) for *in situ* soil classification was undertaken over part of the Site to provide information for proposed bulk excavation soil disposal on a 20 m grid, as shown on Figure F6c.
- Sample depths analysed were totaled into depth intervals by AECOM. Some 76 samples were analysed in the depth range 0-1 m; some 114 samples in the range 1-2 m; 71 samples in the range 2-4 m and 12 samples were analysed deeper than 4 m. AECOM noted that samples taken below the water table were considered to be superseded by groundwater samples for volatile contaminants, because any volatiles would affect soil vapour based on dissolved concentrations at the water table.
  - The Auditor considers that the sampling locations and depth of samples were reasonable to characterise Site conditions.
- Remediation validation sampling consisted of 269 samples on the Site and within the 20 m buffer zone (195 samples within the Site boundary).
  - Validation sampling was undertaken where there were no field observations indicative of persistent contamination following excavation, and at a rate of one sample per 20 m^2 of excavation wall/base. The Auditor notes that the excavation validation samples for the section of pipeline remediated in 2023 (Figure F7d and Figure F13d) underestimate the quantity of validation sampling undertaken, because each 'location' consisted of a base and a wall sample in that area of the Diesel Pipeline and Oil Pipeline removal – this occurs in the pipeline excavations both north and south of the UST excavation area. Table T1b details the sampling locations to demonstrate that there were two samples taken at each location marked on the plan.
- AECOM described that acid sulfate sampling of soils was undertaken across the overall site, including four locations within the Precinct South and five within the 20 m buffer zone.
- Backfilled soil into excavation areas was either Virgin Excavated Natural Material (VENM) or was check-sampled in stockpiles based on a 1 sample per 25 m^3 rate, or a rate adequate to conduct 95% Upper Confidence Limit calculation, per Publication 702.2 – *Soil sampling for waste soils* (EPA Victoria, 2024).

It is noted that assessment data have been obtained from investigations over a long timeframe. Because of this, some data are many years old. However, investigations have occurred in a period where new primary sources have not existed. As well, hydrocarbon-based contaminants are likely over time to degrade, having the effect of generally reducing contaminant load, such that the data used in the assessment of the site is considered reasonable to use in describing site conditions.

The Auditor notes that the grid sampling per the NSW *Sampling Design Guidelines* (NSW EPA, 2022) is based on a square regular grid across a square or rectangular site, and that it should not include targeted sampling locations - although these can often serve to coincidentally address the grid needs where they fall on or close to grid locations. The grid density basis for assessment supposes a hot spot of contamination emanating from a specific source, in which exposure to the hot spot that may be theoretically detected is proportional to the overall site. That is, a receptor would occupy the entire site and have some exposure to a hot spot that may be missed by the grid. The grid sampling has a less applicable rationale for heterogeneously distributed contaminants, where contamination would not be organized in continuous 'hot spots'. In this regard, the grid density does not apply particularly well for many possible contamination scenarios. For example, if a small 10 m by 10 m zone of contamination may be present, the grid would have low probability of picking such a hot spot up. Contamination that is widespread but 'spotty' (such as discrete asbestos fragments) may also be present without being in continuous 'hot spots'. Nevertheless, the Auditor considers that the grid density nominated is reasonably used as a default basis for evaluating an area such as the Precinct South. In an ideal scenario, a whole-of-Site scrape would be undertaken to gain insight into observable signs of contamination across the area below concrete slabs and paving. In this instance, such an approach would not have been practicable, particularly as Site infrastructure, including slabs and sheds, was at various stages proposed to be retained. A consequence of this is that while the evaluation of soil impacts is considered reasonable to characterise contamination across the Site that may be relevant to average

exposure of potential Site users (and so suitability of the Site may reasonably be assessed), there remains a possibility that localised contamination hot spots may remain in place, and may be encountered where any future Site excavations occur. In short, while the sampling density is considered reasonable to characterise the Site overall, it does not confirm conditions between sampling locations.

The Auditor also considers that the density of validation sampling was adequate to reasonably characterise the extent of contamination in the excavated areas.

Overall, although the 'grid' of sampling locations was irregular, the Auditor considers that the sampling location density was appropriate to characterise Site soil conditions.The Auditor considers that the sampling of remediation validation locations and acid sulfate assessment locations, and backfill sampling, has been adequate to characterise conditions in relation to these aspects of the Site condition.

7.13.4.2 Soil Investigation Methodologies

AECOM described soil sampling methodologies broadly in Section 5.1.1 of AECOM (2026d), with the approach taken to decontamination and sampling for soil bores (push tube and sonic) and validation sampling (trowel and/or new nitrile glove sample collection).

The Auditor considers the sampling methods described were adequate for the purposes of the investigations.

7.13.4.3 Field Observations

Tabulated field observations are presented in Table T1 and bore logs are presented in Appendix H of AECOM (2026d), and demonstrate the fill used to reclaim the area of the Precinct South is mostly a mixture of sands, clay/silts and gravels (with some cobbles), but also routinely includes anthropogenic materials, including:

- Brick/rubble
- Coke/Coal/slag
- Timber
- Glass
- Ceramics
- Metal
- Leather
- Shell fragments

Table T1a notes the presence of elevated PID concentrations, and shows that where high PID readings were observed, analyses of hydrocarbon contaminants have been undertaken. The Auditor conducted a separate review of bore log observations and confirmed the PID reading ranges noted in Table T1a. Also, it was noted that for all locations where hydrocarbons odours were noted, soil analyses for hydrocarbons were done, except for MW05, MW06, and MW154 (BH107). These are all well locations so there is groundwater assessment that describes contamination presence (these are all well locations within or proximal to LNAPL Plume B). Table T1a indicated that soil analytical data were available for BH107/MW154, but the Auditor did not find this in the soil analysis tables.

Other observations indicating potential contamination were analysed for a range of other CoPC.

Overall, the Auditor considers that the field observations have been taken into account appropriately for the selection of samples for analyses, in assessing the Site.

7.13.4.4 Tier 1 Soil Impact Assessment

Tier 1 criteria were developed for initial screening assessment of impacts to protected PEVs at the Site.

Analytical data for soil remaining in the Precinct South, and the 20 m buffer zone, was presented screened against the adopted Tier 1 assessment criteria in Table T4 to Table T6 of the CUTEP Report and are reproduced in the tables section of this audit report.

These are criteria that may apply for uncontrolled uses of the Site, as a check on impacts that would exist for any possible development scenario, whether or not planned for the Site. This means that exceedances of the Tier 1 criteria do not necessarily mean there would be an unacceptable impact to the proposed Site development.

The relevant PEVs which have been identified from the Land SEPP in the absence of specific Tasmanian guidance, are:

- Maintenance of Ecosystems - Modified and Highly Modified Ecosystems
- Human Health
- Buildings and Structures
- Aesthetics.

Detected concentrations of CoPC in soil samples collected between 2014 and 2025, as described above, were recorded above the adopted Tier 1 criteria for a range of PEVS by various contaminants.

Exceedances of the Tier 1 criteria for soils from assessment locations are depicted on Figures F10a, F10b, F11a and F11b. It should be noted that there are some other exceedances of Tier 1 criteria in remediation validation samples taken during excavation of the Diesel Pipeline and Oil Pipeline and the Former UST Area (Figures F13a – F13d), and in grid-based sampling for classification of soils expected to be removed as part of site development (F13e). Tier 1 criteria exceedances are not depicted on those figures, but are shown in the analytical results tables.

The following sections describe soil concentration exceedances for Direct Contact; Ecosystems; Buildings and Structures, Soil Vapour Intrusion (human health) and Aesthetics.

Tier 1 Criteria Soil Exceedances – Direct Contact

A summary of the exceedances for Direct Contact (human health) is as follows – refer Figure F10a for spatial distribution of exceedances.

- Benzo(a)pyrene, and Benzo(a)pyrene TEQ is present routinely above the Tier 1 criteria for Benzo(a)pyrene TEQ for direct contact for low density residential use and open space (3 mg/kg), and for medium/high density residential use (4 mg/kg). These exceedances were found across all parts of the Site and throughout the fill depths, including well below the water table. Benzo(a)pyrene exceeded the Tier 1 commercial/industrial use criterion of 40 mg/kg at several locations distributed throughout the Site area (and at arrange of depths). The exceedances of the commercial/industrial Tier 1 criterion were in three main areas:
    - Central/north part of the Site (BH35, BH55)
    - Central/west part of the Site (SV24, BH67, BH116, S3)
    - Central/south part of the Site (BH102, S9)
- Sum of PAHs exceeded direct contact criteria less commonly than benzo(a)pyrene, limited to BH116 (residential), BH55 (low density residential), BH67 (residential and commercial/industrial, at 4 m depth), and RN4 (low density residential).
- TRH >C10-C16 (minus naphthalene) (F2) and TRHs > C16-C34 exceeded adopted low/medium/high density residential use criteria for direct contact, mostly in the southern part of the Site proximal to LNAPL

Plume B (although also in the north of the Site), and mainly at depth (near or below the water table). Some exceedances were also present in the northern part of the Site. Open space criteria were also exceeded at several locations, including the northern part of the Site.

- Lead was present in soils above Tier 1 direct contact criteria for residential and open space uses at several locations distributed across the Site, although this was commonly at depths greater than 1 m.
- There were sporadic exceedances of Tier 1 direct contact criteria for cadmium and arsenic.
- There was a single exceedance for PFOS at BH70 (low density residential).
- Exceedances not shown on figures included: chromium at K11 (residential and open space) and K12 (residential), dieldrin at BH70 (residential and open space), and TRH >C34-C40 at MP-EX-05 for residential and open space.

Figure F10b shows that the 20 m buffer zone contained soil concentrations with exceedances for similar CoPC as occurred within the Precinct South boundary, indicating that the contamination present is continuous across the boundaries, but not generally indicating different contaminants than already understood to exist on the Precinct South (although there was an isolated chromium Tier 1 criteria exceedance for residential direct contact at SV34, whereas no such chromium exceedances were noted within the Precinct South soils).

The Auditor notes that this evaluation against Tier 1 direct contact criteria shows that the Site would not be suitable for use for residential, open space or commercial/industrial uses without management. Residential uses are in any case not planned. It is noted that the Remediation Criteria were developed to assess the Site with the assumption of management measures which could be applied at the Site for proposed uses, and so in effect supersede the Tier 1 criteria for evaluation of the Site conditions, on condition that the management measures are applied.

Tier 1 Criteria Soil Exceedances – Ecosystems, Buildings and Structures

Table T5 and Figure F11a describe comparison of Tier 1 criteria for modified and/or highly modified ecosystems are exceeded for metals concentrations across the Site in shallow soils up to 2 m depth. It is noted that terrestrial ecosystems are not expected to be exposed at depths greater than 2 m, so deeper concentrations that exceed the ecosystem criteria are not shown.

Concentrations of the metals copper, zinc, nickel and lead, along with benzo(a)pyrene and TRH >C16-C34 fraction are widespread across the Site. TRH >C10-C16 are less common but are present at some locations shown in Figure F11a, but also at non-depicted locations K11 and M12, and in a number of remediation validation samples.

There were a small number of pH and sulfate analyses carried out relevant to the Precinct South. None of these indicated aggressive conditions, although the local presence of high salinity from possible seawater intrusion/mixing and acid sulfate conditions in natural sediments requires consideration.

Figure 11b and Table T5 show that similar ecosystem protection exceedances of Tier 1 soil criteria were present in soils in the 20 m buffer zone. As noted above, some Tier 1 exceedances in classification sampling and remediation validation are not shown on the figure (but are listed in the relevant table).

The Tier 1 comparison for ecosystem protection indicates that the Site would not sustain a terrestrial ecosystem in a development and so requires management under a SEMP to manage ecological receptor exposure.

Tier 1 Criteria Soil Exceedances – Soil Vapour Intrusion (human health)

Assessment of soil concentrations was undertaken to compare to Tier 1 criteria indicating possible vapour risks based on detected concentrations in soils. It should be noted that concentrations from soils deeper than the water table would not pose a vapour risk, because the vapour risk would depend instead on the concentrations present in the groundwater. Direct measurement of soil vapour concentrations was undertaken by soil vapour probes (and shallow vapour pins under the SeaRoad Shed) to assess vapour risk more directly.

The soil concentrations indicated a potential vapour risk for residential use at widespread locations across the Site.

The following observations of analytical data are made.

- There was a single exceedance of criteria for naphthalene for residential (3 mg/kg) and commercial/industrial (10 mg/kg) uses, at BH67 in the central part of the Site, but this was at 4 m depth (below the water table). The naphthalene concentration in soil at BH67 was subject to soil vapour sampling via SV23 and SV24 nearby.
- Most soil exceedances were for TRH >C10-C16 (minus naphthalene) (F2), over the residential (25 mg/kg) and commercial/industrial (137 mg/kg) criteria for sand soils (sand adopted conservatively because of the variable nature of the fill). The residential exceedances occurred across the Site, while commercial/industrial exceedances occurred mainly through the central/eastern and southern parts of the Site. The highest TRH >C10-C16 (minus naphthalene) (F2) hydrocarbon concentrations were in BH107 (2.5 m depth, 4,060 mg/kg), as noted proximal to SV37; S3 (2.65 m depth, 3,350 mg/kg), proximal to SV29 as noted above; BH67 (4 m depth, 2,890 mg/kg), proximal to SV23 and SV24 (sampled in 2019 but both later lost) and SV46. SV25 contained 2,270 mg/kg at 1.55 m depth.
- Exceedances for TRH >C6-C10 (minus BTEX) (F1) were less common but were also present through the central/eastern and southern parts of the Site. The highest concentrations of TRH >C6-C10 (minus BTEX) (F1) hydrocarbons were at BH107 (2.5 m depth, 847 mg/kg), which was proximal to the vapour pin at SV37, and S3 (2.65 m depth, 229 mg/kg), which was proximal to SV29.
- Aromatic/aliphatic sub-fractions were analysed on a minority of samples (generally where initial TRH concentrations were elevated). A number of these samples were from below where the water table would render the results irrelevant because groundwater would control vapour intrusion (for example BH193 and BH195). A number of other aromatic/aliphatic sub-fraction exceedances are listed in the tables (for example DL-EX-23, EX6-38, UST_EXT_59E_1.6, UST_EXT_59N_1.6, and UST_80_1.2_S, and several Oil Pipeline validation locations.

The Tier 1 soil data for vapour intrusion indicates that there is potential for the soil concentrations of naphthalene, TRH >C6-C10 (minus BTEX) (F1), TRH >C10-C16 (minus naphthalene) (F2) and aromatic/aliphatic TRH sub-fractions to pose risks to site users in indoor air, without management measures being instituted.

Tier 1 Criteria Soil Exceedances – Aesthetics

Table 22 of AECOM (2026d) details the presence of glass, ceramics, metal, brick, timber, coke/coal, leather, wire, slag gravels, ash, rubber), hydrocarbon odours and residual LNAPL remaining in soils on Site as representing an unacceptable aesthetic impact requiring management under a SEMP.

7.13.4.5 Remediation Criteria Impact Assessment

Remediation Criteria were developed by AECOM to assess risks from vapour intrusion – the potential for TRH/TPH and naphthalene in soil to volatilise and reach indoor air concentrations representing unacceptable risk of harm to future site users.

Remediation Criteria Exceedances for Future Commercial/Industrial Workers

Exceedances were listed for TRH >C6-C10 (minus BTEX) (F1) and TRH >C10-C16 (minus naphthalene) (F2) fractions at a number of locations, and for naphthalene at one location (BH67). The exceedances indicate potential for vapour risk caused by the soil concentrations. There were also some Remediation Criteria exceedances for Intrusive Maintenance Workers for lead (direct contact).

The exceedances were above Remediation Criteria summarised as follows:

- Commercial/Industrial workers, unknown building construction
  - TRH >C6-C10 (minus BTEX) (F1)) 67 mg/kg
  - TRH >C10-C16 (minus naphthalene) (F2)) 140 mg/kg
- Commercial/Industrial workers, low rise, slab-on-grade
  - TRH >C6-C10 (minus BTEX) (F1) 340 mg/kg
- Commercial/Industrial workers, working in a basement
  - TRH >C6-C10 (minus BTEX) (F1) 170 mg/kg
  - TRH >C10-C16 (minus naphthalene) (F2) 770 mg/kg
- Intrusive Maintenance workers
  - Lead 620 mg/kg

Exceedances are shown on Figure F13a, and in Table T7.

Remediation Criteria exceedances were reviewed by AECOM and were eliminated from consideration as representing a risk (where appropriate) based on a range of considerations, including the following.

- Soil concentrations below the level of the water table:
  - Where soil concentrations exceeded Remediation Criteria but were clearly from below the water table, groundwater concentrations (or direct soil vapour measurements) were considered more relevant for vapour risk characterisation.
  - This applies to the following exceedances:
    - BH107 (2.5 mbgl, water table 1.0-2.1 mbgl at MW154/BH107)
    - BH193 (2.5 mbgl, water table 2.3 mbgl at MW193)
    - BH194 (2.0 mbgl, groundwater observed in Former UST Area excavation at 2 m depth)
    - BH195 (2.5 mbgl, water table approximately 2.25 mbgl depth based on interpolation between MW188 and MW193)
    - BH35 (3.7 mbgl, water table depth of 3.1 to 3.2 mbgl at nearest well MW162)
    - BH67 (4 mbgl, water table inferred between 1.5 mbgl at MW164 and 3 mbgl at MW55)
- Soil concentrations superseded by nearby direct soil vapour assessment analyses:
  - Where soil vapour investigations were conducted proximal to soil assessment locations, the soil vapour data were considered by AECOM to supersede the soil concentrations.
- Remediation Criteria exceedances for F1 and F2 TRHs superseded by consideration of specific criteria for aromatic/aliphatic species:
  - Specific criteria for narrow TRH fraction ranges were developed by AECOM (2016c), which are higher than the F1 and F2 TRH criteria (which are based on worst case assumptions about the relative representation of aliphatic versus aromatic species). These criteria are listed in Table S13 in Appendix N of AECOM (2026d), and a comparison is presented of results against the criteria in Table T7.

Excavation and removal of impacted soil associated with lead impacts, and of remnant infrastructure, including disused pipelines was conducted between November 2019 and June 2023. Areas of excavated soil and infrastructure have been backfilled with a mixture of imported Virgin Excavated Natural Material (VENM), trench material backfilled in place, and reused Site soil or crushed concrete.

Soil impacts are present in excess of the Remediation Criteria in the locations listed below:

- Fuel related impacts (TRH, naphthalene), which represent a potential risk of vapour intrusion to future Commercial/Industrial users, have been detected in the vicinity of LNAPL or locations associated with historical fuel handling, and were present in one soil stockpile used as backfill in an area formerly intended for development as an Open Space Recreation area.
- Impacts attributed to soil used for historic land reclamation (of lead and benzo(a)pyrene) which represent a potential risk to future Intrusive Maintenance Workers have been detected in some locations.

Further excavation to remove these impacts is not practicable currently. Impacts and risks to future users are considered able to be safely mitigated and managed in place by procedural and Personal Protective Equipment (PPE) controls noted in the report and documented in the SEMP.

Soil impacts which exceed the Remediation Criteria and remnant infrastructure may remain present in other areas of the Site, but remediation of these locations is not considered required prior to development of the Precinct South.

It is noted that the soil Remediation Criteria have been developed for human health exposure scenarios only and do not consider potential ecological receptors. Potential impacts to off-Site ecological receptors have been considered separately and are discussed below.

Potential Acid Sulfate Soil (PASS) has been identified in Site soil, as further discussed in Section 7.14.

7.13.4.6 Groundwater and LNAPL

Groundwater Well Network

Groundwater monitoring events have been conducted on 22 groundwater wells within the Precinct South, and 24 wells located in the remainder of the overall site, between 1996 and 2023.

The well locations are shown on Figure F6a. The wells are distributed spatially as follows:

- Groundwater wells MW03, MW05, MW06, MW13 (lost/destroyed after November 2019), MW16, MW154, MW188, MW193, PW02, S4, S6 and S8 assessed groundwater near LNAPL Plume B in the southeastern part of the Precinct South. MW188 is proximal to the lost MW13, and north of the UST Excavation Area. This is a total of twelve wells, of which three have been lost/destroyed.
- Groundwater wells MW163 and MW164 are located north of LNAPL Plume B along the eastern boundary of the Precinct South, and assessed groundwater in this area. These wells assist in delineating impacts from LNAPL Plume B and address the potential for groundwater contamination associated with on-Site sources such as the removed pipelines, and potential impacts from the former bulk fuel terminal for which large aboveground tanks were previously present in the nearby off-Site area (now TasPorts). These two wells remained current at the time of last sampling (June 2025).
- Wells TW03 (lost/destroyed after August 2018) and MW192, just north of the Precinct South (within the Precinct North), provided data to characterise conditions in the Precinct South.
- Wells MW162 and RN4 in the northwest part of the Precinct South, generally down-gradient from LNAPL plumes A1, A2 and A3, assessed potential impacts from these off-Site LNAPL plumes, as well as being proximal to removed infrastructure in the former Goods Shed Annex area.
- Wells MW137 (lost/destroyed after August 2019), MW142 (lost/destroyed after August 2018), MW143 (lost/destroyed after November 2019), MW146, MW55, MW124A, MW124B, MW127A, MW127B, MW155, MW175, MW176, MW185, MW186, MW187, and R4 (lost/destroyed after August 2018) were north and east of the Precinct South, and assessed groundwater in these areas or entering the Precinct South.
- Wells MW60, MW125A, MW125B, MW126A, MS126B, MW193, and S9 (lost/destroyed after November 2019) assessed groundwater in the southern part of the site.

- Wells MW150, MW151, MW152 and MW153 were off-Site to the south of the Precinct South, assessing conditions towards Sullivans Cove. Wells MW151, MW152 and MW153 were placed in a line towards where groundwater is inferred to migrate towards Sullivans Cove and assess impacts likely to represent contamination from the Site to the receiving surface water.
- TasPorts wells C1, MW134_GHD, MW135_GHD, MW136_GHD, PC12 and PC13 were used for gauging information. AECOM noted that access was provided intermittently only for gauging, and that no sampling access was granted.

Between December 1996 and June 2025, twenty six GMEs or other groundwater sampling events conducted at the Site have involved collection of samples from wells within and near the Precinct South (within the 20 m buffer zone and beyond to the south), as summarised in Table 7-3 (reproduced from Table 26 of the CUTEP Report).

Table 7-3: The Precinct South - Groundwater Monitoring Events (December 1996 to June 2025)

Sampling Event	Sampled Wells	
	Within the Precinct South	Within the 20 m Buffer Zone and surrounds
December 1996	MW03, MW06	-
February 1997	MW13, MW16	-
August 1997	MW06, MW13, MW60	MW55
January 1998	MW05, MW16	-
January 1999	MW03, MW13, MW16, MW60	MW55
March 1999	MW03, MW13, MW60	MW55
March 2001	MW03, MW05, MW06, MW13, MW16, MW60	-
June 2001	MW03, MW05, MW06, MW13, MW16, MW60	MW55
September 2001	MW03, MW05, MW06, MW13, MW16, MW60, PW02	MW55
October 2001	PW02	-
November 2001	MW03, MW05, MW06, MW13, MW16, MW60, PW02	MW55
August 2007	MW60	-
July 2009	MW60	-
January 2015	MW06, MW13, MW16, MW60, RN4, S4, S6, S8, S9	MW55
August 2015	MW126A, MW126B, S9	MW124A, MW124B, MW125A, MW125B, MW127A, MW127B
February 2016	MW125A, MW125B, MW126A, MW126B, S9	MW124A, MW124B, MW127A, MW127B, MW142
July 2016	MW06, MW16, MW60, MW125A, MW125B, MW126A, MW126B, RN4, S4, S9	MW124A, MW124B, MW127A, MW127B, MW142, MW146, TW03
May 2017	-	MW124A, MW124B, MW127A, MW127B
July 2017	MW06, MW16, MW60, MW125A, MW125B, MW126A, MW126B, RN4, S4, S9	MW124A, MW124B, MW127A, MW127B, MW142, MW146
February 2018	MW16, MW125A, MW125B, MWS126A, MW126B, RN4, S9	MW124A, MW124B, MW127A, MW127B, MW150, MW151, MW152, MW153, TW03
August 2018	MW16, MW126A, MW126B, MW154, S9	MW124A, MW124B, MW142, MW146, MW150, MW151, MW152, MW153, MW155
August 2019	MW06, MW13, MW16, MW126A, MW154, MW162, MW163, MW164, PW02, RN4, S4, S9	MW150, MW151, MW152, MW153, MW155, TW03
November 2019	MW06, MW13, MW16, MW125A, MW126B, MW154, MW162, MW163 MW164, RN4, S9	MW150, MW151, MW152, MW153, MW155, TW03
December 2022	-	MW127A, MW127B, MW150

Sampling Event	Sampled Wells	
	Within the Precinct South	Within the 20 m Buffer Zone and surrounds
December 2024	MW06, MW16, MW60, MW125A, MW125B, MW126A, MW126B, MW154, MW162, MW163, MW164, RN4, S4, S6	MW55, MW124A, MW124B, MW127A, MW127B, MW146, MW150, MW151, MW152, MW153, MW155, MW175, MW176
June 2025	MW125A, MW126A, MW164, MW188, MW193, MW06, MW60, RN4	MW127A, MW150, MW151, MW152, MW153, MW192, MW55

Some 22 wells within the Precinct South have been gauged or sampled at least once since January 2015, when AECOM commenced gathering data (earlier monitoring was conducted by other consultants). A further 12 wells within the 20 m buffer zone, and 16 wells, more than 20 m from the area boundary but considered relevant by AECOM to the assessment of groundwater, have been considered in AECOM (2026d).

During well maintenance works in late 2023 (AECOM, 2024d), and inspection of wells in early 2025 (AECOM, 2025a), a number of wells in or near to the Precinct South could not be located and were considered lost or destroyed. Replacement of wells was conducted in June 2025, and the location and purpose of the wells, and assessment of replacements, is presented in Table 25 in AECOM (2026d).

A comprehensive round of monitoring was conducted on wells in the Precinct South in December 2023. Fourteen wells within the Precinct South boundaries were sampled for analysis, as noted in Table 7-3 above. The four other wells existing in the Precinct South at the time were located within the extent of LNAPL Plume B, and so were not sampled for analysis. Wells MW188 and MW193, later installed as replacements for the lost wells S9 and MW13, did not exist in December 2023. Wells in the area surrounding the Precinct South, both within and proximal to the 20 m buffer zone outside the Precinct South boundaries were also sampled to provide context to surrounding groundwater conditions, as described in Table 7-3.

Sampling in June 2025 involved 20 wells (gauged) and eight wells (sampled) within the Precinct South. The eight sampled wells included new wells MW188 and MW193 (replacements for S9 and MW13), and wells along the southeastern perimeter, where the main known groundwater contamination is present and potentially migrating off-site (MW125A, MW126A, MW164, MW06, MW60), and well RN4, which assesses potential up-gradient groundwater migrating into the Precinct South.

Groundwater sampling before 2015 was not conducted by AECOM, and in some cases full reports with assessment of data quality were not available. Groundwater has been assessed mainly in respect of data obtained by AECOM since 2015.

Adequacy of Well Network and Sampling Frequency

The Auditor notes the following in regard to the adequacy of the well network.

- The well network and sampling regime has been focused on key areas of potential contamination that could cause risks to the developed site or pose risks to off-Site areas, particularly off-Site ecological receptors.
- Well density has been concentrated around the LNAPL Plume B area and south and east boundaries of the Precinct South. Wells in these areas have also provided assessment in the area around the former USTs which were removed, and around removed infrastructure in the Goods Shed Annex area.
- The wells in the Goods Shed area provide an indication of possible contamination entering the Precinct South from nearby up-gradient areas (including LNAPL Plumes A1, A2 and A3).
- Wells around the Precinct South both within the 20 m buffer zone and proximal to that zone provide added data to characterise groundwater conditions around the Site, particularly where groundwater is inferred to exit the Site and flow towards the receiving water of Sullivans Cove to the south. Wells to the east in TasPorts land have been able to be accessed infrequently for gauging, but access for sampling

has not been granted, despite requests by AECOM. This limits AECOM's ability to obtain groundwater concentration data in those areas, although gauging data and LNAPL measurements provide useful characterisation of LNAPL extent and likely stability.

Generally, the well network included wells at or proximal to key sources of potential contamination and locations where soil sampling detected elevated concentrations of hydrocarbons (over 1000 mg/kg). The following specific detail is noted:

- Concentrations of TRH >C10-C16 (minus naphthalene) (F2) exceeded 1,000 mg/kg at soil bore locations around the Former UST Area on the western edge of the southern part of the former SeaRoad Shed. Original wells MW13 (generally up-gradient) and S9 (generally down-gradient) of the Former UST Area provided information proximal to the former USTs. After these wells were noted to be lost/destroyed, new wells MW188 (up-gradient edge of the Former UST Area) and MW193 (approximately 15 m generally down-gradient) provided proximal data. As noted in Section 5.2.1.1.1 of AECOM (2026d), excavations extended through the water table, and no LNAPL was observed on standing water in the excavation base. AECOM also described a restriction preventing new wells being installed directly within the UST area, because of stormwater, power and communication lines being installed following the reinstatement of the excavations. Soil vapour monitoring in the backfilled excavation would likely have been compromised because of the disturbed geology, and vapour concerns for the area were considered to be represented by two vapour points installed to assess the western fringe of LNAPL Plume B (SV05 and SV30, since lost, both of which reported low hydrocarbon volatiles on the fringe of the plume). The Former UST Area was excavated to below the water table (based on field observations of groundwater with no observable signs of LNAPL flowing into the excavation at 2 mbgl (refer Plate 5 in Section 5.2.1.1.1 of AECOM (2026d)), so the source of hydrocarbons in the vadose zone was effectively removed from the area so far as reasonably practicable. Although a well centrally within the UST excavation area would have provided more direct groundwater information, the monitoring data from MW188 and MW193 are considered adequate to characterise conditions around the remediated zone.
- Concentrations of TRH >C10-C16 (minus naphthalene) (F2) over 1,000 mg/kg were identified at soil bore BH67, at 4.0 m depth, which is inferred to be below the water table based on interpolation between existing wells. A groundwater well was not installed at or close to BH67. Groundwater across the Precinct South and surrounds is considered, based on assessment across broad areas of the Site, to be unsuitable for extraction for use (other than for monitoring or remediation) and is planned to be managed by controls on extraction under the SEMP. Therefore, the key risk issue was considered to be the potential for vapour to affect Site uses. Soil vapour locations very close to BH67 were sampled (at SV23 and SV24) and identified no elevated vapours in 2019. These vapour locations were later removed during soil remediation works. On the basis that vapour risks were considered to be characterised and groundwater was to be managed to prevent extractive use, AECOM did not consider that an additional monitoring well was needed in this location. Although the Auditor considers that an additional well would have provided more specific groundwater information at the location, it is accepted that conditions are understood adequately to define management measures needed for the Site to be considered suitable for use.

Well installation was by a combination of direct push, air hammer, hollow stem auger, sonic and diamond core and nested sonic methods. The method of installation of MW60 is unknown.

Sampling methods were collected using low flow sampling, in general accordance with EPA Victoria Publication 668.1 *Hydrogeological Assessment (Groundwater Quality) Guidelines* and Publication 669.1 *Groundwater Sampling Guidelines*.

Overall, the network of wells and progressive sampling events are considered adequate to have characterised groundwater conditions sufficient to determine the practicability or otherwise of further active remediation, and to identify management requirements for protection of groundwater environmental values. It is noted that in some instances, groundwater analyses have not been undertaken for all analytes across all rounds of

sampling, and in some cases the most recent groundwater data at a particular well are relatively old. However, the data are considered adequate to evaluate the condition of the Site in respect of whether unacceptable impacts exist and require management under the SEMP.

Groundwater Tier 1 Impacts to PEVs

The dataset for groundwater from wells presents within Precinct South, and the surrounding areas, has been assessed against adopted Tier 1 criteria for PEVs.

Based on recorded TDS concentrations, PEVs have been identified as described in Section 6.2 of this audit report.

Figure F14a (on Site) and Figure F14b (nearby off-Site) show the spatial and temporal spread of Tier 1 criteria exceedances in analyses for the PEVs of Drinking Water use (Human Health and Aesthetics) and Primary Contact Recreation.

Figure F15a (on Site) and Figure F15b (nearby off-Site) show the spatial and temporal spread of Tier 1 criteria exceedances in analyses for Ecosystem Protection, Buildings and Structures, Irrigation and Stock Watering. It is noted that Ecosystem Protection exceedances do not strictly apply in the groundwater on Site, as there are no known on Site aquatic ecosystems, and the potential effect of on Site groundwater contamination to the off-Site receiving water of the Derwent River and Sullivans Cove has been considered in AECOM (2025e).

Figure F16 considers groundwater Tier 1 exceedances for vapour intrusion, noting that these are superseded by Remediation Criteria (for some scenarios) and direct vapour measurements.

A summary of impacts to PEVs for on Site groundwater is provided in Table 7-4 below, summarised from Table 33 of AECOM (2026d). The AECOM table also summarises exceedances of PEV criteria in the surrounding area, with the summary indicating similar contaminants in the surrounds. It is noted that these exceedances are across all available data. While Table 32 of AECOM (2026d) depicts exceedances in the most recent round of monitoring, the Auditor considers the below summary from Table 33 of AECOM (2026d) to be more relevant, because not all wells were sampled in June 2025, including some where exceedances of criteria were found in the last monitoring round at various wells.

Table 7-4: Groundwater Impacts to On Site PEVs

Precluded Beneficial Use	Contaminants
Water dependent ecosystems (90% of species) (1)	LNAPL Metals – aluminium, copper, chromium, lead, manganese, zinc; TRH – >C10-C40; PAH – anthracene, phenanthrene, fluoranthene, benzo(a)pyrene; Nutrients – ammonia (as N); PFAS (95% of species) - PFOS
Drinking Water (Human Health and Aesthetics)	LNAPL TDS (aesthetics only), Metals – arsenic, aluminium (aesthetics only), cadmium, chromium, iron, lead, manganese, zinc; Major Ions – chloride (aesthetics only), sodium (aesthetics only), sulphate (as SO4); Nutrients – ammonia (as N) (aesthetics only); Cyanide (total) (health only); Escherichia Coli (E.coli) (health); MAH – benzene (health), ethylbenzene (aesthetics only), n-propylbenzene (health only); PAH (aesthetics only) – naphthalene, benz(a)anthracene, benzo(a)pyrene, 1-methylnaphthalene, indeno(1,2,3-cd)pyrene, chrysene, pyrene; PFAS – PFOS
Recreation (Primary / Secondary Contact)	LNAPL Metals – lead, manganese Escherichia Coli (E.coli) PAH – naphthalene, benz(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benz(a)anthracene
Irrigation	LNAPL Metals – boron, iron, lead, zinc
Stock Watering	LNAPL Metals – lead Major Ions – calcium Nutrients – phosphorus, total nitrogen (as N)
Industrial and Commercial	No criteria identified
Buildings and structures	Major Ions – chloride, sulfate (as SO_4)
Vapour Intrusion	TRH (residential use only): C6-C10 (minus BTEX)3, >C10-C16 (minus naphthalene), >C8-C10 (aliphatic), >C12-C16 (aliphatic) Methane

In regard to the above groundwater Tier 1 criteria exceedances, manganese, zinc and TDS are considered to be naturally occurring, with TDS related to nearby seawater ingress into the reclaimed area, and manganese being a natural component of dolerite rock.

Methane and ammonia may be sourced from natural organic matter in the marine sediments, but may also be Site-sourced, associated with the breakdown of hydrocarbons (to methane) or (while not mentioned by AECOM) from the sewer where it runs across the Site.

LNAPL is or was previously present on groundwater in and hydraulically up-gradient of the Precinct South. Groundwater and LNAPL remediation has been conducted on LNAPL Plume B (within the Precinct South) and LNAPL Plumes A1, A2 and A3, which are located hydraulically up-gradient, between 2000-2001 and

November 2015 – November 2017, and it was concluded at the completion of remediation that further clean-up was not practicable. Further assessment of the potential mobility of LNAPL Plume B in March 2024, and of the mobility and recoverability of all four LNAPL plumes in June 2025, concluded that this assessment is still valid. (Refer Section 7.7 of this audit report.)

The potential for groundwater conditions to impact off-Site ecosystems has been considered by AECOM (2025e), concluding that the on-Site contamination does not pose a likely risk to the receiving water of the Derwent River or Sullivans Cove. The Auditor agrees with this conclusion. (Refer Section 7.3 of this audit report.)

All other PEVS impacts relating to groundwater can be managed by non-extraction of groundwater for use (other than for monitoring or remediation), and vapour mitigation to account for methane or volatile hydrocarbon risk, and so can be managed under the SEMP.

Groundwater Remediation Criteria Impacts to PEVs

Groundwater data has been assessed against the Remediation Criteria for the same future uses as soil, and no exceedances of Remediation Criteria have been detected in recent data. One exceedance of the Remediation Criteria was detected in the groundwater sample collected from well MW155 in the Precinct North (some 50 m north of the Precinct South) for benzo(a)pyrene in 2018, but has not re-occurred in subsequent monitoring events, and is not considered likely to be characteristic of groundwater in the Precinct South.

AECOM considered that no further groundwater remediation was necessary, noting that:

- LNAPL remains in the southeast of the Site, is considered to have been cleaned up to the extent practicable and is subject to management under the SEMP.
- The Remediation Criteria assumed groundwater will be at more than 2 m depth (that is, well below the base of structures), except for considerations of health risk based on a working within a basement scenario which assesses risk including from seepage water. AECOM (2025c) conducted a review of the remediation criteria and determined that the Remediation Criteria would not change materially (<20%) if groundwater was present at >1 mbgl, see Section 6.2.2 of this audit report.

Groundwater Contaminant Concentration Trends

AECOM included Mann-Kendall analysis for contaminant concentration trends, in Appendix L of AECOM (2026d). The increasing trend analytes are summarised by well in Table 34 of the AECOM report. As noted by AECOM, trends are mostly for:

- Contaminants considered to be naturally occurring (manganese)
- Low concentration results below Tier 1 criteria (for which trend analysis would not generally be considered)
- TRH in off-Site well MW152 (where up-gradient and down-gradient wells do not reflect changes from inferred migration, and may be due to off-Site sources in the adjacent carpark area)
- PAH species of low inherent mobility, and evidence from filtered versus unfiltered samples indicates the bulk of detected contaminants are not in the dissolved phase.
- Where ammonia concentrations, which are expected to attenuate before reaching the water dependent ecosystem and are not considered to pose a risk to off-Site receptors.

The Auditor has reviewed the tabulated concentration data and agrees that the concentration trends do not indicate a change in groundwater conditions representing a worsening impact to receptors over time.

7.13.4.7 Soil Vapour

Indoor air and soil vapour monitoring has been conducted across the Site between 2015 and 2025, including at locations within and immediately adjacent (within the MPDC site) to the Precinct South. No indoor air or soil vapour sampling has been undertaken outside the overall MPDP site.

Vapour sampling included ambient air monitoring and indoor air (in the period 2015 to 2019) in and around the Red Shed and SeaRoad Shed. Sub-slab pins and soil vapour bores were sampled over that period and sampling, including new locations, was also undertaken in June 2025. Sampling was from sealed sampling locations that were integrity-tested, with tracer testing using inert gas undertaken. Sampling was undertaken using laboratory-supplied cannisters.

Soil vapour locations were targeted across the overall site in areas of inferred potential hydrocarbon vapour intrusion risk, based on either soil or groundwater contaminant concentrations above Tier 1 vapour intrusion criteria, or near LNAPL plumes. This approach was adopted rather than conducting vapour sampling in a close-spaced grid across the site because the areas of inferred risk were relatively isolated and focused around LNAPL or other significantly impacted areas.

Analytical results were compared to CRC CARE 2011 HSL A/B (residential), HSL C ((recreational), HSL D ((commercial/industrial), and HSLs for intrusive maintenance workers, for benzene, toluene, ethylbenzene, naphthalene, and aliphatic/aromatic TPH fractions. Methane concentrations were compared to a CRC CARE 2013 Action Level (subsurface near foundations) of 1.25% v/v.

None of the soil vapour results exceeded the adopted criteria, with the exception of one sample at SV26 in the nearby Precinct North in 2019 (where the concentrations were above residential and commercial/industrial criteria). SV26 was lost between 2019 and 2025 and was replaced by SV34. Although AECOM noted that the potential for a risk to exist around SV26 was mitigated by the nearby lower result in SV34, they also noted that the result from SV26 indicated potential for a risk to exist at the boundary of the Precinct South, in the eventual scenario of the Site surface being lowered.

Methane routinely exceeded the CRC CARE Action level of 1.25% v/v and was recorded at up to 75% v/v (SV34 on the northern boundary), 59% v/v at the lost SV26, and 35% v/v at SV25. Methane in soil vapour is consistent with groundwater concentrations which indicated elevated methane.

The source of the methane was not confirmed – it could be from organic matter (either natural or buried in the fill) or from hydrocarbon breakdown, although AECOM considered that methane in the Former UST Area was unlikely to have arisen from TRH degradation.

AECOM calculated a GSV at SV34 of 0.3 L/hr. While this is below the threshold for Characteristic Situation 3 (CS3) – Moderate Risk (EPA NSW, 2020), this was based on only one round of flow monitoring, where some sampling occurred under pressures indicating possible flow from atmosphere into the ground, which may not be reliable for assessing flow rates for GSV calculation. AECOM therefore conservatively assessed methane to represent CS3 per the NSW guidelines.

The Auditor agrees that in the absence of better flow data, the CS3 rating is appropriate. In any case, the NSW guidelines note that where methane exceeds 20% v/v, an increase to CS3 should be considered regardless of flow. In this case, where the highest readings have been over 70% v/v, the adoption of CS3 is considered appropriately conservative. The Auditor notes that comprehensive flow monitoring and a greater level of assessment could potentially have been used to assess a lower CS value, but was not undertaken by AECOM.

Based on the CS3 rating, and the proposed future development of the area (Multipurpose Stadium and Integrated Mixed Use - considered by AECOM to be equivalent to conservatively represent ‘Standard Commercial Building’), a minimum gas protection guidance value of 2, per Section 5.3.2.2 of AECOM (2026d), should be incorporated into the future development.

In addition, AECOM considered that based on the proposed building footprints extending across areas of the Site where vapour risks may exist, and from where vapour may migrate under continuous building footprints, the future vapour barrier is required to also provide protection against vapour intrusion of benzene, naphthalene, and total recoverable hydrocarbons (TRH). AECOM also notes at Section 7.4.3 of their report (AECOM, 2026d) that the need to protect against hydrocarbon vapours arises because of proposed changes in surface elevation. This is because while vapour measurements were used to supersede the exceedances of Tier 1 criteria, the vapour characterisation may not be valid with a reduced vadose zone and shallower depth to source material when the surface is lowered.

Indoor air monitoring results that have been obtained are not considered directly relevant to the future development of the Site, as the structures monitored are not retained in the proposed development.

7.13.4.8 Ecological Impacts

As discussed in Section 7.2 and 7.3, the *Assessment of Potential Off-Site Ecological Impacts* (AECOM, 2020b) was prepared to evaluate the potential risk to identified ecological receptors from groundwater impacts on the Site, primarily the nearby marine ecosystems of the Derwent River and Sullivans Cove, which contain the inferred points of discharge of Site groundwater.

Based on the weight of evidence approach, which considered concentrations of CoPC, composition and stability of LNAPL impacts, and interaction between groundwater and seawater, including the effects of subsurface infrastructure and sea walls, it is considered that groundwater emanating from the Site boundary is unlikely to pose an unacceptable risk to off-Site aquatic ecological receptors within the Derwent River and Sullivans Cove.

Review of the outcomes of AECOM (2020b) was undertaken in 2025 in *Addendum to Assessment of Potential Off-Site Ecological Impacts* (AECOM, 2025e). The review considered additional data collected since initial issue of the assessment on the Site's environmental condition and changes in proposed future development. Further assessment of ecosystem classification and associated species protection was included along with changes in CoPC, and the impacts on remediation work undertaken since 2020.

This assessment concluded that the outcomes of the AECOM (2020b) assessment remain valid and suitable for ongoing assessment of the Site. No material changes in the off-Site aquatic ecological risk profile have been identified, and ecological risk to receptors in the Derwent River and Sullivans Cove remains low.

7.14 ACID SULFATE SOIL INVESTIGATION (AECOM 2025D)

Sampling to assess Actual Acid Sulfate Soil (AASS) or Potential Acid Sulfate Soil (PASS) presence was undertaken for the overall site in 2024 and reported in *Acid Sulfate Soil Investigation* (AECOM, 2025d). The assessment indicated:

- No AASS was detected in any soil samples collected from the overall site (including from within the Precinct South).
- PASS was detected in fill and natural estuarine material within the Precinct South and the overall site.
- The Acid Neutralising Capacity (ANC) of soil was considered likely to be greater than the potential for acidification, with the exception of some samples (primarily natural estuarine soil beneath the water table), and was likely to prevent the acidification of soil.

The SEMP (AECOM, 2026c) attached to the Site Suitability Statement describes the scope of an Acid Sulfate Soil Management Plan (ASSMP) and a Dewatering Management Plan (DWMP) which is required to be implemented for works where disturbance of PASS may occur.

8. QUALITY AND COMPLETENESS OF DATA

This environmental audit report relies upon site assessment works conducted by AECOM as the assessment consultant (with soil remediation and validation undertaken by Elgin (supporting AECOM) during excavations by BlackCap, and by Geo-Environmental Solutions (GES) in support of remediation works undertaken by Synergy in the far north of the Precinct South). The following appraisal of the site assessor's investigation addresses the following:

- Appropriateness and completeness of the assessment with respect to the potential for contamination on the Site;
- Validity of the investigation data with respect to data quality; and
- Appropriate and correct interpretation of the data and justification for the assessment conclusions.

These factors are considered in the following three sections.

8.1 CONFORMANCE WITH EPA VICTORIA REQUIREMENTS

As part of the environmental audit, the work completed by AECOM and others has been reviewed by the Auditor in the context of its completeness in accordance with Appendix 2 of the EPA Victoria (2015) Publication 759.3 *Guidelines for Issue of Certificates and Statements of Environmental Audit*, as summarised in Table 8-1 to Table 8-4 below.

Table 8-1: Contents of Site Assessment Reports

History of the Site and adjacent land uses	The history of the Site has been described in detail in the DSI reports (AECOM 2021a and AECOM 2022), the CUTEP report (AECOM 2025b) and the SEMP report (AECOM 2025d). The contaminants associated with the uses have been adequately identified.
Visual Inspections	The Auditor (and/or his representative) has visited the overall site on multiple occasions and also has been involved in virtual video link tours. In addition, numerous visual inspections have been completed by AECOM during the course of the assessment works. Records of site observations are documented throughout the available AECOM reports.
Geology and hydrogeology	Broad descriptions of the regional geology and hydrogeology were provided, along with detailed information obtained by numerous rounds of intrusive soil and groundwater investigations, documented in borelogs and field sampling sheets.
Condition of Site structures and water courses	The DSI reports (and Remediation Validation report) describe various existing, former and buried structures across the Site. There are no water courses on-Site, although the rivulet diversion lies to the north of the overall site. The *Off-Site Ecological Impact report* (AECOM, 2020b) provides information regarding down-gradient surface water receptors.
Analytical detection limits	Soil and groundwater analyses were completed by NATA accredited laboratories. Laboratory detection limits for soil were below the adopted criteria with the exception of F2 hydrocarbons (25 mg/kg for 0-1 m in sand, versus a detection limit of 50 mg/kg), a range of PAHs and halogenated compounds. Laboratory detection limits for groundwater were below the adopted criteria with the exception of several PAHs (naphthalene, benzo(a)pyrene, benz(a)anthracene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, sum of PAHs) and phenolic compounds (4,6-dintro-2-methylphenol [dinitro-o-cresol]), 2-cyclohexyl-4,6-dinitrophenol, dinoseb, 2-chlorophenol, 2,4- dichlorophenol). Detection limits for soil vapour samples were below adopted criteria. For soil, the above criteria laboratory detection limits would not be considered to compromise the data set, given the F2 hydrocarbon exceedance is also addressed by the direct assessment of soil vapour impacts (which included NAPL-impacted areas and found no risks), and the other contaminants were either less volatile PAHs (which will be managed by engineered break layers), or were not expected COPCs. For groundwater, the above criteria laboratory detection limits were not considered to compromise the CSM – the Auditor notes that there is an assumption of exceedances of ecosystem criteria (for metals, TRH and PAHs) in the Precinct South (where LNAPL remains present), but that this does not pose a risk to the wider ecosystem at the point of discharge to surface water. The halogenated compounds exceed groundwater criteria for the PEV of drinking water, which is an implausible use on the Site and will be controlled by restriction of groundwater extraction.

Table 8-2: Scope of Site Investigation to support an Environmental Audit

Sampling and analysis program	The methodologies provided in the AECOM assessment reports were reviewed by the Auditor and were considered to comply with the following guidance documents: • National Environment Protection Measure (Assessment of Site Contamination); • EPA NSW (2022), *Contaminated Land Guidelines - Sampling Design Part 1 – Application*, Environment Protection Authority New South Wales; • AS 4482.1-Australian Standard, *Guide to the sampling and investigation of potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds*; • AS 4482.2-Australian Standard, *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile substances*; Soil sampling density is considered to be adequate across the various investigation and remediation validation stages to identify contamination status across the Site. Although heterogeneity of fill materials means that conditions may vary locally from those reasonably inferred to exist based on sampling, this is true for any site where heterogeneous fill exists. In this regard, the management of residual Site contamination under the SEMP is considered appropriate to deal with potential variability in conditions between sampling points. Groundwater sampling locations were targeted towards known or likely contamination by LNAPL, and in inferred down-gradient areas towards Site boundaries. While additional groundwater wells would have ideally been installed at some additional on Site locations (such as directly within the

	Former UST Area, and near BH67), the assessment is considered to have been adequate to describe the risk posed by conditions at the Site (including to off-Site receptors), and to define SEMP management requirements. Additional data from monitoring in off-Site areas (particularly TasPorts land to the east) would have been preferable, but AECOM advised that access to existing wells was granted only intermittently and for gauging only. Despite the limitations on data availability, AECOM has reached conclusions regarding the level of risk to off-Site receptors, and the conclusions are considered reasonable based on the data availability and limitations in those areas. Soil vapour sampling was undertaken at targeted locations to assess worst case risks, rather than by adopting a close-spaced grid sampling approach across the Site. In monitoring, flow readings were not recovered in a range of sampling rounds, and ambient conditions were not confirmed to represent optimal (low/falling pressure) conditions to assess worst-case gas emissions (particularly as relates to the gas screening value). Because of this, AECOM has been cautiously conservative in nominating a Characteristic Situation value. In the absence of more comprehensive data, the Auditor supports the approach adopted. Overall, the Auditor was satisfied that the sampling and analysis program was sufficient and in accordance with the Site history information and CSM.
Compliance with approved methods/protocols	The AECOM reports include information to support that appropriate field investigation and sampling methods were adopted. The scope of work for each stage of investigation was discussed with the Auditor in advance of execution and so potential for non-compliance was generally eliminated.
Laboratory accreditation	The Auditor has reviewed the laboratories used and confirms that all laboratories used were NATA-accredited for the analyses performed as part of the recent assessments (ALS and Eurofins for soil and groundwater, and SGS and NMI for soil vapour samples.)
Site plans and bore logs	Site plans showing the Site locality, locations of sampling points, historical uses, development areas, groundwater contours and analytical results exceeding criteria are provided in the various assessment and investigation reports. These components are summarised for the Precinct South in the CUTEP report (from which figures have been extracted for this audit report). Borelogs are presented in the DSI reports and included in Appendix H of the CUTEP report. As noted by AECOM, a small number of older bores did not have available bore logs, but these represent a minor proportion of all bore logs and their absence does not materially change the interpretation of Site conditions that can be made from the logs that do exist. Some of the reports were prepared without regard to the boundaries of the Precinct South, so in many instances it is difficult when reviewing the reports to distinguish data that are within or without the Site boundary. However, the Site boundaries are shown, and tabulated results are isolated for the Precinct South (and the 20 m buffer zone showing proximal conditions) in the CUTEP report and also the *Well Maintenance and Targeted Groundwater Monitoring Event* (AECOM, 2024d).

Quality assurance	AECOM (and others) implemented a QA/QC program throughout the assessment process. The data validation criteria, quality assurance and quality control results are presented in Section 5.7 and Appendix M of the CUTEP report, which summarises the locations of data quality investigations (data quality objectives, calibration certificates, borelogs, sampling sheets, well development details, analytical results, data validation) for the following reports:
	• Soil and groundwater investigative assessments:
	  ○ Between 2015 and 2023
	  ○ In 2024 for *in situ* waste categorisation.
	• Soil, Soil Vapour and Indoor Air Investigations 2019
	• Groundwater and soil vapour investigations in June 2025
	• Remediation Validation Soil Sampling
	Appendix M of the CUTEP report consolidated the assessment of Data Quality from the above reports.
	The Auditor undertook a review of the QA/QC program undertaken by AECOM and found that generally the works undertaken met the requirements of AS 4482, the NEPM (2013) and EPA Victoria Publication 668 (2006). Some deficiencies were identified in the program, and these are discussed below.

Background samples	Groundwater well BG1, located to the northwest of the overall site, is considered to be representative of background groundwater conditions. AECOM (2020b) noted exceedances of Tier 1 criteria inferred to represent background conditions as follows:

	• Ecosystem Protection: manganese and copper • Drinking Water (Aesthetics): TDS Although background soil samples were not specifically collected, the soil sampling conducted on surrounding areas of the overall site are considered to be representative of background soil conditions.
Soil screens/targets contaminants	The earlier soil and groundwater analytical program included a broad suite of analytes to ensure other contaminants were not present. Subsequent sampling programs focussed on the identified contaminants of potential concern (CoPC). The range of contaminants assessed is considered to have been appropriate and provides a robust assessment of the Site conditions. The soil vapour sampling conducted included an appropriate range of contaminants, noting an absence of chlorinated hydrocarbons in widespread soil and groundwater testing as a reason to exclude them from vapour sampling.
Other environmental hazards	Nil.

Table 8-3: Information required for contaminants of potential concern

Chemical properties	AECOM has identified the contaminants of potential concern (CoPC) in the soil, groundwater and soil vapour at the Site based on the Site history and historical assessment works. A conceptual site model (CSM) in Section 3 of the CUTEP Report presents the potential exposure pathways, transport mechanisms and sensitive receptors. The CSM is also described in Section 5 of this audit report. The AECOM DSI reports and the CUTEP Report (Section 7.4) includes a comparison of the final soil condition with adopted soil guideline concentrations, and a discussion on the potential impacts to PEVs of land. The CUTEP report includes a comparison with the adopted groundwater guideline concentrations and a discussion on the potential impacts to PEVs of groundwater (Section 5). The *Soil Vapour and Indoor Air Assessment 2019* (AECOM, 2021c) includes an assessment of vapour intrusion risks, relevant to human health, including the explosive risk from methane. Overall, the information provided regarding contaminants of potential concern (CoPC) considers the form of the species present, including physical characteristics, exposure pathways, harm and detriment to PEVs, including those off-Site, and is considered sufficient for the purposes of this environmental audit.
Form / species	
Physical characteristics	
Potential harm	
Detriment to beneficial uses/environmental values	
Potential off-Site effects	

Table 8-4: Assessing the significance of Site investigation results

Reference to SEPPs	The significance of soil assessment results in terms of potential impacts to PEVs of the Site, were assessed against the Land SEPP. The significance of groundwater assessment results in terms of potential impacts references the Tasmanian Government *State Policy on Water Quality Management* (1997) [SPoWQM]. Reference is also made to EPA Victoria Publication 840.2: *The cleanup and management of polluted groundwater* (2016).
Evaluation of risk in compliance with NEPM	An evaluation of risk was undertaken by comparison of soil, groundwater and soil vapour analytical results with established criteria provided in the NEPM, ANZG, NEMP and other relevant guidelines.
Use of other guidelines	In cases where NEPM, ANZG or NEMP criteria were not available, other published national and international guideline criteria were used to evaluate risk.
Consideration of impact to all beneficial uses /PEVs	Beneficial uses/PEVs associated with on-Site receptors (Site occupants and ecosystem receptors) were considered. The PEVs of groundwater both on and off Site were considered.
Waste classification	Waste classification for off-Site disposal of excavated soil was completed in accordance with the EPA Tas *Information Bulletin No. 105: Classification and Management of Contaminated Soil for Disposal* (IB105) (EPA, 2012), including EPA approvals.

8.2 QUALITY OF ASSESSMENT DATA

Section 8.1 of this audit report reviews the content and quality, in general terms, of the assessment and validation reports. This section of the report focuses on the fieldwork and analysis undertaken as part of the Site investigations and quality control undertaken by AECOM (and others) and the laboratories selected to analyse samples.

As part of the assessment works, AECOM (and others) implemented a quality assurance program to ensure the reliability and traceability of samples collected. It is noted that key features of this program were:

- Preservation and storage of samples upon collection and during transport to the laboratory in order to maintain sample integrity and sample temperatures in accordance with AS 4482.
- Vapour sampling was conducted in accordance with Technical Report no. 10, 2011, *Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 1: technical development document* (CRC CARE, 2011a)
- Sample holding times to maintain sample integrity in accordance with AS 4482 and Victorian EPA Publication IWRG701;
- Use of appropriate analytical procedures in accordance with NATA requirements.
- Required limits of reporting (LORs) to be below applied guideline concentrations (assessment criteria);
- Frequency of conducting quality control measurements as defined in AS4482, NEPM (2013) and IWRG701;
- Checking of laboratory blank results to assess the potential for incidental or accidental contamination or analytical interference within the laboratory;
- Checking of field blanks such as rinsate and trip blanks to assess the potential for incidental or accidental sample contamination;
- Matrix spike recovery results in order to assess the effects of the sample matrix on the precision and accuracy of the analyses (the desired matrix spike recovery range is between 70% - 130%);
- Laboratory control sample recovery results in order to assess analytical method precision and accuracy independent of sample matrix;
- Surrogate spike results in order to assess the accuracy of organic analyses that involve chromatographic techniques. (The desired surrogate recovery range is between 70% - 130%, except where the laboratory has specific recovery ranges);
- Comparison of field and inter-laboratory duplicate results with parent sample results to ensure that the relative percent difference is within acceptable ranges; and
- Investigation of the occurrence of apparently unusual or anomalous results.

The following non-conformances were noted with regards to the assessor's procedures and quality control objectives:

- A number of samples exceeded the recommended temperature range as noted in laboratory certificates, for both soil and groundwater. Evidence of chilling was generally recorded, and the temperature variations are not considered to significantly affect the data integrity.
- Holding times were mostly complied with for soil and groundwater samples, although AECOM excluded some samples from the dataset where it was considered the holding time non-compliance could affect sample integrity.
- A number of duplicate soil pair results (both inter and intra lab duplicates) were outside the recommended RPD ranges. Of these RPD exceedances, approximately 85% (i.e. 770 of 907) are attributed to concentrations of PAHs and TRHs, and the remainder are attributed to other chemicals including total cyanide, metals, phenolic compounds, naphthalene, PCBs, OCPs, anilines and benzidines. While

AECOM noted only the over 90% compliance with recommended ranges as acceptable, the Auditor notes that RPD variation is routinely present in heterogeneous soil sampling – which constitutes a large proportion of the non-compliant results.

- Groundwater inter and intra laboratory duplicate pairs were highly compliant, with approximately 3% of pairs outside the recommended RPD range, those being for metals, ammonia, ferrous iron, sulfate, total dissolved solids (TDS), methane and PFOS. Given >97% of the RPD results were reported within acceptable limits, these are not considered to have affected the overall quality of the groundwater data for interpretive use.
- A range of rinsate blank samples from DSI field works detected variously low concentrations of metals (mostly copper and manganese, but including barium, nickel, zinc, and cadmium) and ammonia.
- The Auditor notes that for *Remediation Validation Report - Audit Areas 2 and 7 and Pipeline Removal* dated 27 April 2021 (AECOM, 2021d), ALS in Melbourne was used as primary laboratory with ALS Laboratory in Sydney (ALS Sydney) and Eurofins Laboratory in Melbourne were selected as the secondary laboratories. While there is a degree of independence, a totally separate laboratory should have been used. For other assessments, ALS (primary) and Eurofins (secondary) were used to ensure independence.
- As noted in Table 8-1 above, a number of analyte laboratory detection limits exceeded criteria, but these were not considered to affect the overall characterisation of the Site.

While there were some irregularities in the QC results presented, these were not considered to materially compromise the dataset, and analytical data was found to be directly usable in this audit report.

8.3 AUDITOR OPINION ON ADEQUACY OF DATA

From an overall perspective it is concluded that the dataset obtained from the reports prepared by AECOM provides a reliable understanding of potential Site contamination and is of sufficient quality to support the audit requirements. The following notes are provided in respect of this overall view.

- Appropriateness and completeness of the assessment with respect to the potential for contamination on the Site.
  - The appropriate potential contaminants have been targeted in locations where impacts are more likely to exist.
  - LNAPL behaviour in response to direct LNAPL remediation was investigated and a reasonable position reached regarding the impracticability of further LNAPL removal.
  - Vapour assessment was used to assess vapour risks more directly than by consideration of soil and groundwater concentrations alone. Although more comprehensive assessment could have been pursued for methane concentrations and flows, conservative assumptions were made based on the level of data obtained to specify management requirements that would be protective of receptors.
  - Groundwater assessment targeted the most likely impacted areas, and the down-gradient boundary. AECOM reported limited access off-Site to the east, allowing for only intermittent gauging and no groundwater analysis, so interpretations have been made based on data that was practicably able to be obtained.
- Validity of the investigation data with respect to data quality.
  - Appropriate QA was adopted and QC testing undertaken to consider that the dataset used is adequate to have characterised site conditions sufficiently to support auditing of the site.
- Appropriate and correct interpretation of the data and justification for the assessment conclusions.
  - Interpretation of data is considered to have been appropriate for the purposes of the assessment reporting.

9. ASSESSMENT OF RESIDUAL CONTAMINATION AND RISK

9.1 SOIL - NATURE AND EXTENT OF RESIDUAL SOIL CONTAMINATION

The final condition of soils at the Site is described in Section 5 of the CUTEP Report, as discussed in Section 7.13 of this audit report. The data set used includes assessment of the excavation validation results and the DSI investigation results across the overall site, where DSI data remain relevant (some soils included in earlier DSI data were removed by remediation excavations).

9.1.1 Tier 1 Criteria Exceedances

As described in Section 7.13 of this audit report, concentrations of PAHs [naphthalene, benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, sum of PAHs], TRHs [TRH >C10-C16, TRH >C16-C34, TRH >C34-C40, aliphatic TRH >C10-C12, aromatic TRH >C10-C12, aliphatic TRH >C12-C16, aromatic TRH >C12-C16, TRH >C6-C10 (minus BTEX) (F1), TRH >C10-C16 (minus naphthalene) (F2)], metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), and cyanide in soil remained above Tier 1 Criteria at numerous locations for the following PEVs:

- Modified and Highly Modified Ecosystems
- Human Health Direct Contact – Low Density Residential
- Human Health Direct Contact – Medium/High Density Residential
- Human Health Direct Contact – Recreational/Open Space
- Human Health Direct Contact – Commercial/Industrial
- Human Health Vapour Intrusion – Residential (Low and High Density)
- Human Health Vapour Intrusion – Commercial/Industrial

The number of exceedances for analytical results of samples is summarised in Table 9-1 below for a range of phases of investigation where these exceeded Tier 1 Criteria (but were below site specific Remediation Criteria) consisting of the following:

- investigation sampling results for soils remaining *in situ* (i.e. not remediated nor moved),
- remediation validation sampling, and
- from backfill soils (in a small number of cases).

It should be noted that the Tier 1 exceedance risks are obviated by the proposed nature of the development, inapplicability (vapour screening levels based on aromatic/aliphatic splits) or further assessment (such as vapour risk assessment), as well as management measures proposed by AECOM.

Table 9-1 below summarises the contaminant exceedances for the Site (including the 20 m buffer zone) relevant to the land use scenarios and PEVs.

Table 9-1: Summary of Tier 1 Screening Criteria Exceedances Within the Precinct South and 20 m Buffer Zone

Protected Environmental Value (PEVs)	Land Use Scenario	Contaminant exceeding criteria – Precinct South	Contaminants exceeding criteria 20 m Buffer Zone
Maintenance of Ecosystems	Modified and Highly Modified Terrestrial Ecosystems	TRH >C6-C10 TRH >C10-C16 TRH >C16-C34 Benzo(a)pyrene Arsenic Copper Lead Nickel Zinc PFOS	TRH >C6-C10 TRH >C10-C16 TRH >C16-C34 TRH >C34-C40 Benzo(a)pyrene Arsenic Copper Lead Nickel Zinc
Human Health	Direct Contact (Low or High Density Residential)	TRH >C10-C16 (minus naphthalene) (F2) TRH >C16-C34 TRH >C34-C40 Benzo(a)pyrene TEQ Benzo(a)pyrene Sum of PAHs Dieldrin Arsenic Cadmium Chromium Lead Zinc Cyanide PFOS	TRH - >C10-C16 (minus naphthalene) (F2) TRH >C16-C34 TRH >C34-C40 Benzo(a)pyrene TEQ Benzo(a)pyrene Sum of PAHs Lead PFOS
	Human Health Direct Contact – Recreational/ Open Space	TRH >C10-C16 (minus naphthalene) (F2) TRH >C16-C34 TRH >C34-C40 Benzo(a)pyrene Benzo(a)pyrene (TEQ) Sum of PAHs Dieldrin Arsenic Chromium Lead Cyanide	TRH >C10-C16 (minus naphthalene) (F2) TRH >C16-C34 PAH – Benzo(a)pyrene Benzo(a)pyrene (TEQ) Sum of PAHs Lead

Protected Environmental Value (PEVs)	Land Use Scenario	Contaminant exceeding criteria – Precinct South	Contaminants exceeding criteria 20 m Buffer Zone
	Human Health Direct Contact – Commercial	TRH >C10-C16 (minus naphthalene) (F2) TRH >C16-C34 Benzo(a)pyrene TEQ Benzo(a)pyrene Sum of PAHs Dieldrin Cyanide Lead	TRH >C10-C16 (minus naphthalene) (F2) TRH >C16-C34 Benzo(a)pyrene TEQ Benzo(a)pyrene Sum of PAHs Lead
	Human Health Vapour Intrusion - Residential	TRH >C6-C10 (minus BTEX) (F1) TRH >C10-C16 (minus naphthalene) (F2) Aliphatic >C12-C16 Aromatic >C12-C16 Aliphatic >C6-C8 Aliphatic >C8-C10 Aliphatic >C10-C12 Aromatic >C8-C10 Aromatic >C10-C12 Naphthalene	TRH >C6-C10 (minus BTEX) (F1) TRH >C10-C16 (minus naphthalene) (F2) Aliphatic >C12-C16 Aromatic >C12-C16 Aliphatic >C6-C8 Aliphatic >C8-C10 Aliphatic >C10-C12 Aromatic >C8-C10 Aromatic >C10-C12 Benzene Naphthalene
	Human Health Vapour Intrusion – Commercial	TRH >C6-C10 (minus BTEX) (F1) TRH >C10-C16 (minus naphthalene) (F2) Aliphatic >C12-C16 Aromatic >C12-C16 Aliphatic >C8-C10 Aliphatic >C10-C12 Aromatic >C10-C12 Naphthalene	TRH >C6-C10 (minus BTEX) (F1) TRH >C10-C16 (minus naphthalene) (F2) Aliphatic >C12-C16 Aromatic >C12-C16 Aliphatic >C10-C12 Naphthalene

As well as the PEVs listed above, the PEV of aesthetics is compromised due to the presence of various anthropogenic inclusions, as well as for staining, odour, and LNAPL Plume B.

9.1.2 Remediation Criteria Exceedances

Remediation Criteria were exceeded at the Site as summarised in Table 9-2 below (note: some TRH and metal exceedances screening against residential criteria are not listed in Table 9-2 because residential use is not a current or proposed land use for the Precinct South).

As presented by AECOM, many of the Remediation Criteria exceedances are obviated by one or more of the following.

- The exceedance relates to a receptor or land use that is not planned for Precinct South (e.g., residential criteria exceedances where the intended use consists of commercial, industrial or open space).

- The proposed building design will provide a separation between residual subsurface contamination and any sensitive receptors.
- Criteria being inapplicable (criteria for TRH aliphatic/aromatic splits not exceeded).
- The sample is from below the water table, so groundwater and vapour pathway assessments (rather than direct soil contact criteria) are the appropriate basis for risk evaluation.

Table 9-2 below summarises the contaminant exceedances of Remediation Criteria for the Site (including the 20 m buffer zone) relevant to the proposed land uses. This table excludes results where soil exceedances for vapour risk were mitigated by the following.

- Samples were inferred to be from soils below the water table (where the soil result would not drive vapour risk). This was the case for BH107 at 2.5 m depth, BH193 at 2.5 m, BH195 at 2.5 m, BH54 at 3.5 m, MW126 at 2.5 m, S3 at 2.65 m, S4 at 2.45 m, and S7 at 2.55 m.
- Results were superseded by the evaluation of aromatic/aliphatic species in various sub-fractions, where less conservative criteria were able to be applied (rather than the assumed split of compounds used in the Tier 1 criteria). This occurred for BH201 at 1.05 m, MW164 at 1.55 m, S10 at 0.95 m, SV25 at 1.55 and 1.95 m, DL_23_1.0 at 1.0 m, DL-EX-05 at 0.6 m, DL-EX-23 at 1.0 m, EX6-06 at 1.0 m, EX6-38 at 1.0 m, UST_77_SE_1.6 at 1.6 m, UST_80_1.2_S at 1.2 m, UST_EXT_59E_1.6 at 1.6 m, and UST_EXT_59N_1.6 at 1.6 m.
- Soil samples were taken proximal to soil vapour sampling which detected no vapour concentrations indicating risk. This occurred for BH70 at 2 m depth (near SV25), MW164 at 1.55 m (near SV25), S8 at 1.75 m (near SV37), SV25 at 1.55 and 1.95 m (at SV25), UST_66_E_1.6 at 1.6 m (near SV30 and SV05), UST_80_1.2_S at 1.2 m (near SV30), UST_EXT_59E_1.6 at 1.6 m and UST_EXT_59N_1.6 at 1.6 m (both near SV30 and SV05).
- Soils were later removed. This was noted for OL-EX-107 at 0.9 m, OL-EX-110 at 1.0 m.

Similar rationales were used to determine a lack of risk for a number of Remediation Criteria exceedances in the buffer zone.

The below table summarises those Remediation Criteria exceedances considered to represent a risk requiring management within the Precinct South itself. For a number of samples soils may be excavated and removed later to level the Site for the proposed development. AECOM has taken the approach that the results pose a current risk requiring management on the basis that the exceedances are vertically undelineated. The Auditor notes also that in order to confirm a lack of future risk, the soils would need to be removed and the excavation validated, because under the guidance used for the conduct of this audit, the outcome cannot be reliant on future information. Because the risk is present in the Site condition at the time of the audit (and is not vertically delineated in some cases) the risk is inferred to exist for the development.

Table 9-2: Summary of Residual Remediation Criteria Exceedances Within the Precinct South

Sample Location and depth	Contaminants	Remediation Criteria Exceeded	Notes
BH35 at 2.5 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South.
K11 at 2 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South. Soil may eventually be removed, but at the time of the audit represents a risk.
M11 at 1.5 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South. Soil may eventually be removed, but at the time of the audit represents a risk.
N11 at 1.0 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South. Soil may eventually be removed, but at the time of the audit represents a risk.
S2 at 1.35 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Eastern part of Precinct South. At the time of the audit represents a risk.
TIT-EX-01 at 0.8 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South. Soil may eventually be removed, but at the time of the audit represents a risk.
TIT-EX-02 at 0.6 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South. Soil may eventually be removed, but at the time of the audit represents a risk.
TW-EX-14 at 0.8 m	>C10-C16 (minus Naphthalene) (F2)	Potential Future Commercial Worker (unknown construction or multi-storey building)	Northern part of Precinct South. Soil may eventually be removed, but at the time of the audit represents a risk.

Although the exceedances in the table above are relevant to the intrusive maintenance worker and commercial worker receptors, risks are manageable under SEMP controls (described in Section 9.3).

Lead concentrations exceeding the Remediation Criteria were identified at depths of 1 mbgl in *in situ* waste-categorisation bore locations L13, M12, M13 and M14, and may indicate a contiguous area of elevated lead concentrations in soil. This material currently requires management under SEMP controls, although it is understood that the material will be removed incidentally by planned bulk excavations to accommodate the proposed development.

If the proposed land-use changes to residential or other more sensitive uses, additional assessment and mitigation or remediation is likely to be required.

Risks to PEVS are required to be managed by SEMP measures for the following identified risks:

- Maintenance of Land Dependant Ecosystems and Species, Human Health, and Aesthetics, based on detected soil concentrations of metals, cyanide (total), TRH, PAHs, MAHs, and PFAS.
- Remediation Criteria exceedances for:
  - Commercial / Light Industrial Workers for TRH C6-C10 (minus BTEX), TRH >C10-C16 (minus naphthalene) and TRH >C8-C10 (aliphatic) ranges, and naphthalene
  - Intrusive Maintenance Workers – lead and benzo(a)pyrene

9.2 GROUNDWATER – INCLUDING DETERMINATION OF CUTEP

9.2.1 CUTEP Checklist

In accordance with the EPA Tas Fact Sheet: *Register of Interstate Contaminated Land Auditors* February 2016 (EPA Tas (2016)[13] the determination of CUTEP has been made by the Auditor, rather than by the regulator.

The contents of the CUTEP Checklist (adopted from EPA Victoria Publication 840.2[14] *The Cleanup and Management of Polluted Groundwater (EPA Victoria* (2016), are reproduced in Table 9-3 below, with references to where the information is addressed in the CUTEP Report (AECOM, 2026d).

This is used to check that the relevant aspects of CUTEP have been considered for a CUTEP determination to be reasonably made by the Auditor.

[13] This Fact Sheet issued in 2016 has since been superseded by web-based information available at the EPA Tas website – 'Information for Contaminated Land Auditors'. The web-based version is available at the following link: https://epa.tas.gov.au/environment/land/identification-and-assessment-of-contaminated-land/contaminated-land-and-the-planning-process/information-for-contaminated-land-auditors

[14] As noted earlier in this report, the Auditor has considered Victorian EPA guidance, including EPA Publication 840.2.The term 'CUTEP' and reference to Publication 840.2 are adopted, because auditing of the overall site commenced when this was the prevailing guidance. Use of the more recent Victorian term 'CUSFARP' and direct reference to Publication 2001.2 (the later equivalent to Publication 840.2) has not been made for these reasons.

Table 9-3: CUTEP Checklist

Information included		Section of AECOM CUTEP Report	Undertaken
Title details		Section 2.1	✓
Land area		Section 2.1	✓
Past use		Section 2.2.1	✓
Surrounding land use (North, South, East and West)		Section 2.4	✓
Proposed future use		Section 2.3	✓
Geology		Section 3.2	✓
Groundwater depth (m)		Section 3.3.2	✓
Groundwater flow direction		Section 3.3.1 and 3.3.2	✓
Nearest surface water receptor (distance & direction)		Section 3.3.2	✓
Bore search (2 km radius)		Section 3.3	✓
Groundwater segment (note – most conservative segment should be used)		Section 4.1.2	✓
Protected Environmental Values of groundwater identified		Section 4.1.2	✓
Summary table of precluded Protected Environmental Values, with associated contaminants, as per Attachment C of Publication 840.2		Section 5.2.2.1	✓
Remediation options table	Discussion of specific options	Section 6.2	✓
	Cost	Section 6.2	✓
	Technical feasibility	Section 6.2	✓
	Logistical feasibility	Section 6.2	✓
Vapour risk considered		Sections 5.1.2, 5.2.2, 5.3, and 5.4	✓
GQMP	Responsible party identified	Section 6.2	✓
	Cost – establishment and annual	Not applicable	×
	Duration	Not applicable	×
Water quality summary table showing results from all rounds of monitoring (µg/L)		Table T10 to Table T14, Table T17	✓
Separate table showing latest water quality results that are above guidelines.		Table T17	✓
An opinion on the source of all contaminants over criteria in the groundwater (e.g. on-site source, off-site source, co-source)		Sections 3.4 and 3.5	✓
Groundwater and soil contamination maps		Figure F10 to Figure F16	✓
Hydrogeological cross-section(s) of site showing (as a minimum) geology, groundwater levels, groundwater bores and any relevant features (e.g. USTs, excavations, utility services, building structures, etc).		Figure F9a/b	✓
Discussion of proposed GQRUZ (if applicable). This should include sufficient information to identify it and an associated figure. N.B. A meeting should be held with EPA to discuss the GQRUZ. The GQRUZ itself should cover the known/modelled extent of all known precluded extractive beneficial uses.		A GQRUZ is a Victoria specific requirement without a direct equivalent in Tasmania. Discussion regarding proposed groundwater use restrictions is provided in Section 6.2.	
Details and records of communications with off-site property owners associated with the GQRUZ (if applicable).		Regular liaison has been held with EPA Tas regarding environmental investigation and remediation works at the Site.	

Information included	Section of AECOM CUTEP Report	Undertaken
	AECOM advises that communications regarding groundwater LNAPL have been undertaken with TasWater and TasPorts. AECOM also noted that details of site assessment and contamination status, including the SEMP, have been made publicly available as part of the Project of State Significance (PoSS) process undertaken between 2023 and 2025. The GQMP prepared as part of the SEMP requires that any risks to potential off-Site users from groundwater identified based on the results of GMEs, or assumptions on groundwater use by occupiers of off-Site land which form part of the assessment of groundwater data, should be communicated to the owners/controllers of those areas. This ensures that future monitoring results will be provided on an ongoing basis to any affected parties.	
A clear and concise executive summary providing all of the above information	Executive Summary	✓

9.2.2 Clean Up Actions To Remove LNAPL

As described in Section 7.7 to Section 7.9 of this Audit Report, LNAPL remediation has occurred previously for LNAPL Plume B (and other nearby generally up-gradient LNAPL plumes) over a number of years. LNAPL remediation initially produced significant LNAPL recovery, but this reduced asymptotically, and transmissivity testing indicated that further remediation of LNAPL Plume B was not practicable. LNAPL thicknesses continued to fluctuate following remediation, and LNAPL has appeared transiently in some areas on the periphery of the LNAPL Plume B area. The Auditor agrees with the findings of the AECOM reports discussed in the earlier sections, namely:

- *Assessment of LNAPL Remediation End-Points* (AECOM, 2021b) – refer Section 7.7
- *The Precinct South – Well Maintenance and Targeted Groundwater Monitoring Event*, (AECOM, 2024d) – refer Section 7.8
- *The Precinct South - LNAPL Gauging and Transmissivity Testing* (AECOM, 2024b) – refer Section 7.9.

The Auditor agrees that, collectively, the reports demonstrate that clean up by LNAPL removal has occurred to the extent practicable.

9.2.3 Feasibility of Further Remediation

Notwithstanding that LNAPL remediation has been conducted and was considered to have occurred to the extent practicable, AECOM, at the Auditor's request, included an evaluation of further active groundwater clean up for all contaminants present in groundwater at the Site. This was undertaken in the form of a 'remediation options assessment', in Section 6.2 of AECOM (2026d).

The options considered included:

- In-situ air sparging (AS)

- In-situ chemical oxidation (ISCO)
- Monitored Natural Attenuation (MNA)
- Barrier systems
- Pump and treat
- Excavation of further soil source

The Auditor notes that some options would address only organic contaminants including hydrocarbons (LNAPL and dissolved), while others could address other listed contaminants exceeding criteria.

AECOM considered that none of the options would likely restore all PEVS, and most (other than excavation of further soil source material) would require long-term application to have significant effect. Given the plans to develop the site imminently, long term active remediation to achieve further reductions of contaminant levels was not considered warranted. AECOM noted that risks are not inferred to exist to off-Site ecological receptors, and other risks associated with use of groundwater or from vapours emanating from groundwater can be managed.

Although monitored natural attenuation (MNA) is not proposed as an active remediation approach to be adopted to clean up the site before CUTEP is determined, the Auditor notes that ongoing monitoring to assess risks is proposed under a Groundwater Quality Management Plan (GQMP) (AECOM (2026b)) which is part of a SEMP produced by AECOM (2026c) to manage risks at the site. In this respect, while MNA is not proposed as an active remediation approach to be pursued, the ongoing monitoring will afford both a check on groundwater conditions moving forward (to ensure risk characterisation does not change, and to allow contingency actions if risks do arise) but will also effectively demonstrate whether MNA is ongoing. This is not to say that monitoring will be necessary until PEVs are fully restored, because if conditions following development (and a period of monitoring) remain stable, it may be appropriate at some future point in time to reduce or cease monitoring while maintaining management measures to mitigate plausible risks.

In summary, the Auditor agrees with AECOM's consideration that further active remediation is not warranted, but notes that ongoing monitoring will be undertaken to monitor future groundwater conditions.

9.2.4 Nature and extent of residual groundwater contamination

AECOM discusses groundwater assessment results against adopted criteria in Section 5.2.2 of the CUTEP Report. Full tabulated analytical results and screening assessment for all GME data is provided as Table T10 to Table T12 in the CUTEP Report, reproduced in the tables section of this audit report.

A summary of key guideline exceedances, and in relative locations (up-gradient, on Site and down-gradient from the Precinct South) is presented in Table 9-4 to Table 9-6 below. As well, the range of concentrations in key plume wells is indicated differently from wells that are on-Site but not in (LNAPL) plume areas. The table shows that contaminants do not generally persist down-gradient. The key down-gradient wells are MW151, MW152 and MW153, and while there is limited data from the TasPorts land south of LNAPL Plume B, groundwater contours that do include elevations from TasPorts wells supports a likely groundwater flow that is generally towards those wells. Data for hydrocarbon concentrations are unreliable (and in some cases not obtained) where LNAPL is present, and so 'LNAPL' has been noted for plume centreline, because of the presence of LNAPL Plume B. Some exceedances shown do not represent risks, because uses are not currently planned (e.g. residential use) or because other considerations have been used to assess risks (such as the considerations of off-site ecological impacts in AECOM 2025e).

For each of Tables 9-4 to Table 9-6 below, the contaminant concentrations are in ug/L unless otherwise stated (which is only the case for E. coli). 'NA' indicates that compound was not analysed. Analytes in bold font indicate an exceedance of one or more criterion. 'LOR' stands for 'Limit of Reporting'.

The groupings of the monitoring wells are as follows:

- #1 – **Up-gradient** wells consist of: MW155, MW192, MW127A, MW185, MW187, MW147, MW175, MW176, M55, MW127B, MW142, MW146, and TW03.
- #2 - **Non-Plume** wells consist of: MW125A, MW125B, MW126A, MW126B, MW154, MW16, MW162, MW163, MW164, MW188, MW193, MW06, MW60, RN4, S4, S6, MW13, and S9.
- #3 - **Plume Centreline** wells consist of: PW02, MW05, MW03, and S8.
- #4 – **Down-gradient** wells consist of: MW150, MW151, MW152, and MW153

Table 9-4: Groundwater analytical results above Tier 1 criteria (most recent concentration from the period 2015 to 2025)

COMPOUND	DATA RANGE (ug/L)				ADOPTED CRITERIA (ug/L)						
	Up-gradient[#1]	Within Precinct South		Down-gradient[#4]	Drinking Water (Aesthetics)	Drinking Water (Health)	Recreation (Primary / Secondary Contact)	Standards Australia - AS2159-2009 Buildings and Structures	Ecosystem Protection	Irrigation	Stock Watering
		Non-Plume[#2]	Plume Centreline[#3]								
C10-C36 fraction (sum)	LOR - **1,120**	**LOR - 1,730**	**800 – 1,940** (NAPL)	**LOR**					**600**		
>C10-C40 fraction (sum)	LOR - **1,100**	**LOR - 1,710**	**1,800 - 1,800** (NAPL)	**LOR**					**600**		
Aluminium	LOR - **140**	**LOR - 320**	**NA**	**10 - 290**	**200**				**72**	**20,000**	**5,000**
Arsenic	LOR - 4	**LOR - 10**	**LOR - 14**	**LOR**		**10**	**100**		**42**	**2,000**	**500**
Copper	LOR - **4**	**LOR - 4**	**LOR - 192**	**LOR**	**1,000**	**2,000**	**20,000**		**3**	**5,000**	**400**
Lead	LOR - 3	**LOR - 25**	**LOR - 6**	**LOR**		**10**	**100**		**6.6**	**5,000**	**100**
Manganese	79 - **2,700**	**198 - 1,400**	**252 - 1,170**	**250 - 1,500**	**100**	**500**	**5,000**		**250**	**10,000**	
Zinc	LOR - **134**	**LOR - 33**	**LOR - 47**	**LOR - 6**	**3,000**				**12**	**5,000**	**20,000**
Benzene	LOR	**LOR - 1**	**LOR - 1**	**LOR**		**1**	**10**		**900**		
Ethylbenzene	LOR	**LOR - 4**	**LOR**	**LOR**	**3**	**300**	**3,000**		**110**		
n-propylbenzene	LOR	**LOR**	**3,033 - 3,033**	**LOR**		**660**	**6,600**				
Naphthalene	LOR - **3**	**LOR - 2.6**	**LOR - 57**	**LOR - 2**		**0.17**	**1.7**		**90**		
1-Methylnaphthalene	LOR	**LOR - 3**	**124 - 237**	**NA**		**1.1**	**11**				
2-Methylnaphthalene	LOR	**LOR - 3**	**24 - 1,840**	**LOR**		**36**	**360**				
Anthracene	LOR - **2.7**	**LOR - 4**	**LOR - 17**	**LOR**		**1,800**	**18,000**		**0.4**		
Phenanthrene	LOR - **2.1**	**LOR - 29.4**	**LOR - 40**	**LOR - 2**					**2**		
Fluoranthene	LOR - **6.6**	**LOR - 4.7**	**LOR - 28**	**LOR**		**800**	**8,000**		**1.4**		

Benz(a)anthracene	LOR	**LOR - 1.2**	**LOR - 13**	**LOR**		**0.03**	**0.3**				
Benzo(a)pyrene	LOR	**LOR - 1.3**	**LOR - 13**	**LOR**		**0.01**	**0.1**		**0.2**		
Indeno(1,2,3-cd)pyrene	LOR	**LOR**	**LOR - 5**	**LOR**		**0.25**	**2.5**				
Sum of PAHs	LOR - **35.6**	**LOR - 94.8**	**LOR - 417**	**LOR - 21**		**0.01**	**0.1**				
Perfluorooctane sulfonic acid (PFOS)	LOR	**LOR - 0.3**	**NA**	**NA**		**0.008**	**0.08**		**0.13**		**0.008**
Sum (PFHxS + PFOS)	LOR	**LOR - 0.31**	**NA**	**NA**		**0.07**	**2**				**2**
Chloride	11,000 - **3,000,000**	**9,000 - 713,000**	**41,000 - 100,000**	**220,000 - 12,000,000**	**250,000**			**6,000,000**			
Sodium	7,000 - **1,300,000**	**10,000 - 400,000**	**78,000 - 120,000**	**43,000 - 5,600,000**	**180,000**						
Sulfate as SO4	LOR - 21,000	**LOR - 514,000**	**2,000 - 4,000**	**LOR - 130,000**	**250,000**	**500,000**	**5,000,000**	**1,000,000**			**2,000,000**
Cyanide Total	LOR - 63	**LOR - 160**	**NA**	**LOR - 18**		**80**	**800**				
Ammonia (as N)	LOR - **41,000**	**28,000 - 52,000**	**8,040 - 8,040**	**5,200 - 43,000**					**1,200**		
Ammonia (as NH3)	**10,900 - 10,900**	**7,420 - 47,300**	**39,300 - 39,300**	**NA**	**500**						
Dibenzofuran	LOR	**LOR - 8**	**LOR**	**LOR**		**7.9**	**79**				
E. Coli (CFU/100mL*)	LOR	**LOR - 1,600**	**NA**	**NA**		**1**	**10**				
Iron	**920 - 34,000**	90 - **42,500**	**3,670 - 24,600**	NA	300					10,000	
Total Dissolved Solids	**2,400,000 - 5,700,000**	**196,000 - 1,810,000**	**433,000 - 4,150,000**	**720,000 - 20,000,000**	600,000						

Table 9-5: Methane groundwater analytical results above British Geological Survey criteria (most recent concentration from the period 2015 to 2025)

COMPOUND	DATA RANGE (ug/L)				ADOPTED CRITERIA (ug/L)
	Up-gradient[#1]	Within Precinct South		Down-gradient[#4]	British Geological Survey (2024) methane screening level
		Non-Plume[#2]	Plume Centreline[#3]		
Methane	**1,680 - 24,000**	**3,270 - 24,000**	**9,100 - 10,900**	360 - **19,000**	1,600

Table 9-6: Groundwater analytical results above vapour intrusion criteria (most recent concentration from the period 2015 to 2025)

COMPOUND	DATA RANGE (ug/L)				ADOPTED CRITERIA (ug/L)			
	Up-gradient[#1]	Within Precinct South		Down-gradient[#4]	Vapour Intrusion - Commercial/ Industrial (CRC CARE)	Vapour Intrusion - Intrusive Maintenance Worker (CRC CARE)	Vapour Intrusion – Recreation (CRC CARE)	Vapour Intrusion – Residential (CRC CARE)
		Non-Plume[#2]	Plume Centreline[#3]					
>C10-C16 (minus Naphthalene)(F2)	LOR - 400	LOR - **1,140**	460 - **1,450** (NAPL)	LOR - 50	4,800	NL	NL	760
Aliphatic >C12-C16	LOR	LOR - 100	LOR - **1,640** (NAPL)	LOR	6,030	1,740,000	820,000	953

9.2.4.1 LNAPL remediation

As noted above in Section 7.7 and Section 7.9, LNAPL associated with LNAPL Plume B remains on Site. Active LNAPL recovery was undertaken previously and was ceased in 2017. Remediation was guided by the *LNAPL Remediation Action Plan* (AECOM, 2017a), which defined three pragmatic end-points for cessation of active recovery:

1. LNAPL recovery rates have reached asymptotic, marginal levels (for example, 5% of initial recovery volumes) such that further recovery is impracticable using available technologies within reasonable timeframes and with negligible net environmental benefit.
2. Residual LNAPL plumes are demonstrated to be stable or decreasing, including absence of LNAPL in locations where it has historically been absent.
3. There is no unacceptable risk to current or planned future human health or ecological receptors given the proposed land uses and implemented controls.

An assessment of these end-points in *Assessment of LNAPL Remediation End-Points* (AECOM, 2021b) concluded that all three of the above end-points had been met and that further active remediation was not practicable, and that residual LNAPL could be managed acceptably under the SEMP. The end-points were reassessed in September 2025 following the June 2025 GME (AECOM, 2025a) and the review of more recent field data. Key observations from the reassessment are:

- Targeted GME observations in late 2023 recorded LNAPL thicknesses in PW02 and S8 that exceeded historical maxima. Transmissivity (Tn) testing conducted in March 2024 showed LNAPL thicknesses at that time were consistent with or lower than December 2023 measurements, and only very limited LNAPL rebound occurred following selective bailing in PW05, S8 and MW05.
- A single LNAPL occurrence (~31 mm) was detected in MW154 during inspection in February 2025; MW154 did not contain measurable LNAPL when gauged in June 2025, although small globules were noted on the interface probe.
- The calculated LNAPL transmissivity values for PW02 and S8 (of 0.009 m^2/day to 0.074 m^2/day) fall at or below the range cited in ITRC (2009) where additional recovery is typically inefficient and unlikely to materially reduce residual mass, mobility or plume longevity.

Review of the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021b) concluded that the three remediation end-points for LNAPL are met and:

- Further active LNAPL remediation is not practicable and is unlikely to materially alter LNAPL extent, longevity or associated risks;
- The LNAPL plumes are stable in extent and are not expected to migrate significantly under current hydrogeological conditions; and
- Residual LNAPL can be managed without presenting unacceptable risk to human health or the environment provided the SEMP controls and monitoring commitments are implemented and maintained (noting that an updated assessment of potential off-Site ecological risks is in progress).

AECOM therefore considered that no further remediation of LNAPL was practicable.

The Auditor agrees with the position represented by AECOM, noting that the SEMP will be need to be implemented to manage risk during future Site development and ongoing use.

9.2.4.2 Expected future LNAPL plume behaviour

LNAPL associated with LNAPL Plume B is considered to be residual and, based on recent field data and transmissivity testing, is not expected to undergo significant lateral migration. Key points informing this assessment are:

- Intensive recovery efforts were completed historically and active LNAPL remediation ceased in 2017. As noted, transmissivity indicates additional liquid recovery is impracticable.
- Recent monitoring has recorded small, localised fluctuations in measurable LNAPL thickness (including a brief detection of ~31 mm in MW154 in February 2025 that was not measurable in June 2025). These transient observations are interpreted as short-term responses to groundwater level variability or small-scale redistribution rather than sustained plume migration.
- The combination of low transmissivity, historic recovery performance and the absence of systematic increasing trends in down-gradient monitoring wells supports the conclusion that LNAPL Plume B will remain broadly within its historical footprint, with only localised temporal changes in thickness at plume fringes.

9.2.5 Impacts to protected environmental values of groundwater

A summary of impacts to groundwater Protected Environmental Values is presented in Section 5.2.2 of the CUTEP Report. Key PEVs that are effectively precluded in parts of the monitoring network, and the primary drivers, are summarised below:

- Drinking water is precluded by naphthalene, benz(a)anthracene, benzo(a)pyrene, 1-methylnaphthalene, indeno(1,2,3-cd)pyrene, pyrene, chrysene, arsenic, chromium, lead, manganese, zinc, iron, chloride, sodium, cyanide, sulfate, PFOS, PFHxS, PFOS+PFHxS, TDS and LNAPL. Additional contributors in parts of the network include elevated TDS, chloride and PFOS (see Table 9-3). Groundwater abstraction for potable water supply is not intended for the Precinct South and is restricted by the SEMP.
- Recreation (primary/secondary contact) - precluded on-Site by LNAPL. There are some off-Site CoPC detections, primarily for benz(a)anthracene, benzo(a)pyrene, elevated manganese and LNAPL. Some intermittent exceedances have been recorded off-Site (e.g. MW150–MW153) for benz(a)anthracene and benzo(a)pyrene, but these events are isolated in time, have not recurred in recent GMEs (including June 2025), and are likely influenced by immobile, sediment-bound PAHs rather than active advective transport to down-gradient surface waters. Given the urban setting and reticulated water availability, abstraction for recreational use is not intended and is restricted by the SEMP. Unacceptable impacts in the Derwent Estuary are not inferred.
- Irrigation is precluded by concentrations of aluminium, arsenic, zinc, copper, lead, chromium, and manganese and by the presence of LNAPL. Given the urban setting and reticulated water availability, irrigation abstraction is not intended and is restricted by the SEMP.
- Human health – Results for vapour intrusion (from groundwater) indicated no widespread exceedances relevant to Commercial/Industrial or Public Open Space use. While exceedances were noted for residential use, such a use is not planned. Vapour intrusion risk exists from methane in groundwater. Vapour mitigation will be required regardless of groundwater results for hydrocarbons, based on methane conditions, and some residual soil impacts as discussed in Section 9.1.2.
- Aesthetics/extraction use is precluded. The presence of LNAPL, sheens and hydrocarbon odour would compromise any extracted groundwater for uses other than monitoring or remediation, or where any groundwater affected by LNAPL or odorous groundwater entered any structure, such as a basement.

9.2.6 Likelihood of protected environmental values of groundwater being realised

AECOM assessed the likelihood of groundwater PEVs being realised, both on-Site and off-Site, as detailed in Section 5.2 of the CUTEP Report. The Auditor has also completed an appraisal which is summarised below in Table 9-7.

Table 9-7: Likelihood of Protected Environmental Values being realised

Protected Environmental Value	Comment	Likelihood of PEV being realised
Drinking Water	No known extraction wells on or near the Site.	AECOM considered this use to be UNLIKELY. The Auditor agrees as extractive use in this setting would be implausible. While the groundwater at the Precinct South is generally of low salinity, it is in a reclaimed area, so that it is unlikely any person would consider groundwater extraction. As well, the use can readily be controlled by measures within the SEMP.
Irrigation	Short-term Trigger Values (STV) for Irrigation Water have been adopted based on the surrounding land use, where ongoing irrigation of plants and garden beds is unlikely to occur. STV can be tolerated for up to 20 years of irrigation. Given the proposed open space use, such an extractive use would be plausible. No such use is current.	AECOM considered this use UNLIKELY. While watering of plants in an open space setting would be possible, this is unlikely and can readily be controlled by measures within the SEMP.
Stock Watering	There is no known use for this purpose in the area.	AECOM considered this use UNLIKELY. The Auditor agrees – given the proposed use setting there is no plausible stock watering use at the Site.
Industry	Due to the wide and varied potential industrial uses of groundwater, water quality requirements for use in industrial processes are assessed on an industry-specific basis.	AECOM considered this use UNLIKELY. This use would not be plausible given the proposed development scenario.
Primary Contact Recreation	This would apply for swimming in water extracted on Site or in Sullivans Cove (point of discharge).	AECOM rated this UNLIKELY, and the Auditor agrees, on the basis that there is no plausible extraction for pools or spas on the Site, and swimming in the Sullivans Cove area is unlikely.
Secondary Contact Recreation	This would occur where a person had incidental contact with water while carrying out non immersive recreation activities (in Sullivans Cove).	This was assessed as POTENTIAL by AECOM on the basis that boating/paddling and fishing may occur. The Auditor agrees with this, although notes that the locations where secondary contact recreation would be plausible (out in Sullivans Cove) would not be proximal to the actual points of groundwater discharge, which appear to be well under the wharf structures at the waterline.
Aesthetics	Presence of objectionable odours, colours, taints, visible floating material, foam, oil or grease or 'dirty' water.	AECOM considered this as POTENTIAL, given that there is potential for secondary contact recreation at the point of discharge. Hydrocarbon odours/staining and former LNAPL plumes are present in the Precinct South. Should impacted groundwater enter a basement and cause odours or visible sheens, this would represent an unacceptable aesthetic impact to basement users.

Protected Environmental Value	Comment	Likelihood of PEV being realised
Buildings and structures	Contamination should not affect building integrity through aggressive (e.g., acidic) soil conditions.	AECOM listed this PEV as POTENTIAL given that building elements may contact groundwater.
Ecosystem Protection	The nearest surface water ecosystems that may receive groundwater discharge, i.e. the Derwent River and Sullivans Cove, would be characterised as a moderately to highly disturbed (i.e. active port area) marine environment according to the ANZECC (2000) definitions. As such, the assessment criteria based on 90% level of ecosystem protection (marine) have been adopted, with the exception of identified bioaccumulative CoPC where the 95% level of ecosystem protection (interim marine) has been conservatively adopted, consisting of: • PFAS • Mercury PAHs (anthracene, phenanthrene, fluoranthene, and benzo(a)pyrene)	AECOM listed this PEV as POTENTIAL, on the basis that groundwater discharge could reach a disturbed marine environment where benthic and pelagic receptors are present. The Auditor concurs with this assessment but notes that impacts to off-site ecological receptors has been subject to specific consideration (AECOM, 2020b and AECOM, 2025s).

The above table describes likelihood of a PEV being realised rather than an adverse impact to a PEV. While there is potential for some groundwater PEVs to be realised (Secondary Contact Recreation; Aesthetics; Buildings and Structures; and Ecosystem Protection), these are unlikely to be adversely affected based on the assessment conducted to date. This includes the finding of the lack of impact likely to affect water dependent ecosystems in AECOM (2025e). To the extent that extractive uses could occur on site, these can be managed by the SEMP, by preventing extraction other than for monitoring or remediation. In addition, several detected CoPC are sediment-bound or of low mobility, and LNAPL at LNAPL Plume B is residual and spatially stable, limiting the potential for advective transport.

9.2.7 Methane in ground gas

The soil vapour assessment, as noted earlier in this audit report identified methane risk which will be managed by controls described in the SEMP. For further assessment of methane concentrations see Section 7.4, Section 7.12 and Section 7.13 of this audit report.

9.2.8 CUTEP Summary

The Auditor has reviewed the AECOM reports (and supporting information) relating to the Site and concluded that the groundwater beneath the Site is contaminated by a number of site-sourced contaminants (some possibly of natural origin) including LNAPL and associated TRH constituents (including PAHs), methane (possibly from natural sources but also possibly from hydrocarbon breakdown), PFOS, metals, nutrients and cyanide.

Identified primary sources of contamination have been removed, including the former bulk oil terminal (for which the major storage tanks were off-Site to the east), Oil and Diesel Pipelines, the Former UST Area, truck wash, mechanics pit and triple interceptor trap. While not all soil contamination has been removed that exceeds Remediation Criteria or could represent an ongoing source of groundwater impact, the residual impacts are considered not to pose unacceptable risks to off-Site receptors and can be managed under the SEMP for on-Site receptors.

AECOM has reported on (secondary source) LNAPL removal efforts at LNAPL Plume B as well as former up-gradient plume areas.

Residual risks will be monitored under a GQMP prepared as part of the SEMP.

The Auditor is satisfied that the requirements to determine CUTEP have been appropriately met and consequently is of the opinion that clean up to the extent practicable has been achieved.

9.3 SITE ENVIRONMENT MANAGEMENT PLAN (AECOM, 2026C)

AECOM prepared a Site Environmental Management Plan (SEMP) for the overall site (AECOM, 2026c)). The SEMP describes environmental assessments completed at the Site and outlines the environmental audit process. The SEMP advises those implementing the plan of the residual environmental risks at the Site and how to manage those risks.

All subsurface work and any work that may change the risk profile to receptors while this SEMP is in place must follow the guidance provided in this SEMP. Maintenance of the SEMP has been identified as a condition of Site Suitability Statements issued as part of the Site Audit (discussed in Section 1.6 of the SEMP).

This SEMP manages contaminated soil, groundwater and soil vapour on the Site and supersedes the SEMPs which have been previously issued for some or all of the overall site from 2018 to 2021. The information and management procedures within the previous documents have been updated in this SEMP.

The SEMP is an active document, which is to be updated as conditions at the Site change (e.g. development changes, changes to the known contamination status, etc.). If activities to be undertaken at the Site are not covered in this SEMP, the Site Owner or Manager, or owner of smaller areas of the Site, should update the SEMP to include those activities.

This SEMP provides a framework for soil and groundwater management measures associated with subsurface works such as the excavation, disposal and/or reuse of soil and importation of fill material, as well as the requirements and maintenance of barriers designed to mitigate direct and indirect contact with contaminated soils and sets procedures for managing any discharge points associated with off-Site effluent or dewatering discharges.

This SEMP summarised CoPC likely present, based on known historical activities or identified during the investigation (including freight storage and handling, fuel storage/handling, and land reclamation).

As part of the Environmental Audit process for sub areas of the overall site, several areas of notable impact to soil have been identified. This SEMP identified lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits).

NAPL, consisting of both LNAPL and DNAPL, is known to be present on the overall site, with LNAPL Plume B located in the southeastern part of the Precinct South. LNAPL (likely a combination of diesel and petrol) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c). LNAPL in this area may be co-sourced with the TasPorts land to the east, where the historic bulk fuel storage considered the original source of LNAPL in this area also occurred.

The SEMP specifies, inter alia, the following key requirements regarding the management of potential human health and environmental risks from residual contamination at the Site:

a. Any party conducting subsurface works (including any earthworks for construction of the development or later maintenance) must prepare a Workplace Health and Safety Plan as specified in the SEMP and allow for potential contaminant exposures.

b. The developed Site area must be maintained with a hardstand or an engineered break layer to prevent direct human access to soil as detailed in the SEMP. Where the hardstand or engineered break layer is breached, such as for construction or maintenance works, it must be reinstated to achieve the same or better prevention of access to soil.

c. Vapour intrusion protection must be implemented to manage assessed risks from methane and hydrocarbons, as detailed in the SEMP.

d. Where future development may cause surface levels to be lowered or groundwater levels to rise in parts of the Site, such that the depth to groundwater beneath a building slab becomes less than 1 m, design and construction must include measures to prevent groundwater entering into buildings and structures, or reaching the Site surface. If groundwater drainage is included in protective measures, any drained groundwater must be considered potentially contaminated waste and be removed accordingly. Any drained groundwater must be managed in a way that considers contaminants which may pose risks, including methane.

e. Garden plantings must be in above ground planter boxes and not into the soil directly, or (for deeper rooted plantings) installed in accordance with Appendix H of the SEMP.

f. Specified requirements must be followed for managing excavated soil and for importation of Fill Material.

g. Where works may cause soil disturbance or drainage posing risks from potential acid sulfate soils (PASS), an *Acid Sulfate Soil Management Plan* (ASSMP) must be prepared as specified in the SEMP.

h. Unexpected finds must be managed as specified in the SEMP.

i. The *Groundwater Quality Management Plan* (GQMP) appended to the SEMP must be implemented. The GQMP includes restrictions on use of extracted groundwater, requirements for disposing of extracted groundwater, and consideration of vapours to arise from groundwater, such as potential methane in drainage infrastructure.

j. The *Asbestos Management Plan* (AMP) referenced in the SEMP must be implemented to manage any asbestos that may be encountered during construction or operations at the Site.

The Auditor considers that the SEMP is appropriate in dealing with residual risks, outlining not only conditions for the final future development, but also for maintenance works, including a requirement for services to be installed in protective shrouds or in trenches/corridors of clean fill, to avoid risks from direct contact with contaminated soil.

The Site Environment Management Plan (AECOM, 2026c) is appended to the Site Suitability Statement in Appendix A of this audit report.

10. CONCLUSIONS

This audit report presents the Auditor's opinion as to the environmental condition of the Precinct South occupying the southeastern corner of the Macquarie Point Site, and potential risks that the Site may present to the future use or redevelopment of the Site. In preparing this report, the Auditor has assessed any harm, detriment, or risk for all beneficial uses/Protected Environmental Values.

The Auditor's appraisal of the Site condition has been based largely on a series of soil, groundwater and vapour assessments undertaken at the Site by AECOM. The Auditor is satisfied that the investigations undertaken followed a logical sequence that included a detailed consideration of the Site history and surrounding areas. This was followed by a process of intrusive soil and groundwater investigations (undertaken prior to, during and post remediation) that took account of the preliminary information, and which were designed and executed according to industry standards.

The Auditor and/or his representative visited the Site on several occasions as part of the assessment and auditing of the overall site including the Precinct South. The Auditor is satisfied that the works performed by AECOM provide a reliable set of data on which to make an assessment of the environmental conditions of the Site and risks which it may present to human health or the environment.

10.1 SITE CONDITION

The Site is currently covered with a combination of asphalt, concrete and gravel surfacing, as well as backfill and clean fill material from soil remediation works.

Remediation excavations and validation works have been completed across multiple areas (Figures F7a – F7d); excavations were largely reinstated with approved VENM, reused remediated Site soils and crushed concrete, and temporary surface cover (≥200 mm VENM) or reinstated slab was placed where works occurred.

Key remediation activities undertaken within, or hydraulically up-gradient of, the Precinct South include:

- LNAPL recovery and management (LNAPL Plume B within the Precinct South; LNAPL Plumes A1/A2 up-gradient) via skimmer/MLRU and fixed TFE systems (operations ceased once remediation end-points were reached). Total recorded LNAPL removal for the Site (2000–2025) is in the order of 572–653 L. Recent transmissivity testing and monitoring indicate limited practicable benefit from further active LNAPL recovery.
- Excavation and validated removal of remnant underground fuel pipelines (Diesel Pipeline and Oil Pipeline) and associated contaminated soils, including removal of ACM in the form of asbestos-cladding of Diesel Pipeline sections where identified.
- Excavation and validated removal of hydrocarbon-impacted soils from the Former UST Area (between the Red Shed and the former SeaRoad Shed) and removal of identified lead-impacted fill in mapped locations (northeast Precinct South and buffer areas).
- Removal of defunct mechanics workshop infrastructure (Goods Shed Annexe) and other point sources; validation sampling demonstrated removal to the applicable validation criteria for the intended future uses.

Notwithstanding the remediation works, some residual contamination remains *in situ* (notably hydrocarbons, PAHs and metals in discrete locations). Excavation extents followed practicable limits; in several locations residual concentrations in subsurface soils remain above the originally adopted Remediation Criteria, although validation sampling and the revised (2025) Remediation Criteria indicate the remaining material is manageable for the proposed land uses under the SEMP controls.

Backfill materials used to reinstate excavation areas were assessed and approved for re-use (Level 1 or Level 2 as applicable) and have been documented.

Although excavation extents did not remove all contamination in excess of the Remediation Criteria, the risks to the proposed development were assessed by AECOM and found not to preclude the proposed development, subject to management.

Groundwater remains contaminated with residual LNAPL present in parts of the Site. The groundwater below the Site is not considered to pose any risks to off-Site ecosystems, and risks to Site users may be managed by prevention of extraction for use, and adoption of the development as planned.

10.2 SUITABILITY FOR USE AND SITE SUITABILITY STATEMENT

Based on the considerations covered in this Contaminated Land Audit Report, the Site is considered suitable for use subject to conditions outlined in the Site Suitability Statement which is included in Appendix A.

Overall, the Site is considered suitable for commercial/industrial use, recreational/public open space use and other less sensitive uses per the planned development. The Site is not suitable for sensitive uses such as residential use. If a change to a sensitive land use is proposed, additional assessment would need to be undertaken, and additional mitigation measures beyond those in the SEMP (as current at the time of this report) may be required.

11. STATEMENT OF UNCERTAINTIES

This report represents a review of data and information (together, “Information”) relating to the property which is the subject of this report. The Information was obtained not by the Auditor and Coffey but from other sources and contacts, some of whom may be noted in the report. The Auditor has conducted reasonable checks as to the adequacy of the information provided and is satisfied that it is suitable for the purpose of conducting an environment audit. However, the Auditor notes that, inherent in any environmental assessment approach (and audits that rely on such assessments), is the fact that information is based on a number of ‘spot’ tests and that conditions may vary between those locations.

The analyses, evaluations, opinions and conclusions presented in this report are based on the information provided, and they could change if the information is, in fact, found to be unrepresentative of conditions between sampling and analysis locations.

The Environmental Auditor and Coffey will not update the report and has not taken into account events occurring after the time its review was conducted.

TETRA TECH COFFEY PTY LTD

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APPENDIX A – SITE SUITABILITY STATEMENT AND SITE ENVIRONMENT MANAGEMENT PLAN

SITE SUITABILITY STATEMENT

This Statement provides a summary of the findings of a Contaminated Land Environmental Audit of the Macquarie Point Development Project – **The Precinct South**, Evans Street, Hobart, in accordance with the following

- Placement of the Auditor on the Register of Interstate Contaminated Land Auditors by the Director, Environment Protection Authority (Tasmania)
- EPA Tasmania 'Register of Interstate Contaminated Land Auditors'
- Macquarie Point Development Corporation Act 2012 (consolidated 2015)

I, David Lam of Tetra Tech Coffey, a person appointed by the Victorian Environment Protection Authority ('EPAV') under the *Environment Protection Act 1970* ('the Act') as an environmental auditor for the purposes of the Act, and also a person placed on the *Register of Interstate Contaminated Land Auditors* by the Director, Tasmania Environment Protection Authority (Tas EPA), having

1. been requested by Mr Greg Cooper on behalf of Macquarie Point Development Corporation (MPDC) to issue a Site Suitability Statement in relation to the Precinct South located at Evans Street, Hobart (as defined in Table 3 and Figure F2 in the attached document: *Site Environment Management Plan*) ('the Site') owned by MPDC.

2. had regard to, among other things,
   (i) guidelines issued by EPAV for the purposes of conducting Environmental Audits (contaminated land) and guidelines issued by Tas EPA for conduct of a contaminated land audit, noting that EPAV is allowing ongoing reference to pre-existing guidance documents in Environmental Audits commenced prior to 1 July 2021, regardless of changes to legislation from that date
   (ii) the beneficial uses and protected environmental values that may be made of the Site
   (iii) relevant (Victorian) State environment protection policies/industrial waste management policies, namely
      SEPP Waters
      SEPP Ambient Air Quality and Air Quality Management
      IWMP Prescribed Industrial Waste
      SEPP Prevention and Management of Contamination of Land
   (iv) relevant (Tasmanian) *State Policy on Water Quality Management*

   in making a total assessment of the nature and extent of any harm or detriment caused to, or the risk of any possible harm or detriment, which may be caused to any beneficial uses/protected environmental values associated with use of the Site, by any industrial processes or activity, waste or substance (including any chemical substance), and

3. completed a contaminated land environmental audit report in accordance with Clause 39F of the Macquarie Point Development Corporation Act 2012, a copy of which has been sent to Tas EPA.

HEREBY STATE that I am of the opinion that

The Site is suitable for the Site uses as follows: commercial/industrial use, recreational/public open space use and other less sensitive uses subject to the following Conditions:

1. Nature of development: the Site shall be developed in accordance with the layout provided in Figure F2 of the attached *Site Environment Management Plan* (SEMP), dated 10 April 2026 (or as modified from time to time), with reference to the following details:
    a. The Site uses shown within SEMP Figure F2 consist of a Multipurpose Stadium occupying the northwestern part of the Precinct South, and Complementary Integrated Mixed Use Zone across the balance of the Precinct South. These uses are considered to be consistent with commercial and public open space uses, for which the Site is considered conditionally suitable, other more sensitive uses must not be undertaken without reconsideration of required management or additional remediation.
2. Implementation of SEMP: from the date of issue of this Site Suitability Statement, the owner/occupier of the Site must implement and maintain the SEMP attached to this Site Suitability Statement (or as modified from time to time), including requiring any parties conducting works or otherwise at risk of exposure to residual contamination at the Site to conform to the SEMP. The key features of the SEMP include but are not limited to the following:
    a. Any party conducting subsurface works (including any earthworks for construction of the development or later maintenance) must prepare a Workplace Health and Safety Plan as specified in the SEMP, and allow for potential contaminant exposures.
    b. The developed Site area must be maintained with a hardstand or an engineered break layer to prevent direct human access to soil as detailed in the SEMP. Where the hardstand or engineered break layer is breached, such as for construction or maintenance works, it must be reinstated to achieve the same or better prevention of access to soil.
    c. Vapour intrusion protection must be implemented to manage assessed risks from methane and hydrocarbons, as detailed in the SEMP.
    d. Where future development may cause surface levels to be lowered or groundwater levels to rise in parts of the Site, such that the depth to groundwater beneath a building slab or any other structural void becomes less than 1 m, design and construction must include measures to prevent groundwater entering into buildings and structures, or reaching the Site surface. If groundwater drainage is included in protective measures, any drained groundwater must be considered potentially contaminated waste and be removed accordingly. Any drained groundwater must be managed in a way that considers contaminants which may pose risks, including methane.
    e. Garden plantings must be in above ground planter boxes and not into the soil directly, or (for deeper rooted plantings) installed in accordance with Appendix H (‘*Inground Planting Designs*’) of the SEMP.
    f. Specified requirements must be followed for managing excavated soil and for importation of Fill Material.
    g. Where works may cause soil disturbance or drainage posing risks from potential acid sulfate soils (PASS), an *Acid Sulfate Soil Management Plan* (ASSMP) and *Dewatering Management Plan* (DWMP) must be prepared as specified in the SEMP.
    h. Unexpected finds must be managed as specified in the SEMP.
    i. The *Groundwater Quality Management Plan* (GQMP) in Appendix F of the SEMP must be implemented. The GQMP includes restrictions on use of extracted groundwater, requirements for disposing of extracted groundwater, and consideration of vapours to arise from groundwater, such as potential methane in drainage infrastructure.
    j. The *Asbestos Management Plan* (AMP) referenced in the SEMP must be implemented to manage any asbestos that may be encountered during construction or operations at the Site.

3. Any (substantive) changes to the SEMP referred to in Conditions 1 and 2 must be prepared for the Site by a suitably qualified professional and verified as acceptable by an Environmental Auditor.
4. Groundwater at the Site is contaminated and must not be used for extractive uses other than environmental monitoring or remediation. Where groundwater is encountered during construction or maintenance works, such as in short-term removal during construction, or ongoing drainage, it must be managed in accordance with the SEMP.
5. Removal of any services or pipelines, such as the Hobart Main Pipeline (sewer), which are in contact with groundwater must be conducted in a way that will minimise the potential for creation of preferential pathways for potentially contaminated groundwater by either
    a. Being backfilled with a graded engineered fill with a maximum hydraulic conductivity of 2 m/day; or
    b. Being removed under a documented methodology which prevents creation of a preferential pathway for groundwater flow, where the methodology has been verified as acceptable by an Environmental Auditor.

The condition of the Site is detrimental or potentially detrimental to some possible beneficial uses/protected environmental values associated with the Site, and so requires ongoing management. The Site conditions which would need to be addressed so that no management would be necessary in any use scenario include the following:

- Material containing contaminant concentrations above human health-based criteria considered protective of sensitive land uses and above ecologically-based criteria considered protective of ecosystems would need to be removed or remediated.
- Aesthetically impacted materials would need to be removed.
- Groundwater would need to be cleaned up to the extent that all relevant beneficial uses/protected environmental values associated with all extractive uses were protected.

Other related information

1. This Site Suitability Statement has been adapted from the EPAV Statement of Environmental Audit. The EPAV *Guidelines for Issue of Certificates and Statements of Environmental Audit* (Publication 759.3, December 2015) have been followed so far as reasonably practicable. This Statement varies from the Victorian document in order to suit the Site requirements and Tas EPA's *Fact Sheet Register of Interstate Contaminated Land Auditors* (February 2016), and Tas EPA web-based guidance.
2. The Auditor has determined that groundwater does not have further practicable remediation options and therefore is assessed to have been cleaned up to the extent practicable (CUTEP).
3. Groundwater at the Site is polluted with respect to use for Drinking Water, Irrigation, Stock Watering, Industrial use, and Primary Contact Recreation. Groundwater is not considered to preclude Ecosystem Protection at a point of discharge to a surface water, or Buildings and Structures, although as noted in Condition 2 of this Site Suitability Statement, potential for acid generation where PASS may be disturbed or drained would require an *Acid Sulfate Soil Management Plan* (ASSMP), and this may address possible changes to groundwater acidity.
4. Groundwater monitoring wells present on and adjacent to the Site may be retained for monitoring under the GQMP. Within 12 months of cessation of use, the groundwater monitoring wells are to be decommissioned in accordance with the requirements of '*Minimum Construction Requirements for Water Bores in Australia*', published by the National Uniform Drillers Licensing Committee, [Fourth Edition, 2020].

5. Not all land uses for which the land is considered suitable by this audit may be allowed under the existing zoning of the Sullivans Cove Planning Scheme 1997.

This Site Suitability Statement forms part of contaminated land audit report (Tetra Tech Coffey), *Contaminated Land Audit Report, Macquarie Point Development Project – The Precinct South*, ref. 754-MELEN225720.1-R01, dated 21 April 2026 Further details regarding the condition of the Site may be found in the contaminated land audit report.

DATED: 21 April 2026
Signed:
David Lam

ENVIRONMENTAL AUDITOR (Listed on the Tasmanian *Register of Interstate Contaminated Land Auditors*)

Attachments: Attachment 1 - *Site Environment Management Plan* (SEMP) dated 10 April 2026.

Prepared for
Macquarie Point Development Corporation
ABN: 92 657 409 841

Site Environment Management Plan

Macquarie Point Development Project

10-Apr-2026
Doc No. MPMS-MPDC-MP-ES-04-02

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Delivering a better world

Site Environment Management Plan

Macquarie Point Development Project

Client: Macquarie Point Development Corporation

ABN: 92 657 409 841

Prepared by

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Job No.: Macquarie Point Development Project

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Quality Information

Document Site Environment Management Plan

Ref 60693007

Date 10-Apr-2026

Prepared by Robert Crowe

Reviewed by Paul Carstairs

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	15-Oct-2021	Draft	Paul Carstairs Technical Director - Environment	
0	22-Oct-2021	Final	Paul Carstairs Technical Director - Environment	
1	17-Nov-2021	Updated Final	Paul Carstairs Technical Director - Environment	
2	18-Dec-2024	Updated Final	Paul Carstairs Technical Director - Environment	
3	10-Oct-2025	Updated Final	Paul Carstairs Technical Director - Environment	
4	03-Dec-2025	Updated CNVM and addition of asbestos register	Paul Carstairs Technical Director - Environment	
5	16-Feb-2026	Updated Final	Paul Carstairs Technical Director - Environment	
6	10-Apr-2026	Updated Final	Paul Carstairs Technical Director - Environment	

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List of Acronyms

ACM	Asbestos Containing Material
BCA	Building Code of Australia
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BTEXN	Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene
CEMP	Construction Environment Management Plan
CNMP	Construction Noise Management Plan
CoPC	Chemicals of Potential Concern
CUTEP	Clean Up to the Extent Practicable
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	Environment Protection Authority
GPR	Ground Penetrating Radar
ha	Hectare
HDPE	High Density Polyethylene
ISS	*In situ* solidification
JSA	Job Safety Analysis
LNAPL	Light Non-Aqueous Phase Liquid
mAHD	metres Australian Height Datum
m bgl	metres below ground level
MPDC	Macquarie Point Development Corporation
NAPL	Non-Aqueous Phase Liquid
NDD	Non-Destructive Digging
PAH	Polycyclic Aromatic Hydrocarbons
PEV	Protected Environmental Value
PPE	Personal Protective Equipment
RC	Remediation Criteria
SEMP	Site Environment Management Plan
SVOC	Semi-volatile Organic Compound
SWL	Standing Water Level
SWMS	Safe Work Method Statement
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WHS	Work Health and Safety
WHSP	Work Health and Safety Plan
WMP	Waste Management Plan

1.0 Introduction

1.1 Purpose

This Site Environment Management Plan (SEMP) has been developed by AECOM Australia Pty Ltd (AECOM) on behalf of the Macquarie Point Development Corporation (the Corporation) for implementation at the Macquarie Point site in Hobart, Tasmania (the Site).

The purpose of this SEMP is to identify known areas of contamination on the Site and to provide an overview of appropriate management measures to address potential human health and environmental risks associated with subsurface contamination, and to maintain compliance with relevant environmental management requirements, and related safety management requirements.

The SEMP:

- Documents:
  - The current contamination status of the Site.
  - Environmental management measures (including contaminant management associated with intrusive works such as excavation/disposal of soil, dust and odour control, stormwater and sediment management, noise control and groundwater management).
  - Responsibilities for implementation of the SEMP and for managing identified environmental issues in accordance with the SEMP.
- Defines:
  - Preventative exposure measures for intrusive works (e.g. subsurface excavation) undertaken at the Site.
  - Roles and responsibilities for owner/managers and occupiers/contractors at the Site, or subsections thereof, when undertaking intrusive works.
- Provides a framework for the implementation of measures so that human health and environmental risks to Site users are low and acceptable where the existing preventative exposure barriers and controls remain in place.

All subsurface work and any work that may change the risk profile to receptors on the Site while this SEMP is in place should follow the guidance provided in this SEMP. Maintenance of the SEMP has been identified as a condition of interim Site suitability statements issued as part of the Site Audit (discussed in **Section 1.6**) for management of human health and environmental risks at the Site.

1.2 Applicability

This SEMP applies to the management of contaminated soil, groundwater and soil vapour on the Site. The following parties should be provided with a copy of the SEMP, prior to undertaking any activities which may interact with soil, groundwater or soil vapour:

- Owners or Managers (and delegates) of the Site or subsections of the Site.
- Workers who undertake subsurface work at the Site during which they may be exposed and/or come into contact with contaminated soil and/or groundwater.

It is noted that this SEMP is an active document, which is to be updated as conditions at the Site change (e.g. development changes, changes to the known contamination status, etc.). If activities to be undertaken at the Site are not covered in this SEMP, the Site Owner or Manager, or owner of smaller areas of the Site, should update the SEMP to include those activities.

All future building or structure design must include appropriate environmental management mitigations as specified by the SEMP. If any design variance is proposed as part of Site development, which does not comply with the current wording, it must not be implemented or constructed on-Site unless:

- It has been assessed by a suitably qualified and experienced environmental professional, who has determined that any environmental risks presented by the action or design can be safely managed and does not represent an unacceptable level of risk to human or ecological receptors on- or off-Site; and
- This assessment has been reviewed and verified by a suitably qualified and experienced Contaminated Land Auditor.

A record of the proposed design variance, and verification by a Contaminated Land Auditor, must be maintained by the person responsible for the SEMP (i.e., the Site owner or occupier, or their designated delegate, as defined on **Table 1**), and communicated by them to any contractors or other workers who are undertaking Site activities which may be affected by the design variance.

Within three months of the approval of any design variance by a suitably qualified and experienced Contaminated Land Auditor, the SEMP must be re-issued by the Site owner/occupier (or their designated delegate), with either:

- The record of design variance and Contaminated Land Auditor review and approval added to **Appendix N**; or
- Update of the body text of the SEMP, reviewed and approved by a Contaminated Land Auditor as described in **Section 5.4**.

A description of any design variance, or general changes to the SEMP, must be added to **Appendix N** as part of the update.

Alternatively, should the requirement for a more specific application be determined, a Construction Environment Management Plan (CEMP) may be required which specifically addresses the proposed tasks and a framework to mitigate potential environmental impacts posed by the activities to be undertaken.

If a sale or division of areas at the Site occurs in the future, owners of subdivisions at the Site should communicate changes to owners of other Site subdivisions or develop their own SEMP specific to the subdivision in question. A distribution list is provided in **Appendix B** for tracking the transfer of the SEMP, or copied thereof, if subdivision occurs.

Any significant amendment to this SEMP, such as a change in land use, or changes as part of an Environmental Audit, should be reviewed and verified by a suitably qualified and experienced Contaminated Land Auditor prior to implementation, including by new owners/occupiers if subdivisions occur in the future. Minor changes or reviews should be conducted by a suitably qualified and experienced environmental professional.

1.2.1 Additional Procedures Referenced Within the SEMP

The following documents and procedures are referenced in the SEMP. The most recent issue of each document should be provided by the Site owner/occupier to anyone undertaking intrusive works at the Site:

- *MPMS-MPDC-PC-ES-05-01 – Unanticipated Discovery Plan - Aboriginal Heritage*
- *MPMS-MPDC-FW-MP-04-02 – Construction Noise & Vibration Management Framework*
- *MPMS-IMP-MP-WH-04-01 – Asbestos Management Plan*
- *MPMS-ELG-RG-WH-04-01 – Site Asbestos Register*

1.3 Training and Induction

The appropriate Site representative (i.e. the Owner, Manager or delegates) is to ensure the health, safety and environment (HSE) requirements outlined in this SEMP are met during works. The SEMP should be available to all persons conducting work which may involve contact or disturbance of Site soil or groundwater, and the information about environmental impacts and management requirements in the SEMP incorporated into health and safety documentation for such work.

All persons conducting subsurface work on the Site, including but not limited to Site occupiers, tenants and maintenance workers, will be required to be trained and inducted to this SEMP. All workers should sign the induction form (provided in **Appendix B**) to acknowledge an understanding of the content of this SEMP and completion of the induction and training, or a similar record if the requirements of the SEMP have been incorporated into other environment safety documentation, for example a CEMP.

This training induction recommendation is limited to those personnel and contractors who are in control of the Site (i.e., landowners or managers) or undertaking subsurface works at the Site. It is not the intention that this document be applied to passive users of the Site such as those using it for the purposes of short-term commercial activities (e.g. market holders), car parking, pedestrian thoroughfare or visitors engaging in public uses of the area.

Training should be structured to ensure that relevant workers understand their obligation to exercise due diligence in relation to environmental matters. The following items should be presented in the induction:

- General overview of the work to be conducted
- Overview of Site contamination issues
- Familiarisation with environmental controls
- Chemicals of Potential Concern (CoPC), and associated exposure risks and potential symptoms of exposure
- Hazard identification and prevention
- Personal Protective Equipment (PPE).

Records of all training should be maintained and include:

- Name of the individual receiving training
- When the individual was trained
- Name of trainer
- A general description of the training content.

It should be noted that this SEMP does not preclude the need for a Safe Work Method Statement (SWMS) or equivalent document for each task, but rather should be included as part of the general training for working on the Site and consulted when preparing safety documentation. The requirements and recommendations within this document do not replace or override the responsibility of any other person in ensuring that Site activities are conducted safety and within the requirements of applicable legislation and regulations.

1.4 Responsibilities

The distribution and implementation of this SEMP will be the responsibility of the Owner/Manager of the Site, or of future sub-divisions at the Site. The Site Owner/Manager may at times delegate responsibility for individual items or tasks to maintenance contractors and other persons. However, the Site Owner/Manager retains the overall responsibility for the implementation of this SEMP during any subsurface works and ongoing use of the Site or future subdivisions which they hold responsibilities for.

All contractors, including workers engaged in any subsurface works where groundwater or soil vapour infiltration may occur (such as accessing service conduits or trenches) or works which may come into contact with Site soil or groundwater will be responsible for adhering to the management measures described herein.

Table 1 below provides a summary of the key roles and responsibilities associated with the implementation of this SEMP.

Table 1 Roles and Responsibilities

Role	Key Responsibilities
Site Owner/ Manager (or delegate)	• Provide a full copy of the current version of the SEMP to Site occupiers/ contractors undertaking subsurface works and discuss as part of the Site induction process. • Manage and/or enforce the SEMP for Site occupiers/ contractors undertaking subsurface works. • Implement and complete corrective actions as required. • Complete and keep up to date all necessary registers and records as required in the SEMP. • Undertake reviews and revision of the SEMP every three years (or more frequently, as deemed appropriate based on-Site activities or changes). • Review evidence of compliance to this SEMP every three years (or more frequently, as deemed appropriate). • Undertake visual inspections of existing controls, such as hardstand areas every three years. • Review and revise the SEMP to reflect changes that occur at the Site. • Transfer of the SEMP, and any records associated with it, to new Site owners or occupiers in the event of a change in ownership or land transfer.
Site Occupiers / Contractors undertaking subsurface works or works which may come into contact with Site soil or groundwater.	• Implement the requirements of the current version of the SEMP. • Complete all necessary registers and records as required in the SEMP. • Complete all activities at the Site in a safe and environmentally responsible manner. • Implement a Work Health and Safety Plan (WHSP) and ensure that suitable PPE is worn, and monitoring is undertaken, where required, for tasks that involve potential contact with contamination. • Ensure all contractors or subcontractors comply with the requirements of the SEMP.

1.5 Site Environment Management Plan Revision

This SEMP will remain in place indefinitely, and will require revision:

- In the event that areas of the Site undergo remediation or land use changes.
- Following changes to the conditions at the Site which may change the risk of exposure to contamination on the Site.
- In response to additional data to inform the understanding of the contamination status of the Site.

Regardless of the above-listed considerations, this SEMP should be reviewed (and updated if required) every three years. It is recommended that a suitably qualified environmental practitioner be engaged to review evidence of compliance to this SEMP, including records of works on the Site and compliance with the conditions of implementation contained within **Section 5.5** of this SEMP. A visual inspection of the Site should be conducted as part of this review, as described in **Section 5.1**.

1.5.1 Previous SEMPs

This SEMP combines and supersedes the following SEMPs which have been previously issued for some or all of the Site:

- *Site Environmental Management Plan, Macquarie Point Development Project* (AECOM, 2018a)
- *Site Environmental Management Plan, Macquarie Point – Audit Area 1* (AECOM, 2019a)

- *Audit Area 4 – Site Environmental Management Plan, Macquarie Point Development Project* (AECOM, 2020a)
- *Lot E and Underground Carpark – Site Environmental Management Plan, Macquarie Point Development Project* (AECOM, 2021a)

The information and management procedures within the previous documents have been combined in this SEMP, and have been updated to account for changes in proposed Site development and additional environmental information received or management/mitigation measures identified since issue of earlier SEMPs or versions of this SEMP. A record of revisions to this SEMP is provided in the Revision History at the start of this document.

1.6 Environmental Audit

In conjunction with the amendment of the *Macquarie Point Development Corporation Act 2012*, the Corporation has engaged a Contaminated Land Auditor, David Lam of Tetra Tech Coffey (the Auditor). David is included on the Director of the Tasmanian Environment Protection Authority (EPA) Register of Interstate Contaminated Land Auditors and is considered suitably qualified by EPA to undertake an Environmental Audit to review the progress of environmental assessment, remedial planning and execution works at the Site.

The role of the Auditor is to ensure that the works are carried out in compliance with local Tasmanian legislation and guidelines with consideration given to the requirements of the Victorian EPA Environmental Audit framework in the absence of an Audit scheme in Tasmania. It is noted that Victoria legislation which defines the Audit process was updated and superseded by the *Environment Protection Act 2017* (the EP Act), which came into effect on 1 July 2021, and contains significant changes to Audit methodology and terminology under the Victorian framework. Under Section 478 of the EP Act, existing Audits where an Auditor has been engaged prior to 1 July 2021, and the Audit has not been completed by 1 July 2021, can be conducted under either the EP Act or the previous framework. To maintain continuity with the portions of the Audit already completed, the Site Audit will continue under the previous framework and terminology.

The overarching outcome required for the Environmental Audit is a Contaminated Land Audit Report (i.e. sign off) prepared by the Environmental Auditor confirming that Clean Up to the Extent Practicable (CUTEP) has been achieved and that the Site is suitable for the intended future uses. Site Suitability Statements have been issued by the Auditor for Site sub-areas (described in **Section 2.2**) as part of Contaminated Land Audit Reports as CUTEP has been achieved, and are listed on **Table 2** below.

It is noted that the proposed future Site uses and development as described in **Section 2.3** have altered since issue of some of the Contaminated Land Audit Reports listed on **Table 2**. A review of new information collected and changes in proposed Site use has been undertaken and provided to the Auditor for review (AECOM, 2026a), and has been accepted by addenda as listed on **Table 2** below.

Table 2 Status of Environmental Audit by Area

Site Area	Approx. Area (ha)	Contaminated Land Audit Reports or Remaining Actions and Activities
Site Suitability Statement Issued[1]		
The Goods Shed and Yard (Audit Area 1)	0.86	*Contaminated Land Audit Report – Macquarie Point Development Project – Audit Area 1*, issued by Tetra Tech Coffey Pty Ltd on 5 June 2019 *Addendum to Contaminated Land Audit - Macquarie Point - Audit Area 1 (The Goods Shed and Yard)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026
The Escarpment (Audit Area 4 West)	1.68	*Contaminated Land Audit Report – Macquarie Point Development Project – Audit Area 4 West*, issued by Tetra Tech Coffey Pty Ltd on 24 September 2020 *Addendum to Contaminated Land Audit - Macquarie Point - Audit Area 4 West (The Escarpment)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026

Site Area	Approx. Area (ha)	Contaminated Land Audit Reports or Remaining Actions and Activities
The Promenade and Underground Carpark (Lot E and UGC)	1.73	*Contaminated Land Audit Report – Macquarie Point Development Project – Lot E and Underground Carpark*, issued by Tetra Tech Coffey Pty Ltd on 23 July 2021 *Addendum to Contaminated Land Audit - Macquarie Point – Lot E and Underground Carpark (The Promenade and Underground Carpark)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026
The Precinct North (Lot B)	1.04	*Contaminated Land Audit Report – Macquarie Point Development Project – Lot B*, issued by Tetra Tech Coffey Pty Ltd on 22 November 2021 *Addendum to Contaminated Land Audit -Macquarie Point – Lot B (The Precinct North)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026
Site Suitability Statement Not Issued		
The Precinct South	1.40	No remaining remediation actions identified. A CUTEP assessment of the Precinct South was prepared and submitted to the Auditor in late 2024 (AECOM, 2024d). Comments have been received and an additional Site investigation has been completed, and an updated CUTEP report issued (AECOM, 2026b), and is currently undergoing update in response to Auditor comments to inform a Contaminated Land Audit Report, including a Site Suitability Statement.
The Gateway	1.46	Remediation (removal of remnant infrastructure and treatment of gasworks wastes) was undertaken in 2024, and follow-up sampling of groundwater and soil vapour conducted in 2025. No remaining remediation actions have been identified. The existing Gateway DSI (AECOM, 2024a) is currently being updated to include a CUTEP assessment, and will be submitted to the Auditor to inform a Contaminated Land Audit Report, including a Site Suitability Statement.
Audit Area 4 East	1.20	Audit Area 4 East is currently proposed to be split, with the northern portion handed to the Tasmanian Department of State Growth. A DSI and assessment of the suitability of the proposed future development is currently being prepared for the portion of this land to remain in the control of the Corporation.
Regatta Point	0.7	This area is not yet included in the Macquarie Point Environmental Audit but is considered likely to be included in the future. An initial intrusive investigation to allow preparation of a Detailed Site Investigation (DSI) report for this area was conducted in late 2024, and the collected data is currently being assessed and a DSI prepared. Any remediation or further investigation requirements to allow issue of a Site Suitability Statement will be identified in the DSI and inform future work requirements and timeline.

Site Area	Approx. Area (ha)	Contaminated Land Audit Reports or Remaining Actions and Activities
Royal Engineers Building	0.19	This area is not currently included in the Macquarie Point Environmental Audit and is not considered likely to be included. However, Royal Engineers Building and surrounding land parcel is likely to be added to the Site as part of future development plans (see **Section 2.3**). To date, no potentially contaminating land uses have been identified, or intrusive investigation undertaken, at the Royal Engineers Building.

2.0 Site Details and Background

2.1 Site Identification and Layout

The Site details are provided in **Table 3** below. It is anticipated that the areas referred to as Regatta Point and the Royal Engineers Building will be added to the Site in future, but as land transfer has not yet occurred, these areas have been listed separately:

Table 3 Site Details

Item	Description
Macquarie Point	
Site Address	10 Evans Street, Hobart, Tasmania (refer to the Site Location plan provided as **Figure F1** in the **Figures** section)
Site Area	Approximately 9.3 ha
Current Land Owner	State of Tasmania (Crown Land)
Title Details	The Site includes the following land titles: • 179192/2, consisting of land against the northern border of the Site below the Hobart Cenotaph. • 179192/3, consisting of southern portion of the Site. • 179192/4, consisting of land previously proposed for development as a road/transport corridor between 17919/2 and 17919/3. • 45404/1, consisting of a small narrow band of land in front and to the west of the Goods Shed. This title boundary overlaps 179192/3. • 129483/6, consisting of the south-west corner of the Site, historically occupied by the former Hobart Gasworks.
Current Zoning	In accordance with the Hobart City Council (HCC, 2021), the *Sullivans Cove Planning Scheme 1997* notes that the Macquarie Point site falls within the *Macquarie Point Mixed Use Zone* and is subject to the following use areas: • Commercial and Institutional • Mixed Use • Open Space.

Item	Description
Current Uses	The following is noted with regard to current Macquarie Point use and features: • The majority of Macquarie Point is currently vacant. Portions of the north and west of Macquarie Point are currently in use for remediation activities, including stockpiling of excavated materials. • The Goods Shed, a heritage building, is located on the southern boundary of the Site and is subject to intermittent uses including public events. • An office building (8A Evans Street) is located on the western boundary of Macquarie Point and is occupied by the Corporation. • The "Red Shed", located in the south eastern portion of Macquarie Point, is currently used by a microbrewer and includes a public bar. • A warehouse (the SeaRoad Shed) was located in the south-east corner of Macquarie Point but was demolished in 2023. A large slab (the SeaRoad Slab) remains in place and has been used for intermittent storage of construction equipment. • Small retail outlets are located in the area adjacent to the Red Shed (Red Square) which is also used regularly for markets, music and other outdoor events with food vans. • A public car park is present in the south eastern and eastern portion of Macquarie Point. • A roadway (the Northern Vehicular Access) is present on the northern portion of Macquarie Point.
Closest Surface Water Body	• Sullivans Cove to the southwest (170 m) • River Derwent to the southeast (280 m) and to the northeast (25 m).
Site Layout	• **Figure F2** in the Figures Section
Regatta Point	
Address	A street address is not allocated. Located adjacent to McVilly Drive, Queens Domain
Area	Approximately 0.7 ha
Current Land Owners	The land comprised within Regatta Point is under the authority of: • Department of Natural Resources and Environment Tasmania (DNRET) Property Services (Potential Property ID 2513934), under Crown lease Regatta Point is currently being transferred to the control of the Corporation.
Title Details	Title details are not available for the public reserve (Potential Property ID 2513934).
Current Zoning	In accordance with the Hobart City Council (HCC, 2021), the *Sullivans Cove Planning Scheme 1997* notes that the Regatta Point site falls within the *Macquarie Point Wharf & River Zone B* and is subject to the following use areas: • Commercial • Mixed Use • Open Space

Item	Description
Current Uses	The following is noted with regard to current Regatta Point use and features: • A public reserve in the southern portion of Regatta point is used for public open space and recreation. Carparking and access to the River Derwent (via two marine jetties and two boat ramps) are present in this area, and accessible via McVilly Drive. • A pumphouse (under Crown Licence) is present in this area. It is not known if this pumphouse is operational, what use is authorised under its licence, or what historical uses it may have had, but it is assumed to be related to fuel and oil transfer via underground pipelines which are present beneath Regatta Point. • A small two-storey building of unknown use is in this area. • A disused rail line and corridor passes to the west of Regatta Point.
Closest Surface Water Bodies	• The River Derwent is located to the east, immediately adjacent to Regatta Point. • Sullivans Cove is located approximately 560 m to the south at the closest point. Recreational fishing restrictions apply in the waters adjacent to Regatta Point.
Site Layout	**Figure F2** in the **Figures** section
Royal Engineers Building	
Address	2 Davey Street, Hobart, Tasmania
Area	Approximately 0.19 ha
Current Land Owners	State of Tasmania (Crown Land). The Royal Engineers Building is currently being transferred to the control of the Corporation.
Title Details	Land title 20452/2
Current Zoning	In accordance with the Hobart City Council (HCC, 2021), the *Sullivans Cove Planning Scheme 1997* notes that the Royal Engineers Building falls within the *Macquarie Point Mixed Use Zone* and is subject to the following use areas: • Commercial and Institutional • Mixed Use • Open Space. The Royal Engineers Building (described as the Royal Engineers Building and Stone Post) is also noted as a Place of Cultural Significance in Schedule 1 of the Sullivan's Cover Planning Scheme 1997.
Current Uses	The Royal Engineers Building is currently used as office/commercial space, with surrounding open grounds and garden spaces. Portions of the surface are sealed with bitumen or concrete, or cover in crushed rock, for foot and vehicle passage.
Closest Surface Water Bodies	• Sullivans Cove, approximately 400 m to the south. • River Derwent, approximately 380 m north-east.
Site Layout	• **Figure F2** in the **Figures** section

2.1.1 Surrounding Land Uses

The surrounding land use comprises a number of aspects including public access and cultural significance; commercial and professional services; retailing; health care; port facilities; light industry; marine industry; fishing industry; and education. The immediate local setting is summarised in **Table 4**.

Table 4 Surrounding Land Uses

Direction from Site	Land Use
North	• The Site is bound to the north by the Hobart Cenotaph and associated public open space. • The River Derwent is located in a general northeast direction from the Site.
South	• The Site is bound to the south by Evans Street, with residential apartments and commercial properties beyond, which extend towards Hunter Street and Sullivans Cove.
East	• The Site is bound to the east by the TasPorts' port operations and further east by the River Derwent. • A Wastewater Treatment Plan (WWTP) is located in a general northeast direction from the Site. It is understood that planning is currently being undertaken by TasWater to decommission and remove the WWTP and construct a replacement pump station, with excavation of an interment basin commenced by TasWater in 2025.
West	• The Site is bound to the west by a public bike path and Davey Street, with commercial properties beyond.

2.2 Areas of Site

For the purpose of assessment and completion of the Environmental Audit, the Site has been divided into sub-areas for assessment based on the nature of identified contamination, historic activity, and the intended future uses of each area. Each area may have specific development controls or work requirements, which are discussed in **Section 4.0**. The sub-areas of the Site are shown on **Figure 1** below.

It is noted that a division of title is currently underway and the northern portion of Audit Area 4 East is planned to be handed to the control of the Tasmanian Department of State Growth. As this has not occurred yet, this area is still included in this SEMP.

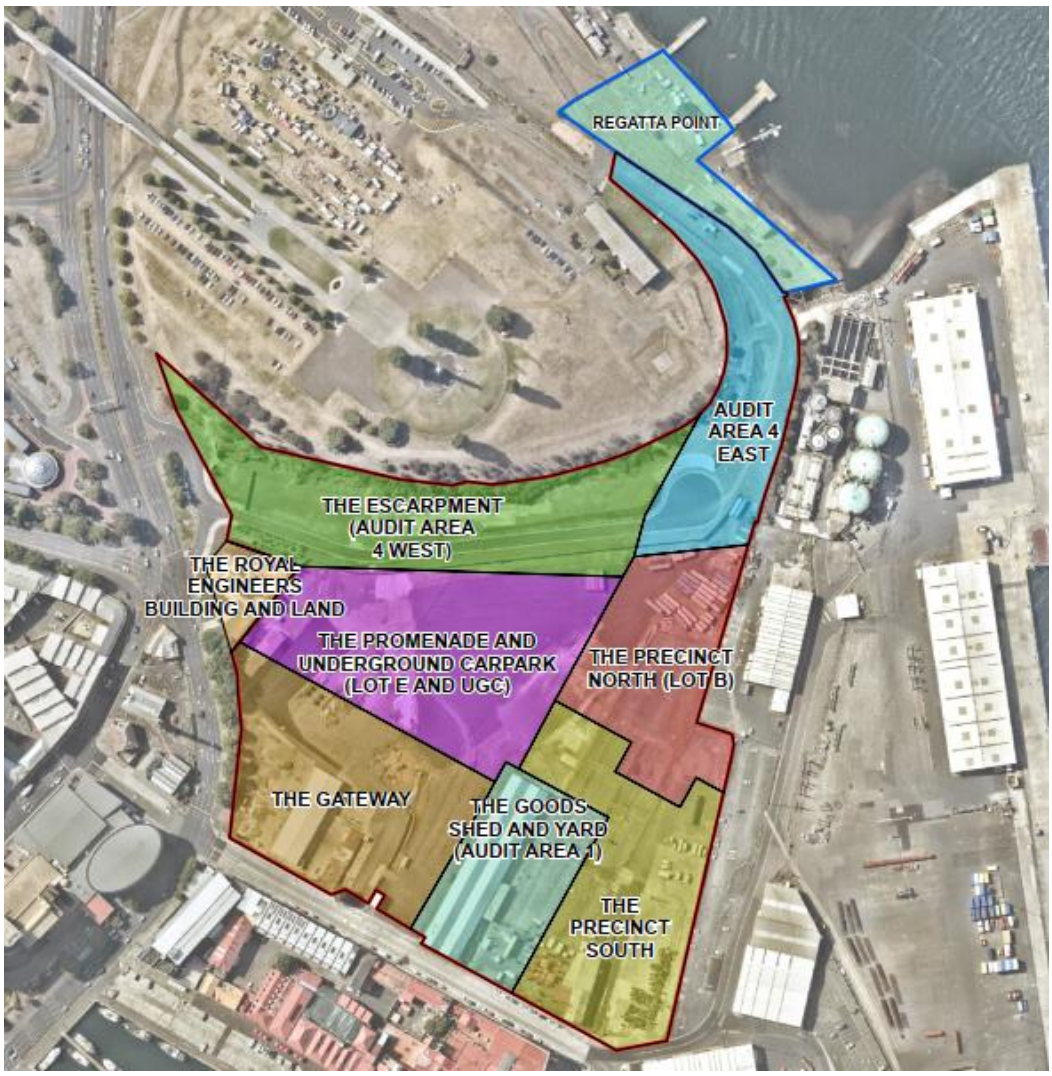

Figure 1 Site Areas

The Site was previously divided into Audit Areas (named Audit Area 1 to Audit Area 7) for assessment. Due to changes in the remediation approach and planned development of the Site, these have been replaced with the sub-areas above. However, the locations of the former Audit Areas are shown on **Figure F2** for reference to earlier documents.

2.3 Future Land Use

Under the previous Site development plan, *New Territory from Old Ground – Macquarie Point Strategic Framework and Masterplan 2015-2030* (the former Masterplan) (MPDC, 2015), the Precinct South was intended for development for a mixture of future uses including residential, commercial and open space.

Environmental assessment and remediation of the Site prior to 2023 was guided by the former Masterplan. However, in September 2022, it was announced by the Tasmanian Government Department of State Growth that the Macquarie Point Site is the preferred location for a future sports stadium and multipurpose area. In August 2024, the *Mac Point Precinct Plan* (the Precinct Plan) (MPDC, 2024a) was finalised for the redevelopment of the Site.

The Precinct Plan outlines the concept for the Site which comprises mixed use precincts summarised in **Table 5** below.

Table 5 Precinct Plan - Proposed Development Precincts

Precinct	Likely Land Use
Aboriginal culturally informed zone	Open space and commercial
Multipurpose stadium and associated concourse zone	Open space and commercial, with an underground carpark in the north-eastern corner.
Royal Engineers building and land	Open space and commercial
Complementary integrated mixed use zone, including restaurants, cafes, hotels, medical facilities and commercial office space	Open space and commercial
Antarctic facilities zone including commercial spaces and connections with the complementary integrated mixed use zone	Commercial and underground car parking
Residential development and public foreshore zone accommodating a variety of tenures and housing opportunities, along with a new public promenade and food and beverage offerings	Medium to high density residential, commercial and open space
A transport corridor and roadway linking Regatta Point to the main areas of the Site	Open space / vehicle traffic / foot traffic
A vegetated area along the northern boundary of the Site. It is proposed that the historic Goods Shed, currently located in the southern central portion of the Site, be moved to this area.	Open space and commercial (the Goods Shed)

Subsurface utilities and maintenance activities are anticipated to occur in all Site areas, and the final surface elevation in some areas is planned to be reduced from the current elevations. The change in development plan and proposed modifications to Site surface elevations affect some previously identified environmental management and mitigation measures, which were included in individual area SEMPs and previous versions of this SEMP (see **Section 1.5.1**). This SEMP has been updated to include the revised measures to suitably manage the Site and avoid unacceptable risks to on- or off-Site users and the environment.

The concept layout of the Site in the Precinct Plan is shown in **Figure 2** below, and on **Figure F2**. The current and proposed final surface elevations are shown on **Figure F3**.

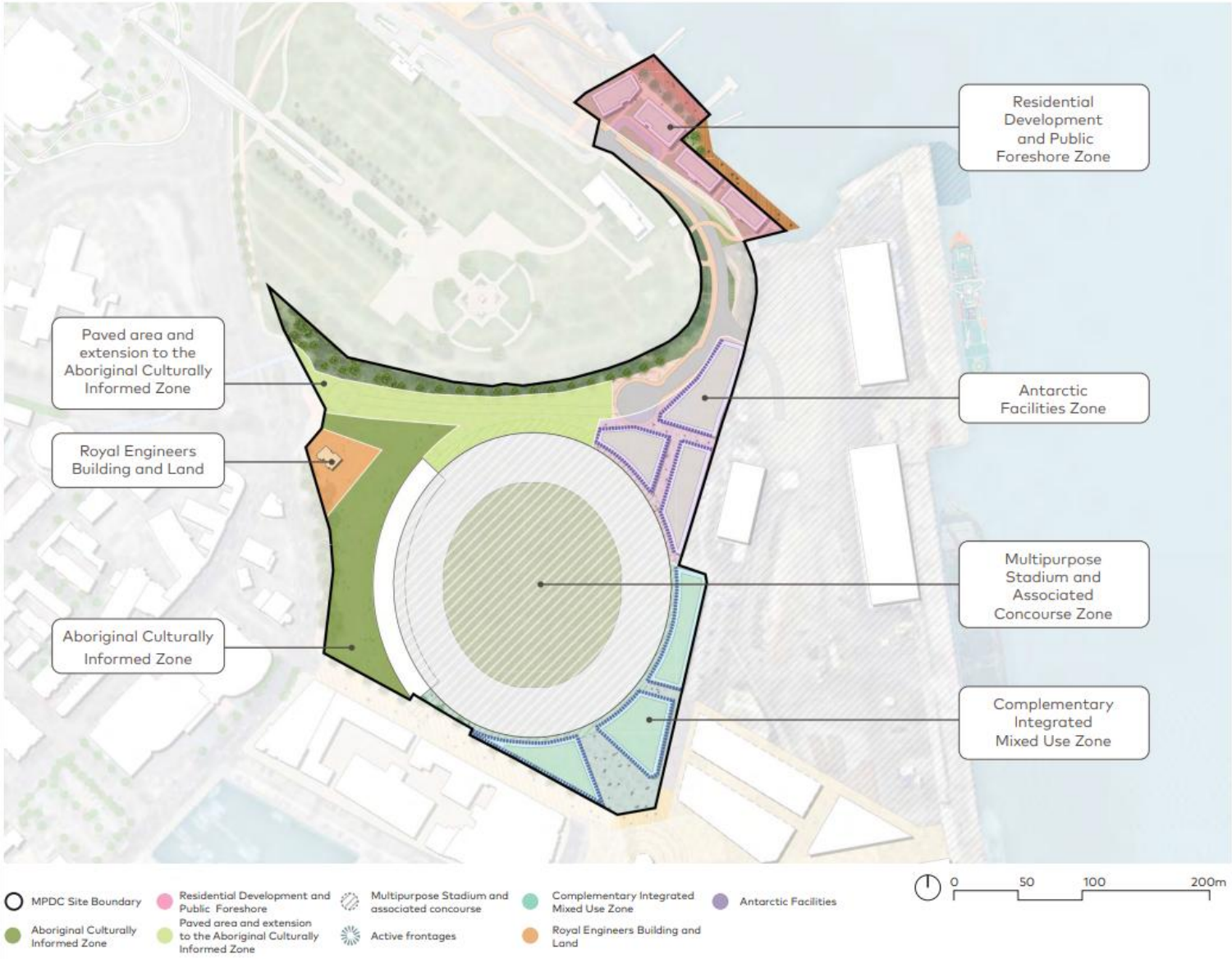

Figure 2 Mac Point Precinct Plan (MPDC, 2024)

The development or future use of the Site may interact with contamination at the Site through contact with potentially impacted soil or groundwater via:

- Excavation of soil.
- Construction of building foundations.
- Extraction of groundwater.
- Construction over or within contaminated soil and groundwater.
- Intrusive maintenance works such as installation or access to buried conduits or pipelines.
- Vapour intrusion into structures or conduits.

2.4 Subsurface Features

Table 6 below provides a summary of currently known subsurface features that may present contaminant source risks or influence subsurface hydrogeology/contaminant transport mechanisms. A plan showing the current known location of subsurface infrastructure is presented in **Figure F5**.

It should be noted that during Site investigations, the Corporation has encountered redundant pipe works and other abandoned services which are not on any records and the origin and purpose of which remains unknown. The potential for unidentified pipe networks or other features to be present below the Site should be considered during future excavation works.

Table 6 Subsurface Feature Summary

Feature	Comment
Gasworks Infrastructure	Historical gasworks infrastructure is located beneath the Gateway area and former gasworks subsurface infrastructure has been backfilled as part of previous Site development. Remediation (via removal) and validation of identified infrastructure which represents a potential source of contamination in the Gateway, was undertaken in 2024 (AECOM, 2025b), and all known pipelines and services related to gasworks operations were removed from the Site. However, the potential remains for unknown pipelines to be present, and should be considered when planning works in this area. Buried concrete slabs may also be encountered in soil in the Gateway area. As part of the same work program, two areas of gasworks waste were remediated by *in situ* solidification and are discussed in **Section 3.4**. Notably, a buried tank base is present around the area of solidified material referred to as Tar Plume B.
Roundhouse	A former Roundhouse was located in the western portion of the Site on the boundary of the Gateway and the Promenade and Underground Carpark areas, and subsurface infrastructure associated with the Roundhouse was backfilled as part of previous Site development. Parts of remaining Roundhouse infrastructure (the central turntable) were excavated and exposed by works in 2021, but other features, such as the maintenance bays, may remain *in situ*.
Buried Railways	During remediation work in 2023, a buried section of railway located between the Red Shed and the SeaRoad Shed Slab was uncovered and removed from the Site. Assessment of samples from the buried railway sleepers reported PAH concentrations below the laboratory limit of reporting (LOR), and as a result it is not considered likely that the railway was treated by creosote and represented a potential source of impact to soil or groundwater. Removal of other Site railway lines was conducted in 2017. However, review of historical aerial photographs identified that the potential exists for two

Feature	Comment
	additional buried railway lines to be located in the Precinct South if not removed as part of this program - one north of the Red Shed, and one beneath the carpark on the western boundary. Potential buried railways are not considered to represent a potential source of environmental risk, as they are from the same time period.
Underground Storage Tanks (USTs)	While no USTs are currently known to exist on the Site, previous known or suspected UST locations are described below and shown on **Figure F5**. • Six USTs were located or suspected to have been historically located to the west of the Goods Shed. - The exact number and location of UST 1 to UST 5 is not known, but based on a historic marked-up plan titled *Hammond Palmer Transport Hobart Tasmania New Pumps & Tanks* and dated 12 June 1984, which indicated fuel tanks associated with freight vessel refuelling may have been present in this area. Investigation of this area in 2017 (AECOM, 20218b) using ground penetrating radar (GPR), Non-Destructive Digging (NDD), and collection and analysis of soil samples, located evidence of former USTs, including backfill sand and fragments of concrete rubble with a metal diesel fill point tag, but did not identify any USTs or hydrocarbon contamination in soil, and later groundwater sampling from wells MW122 and MW148 in the area has not detected any fuel impacts in groundwater. No record of the installation or removal of USTs in this area have been identified, however it is considered unlikely that they are present. - UST 6 was excavated and removed in 2019 (AECOM, 2019b), and is confirmed as no longer present on the Site. • Two USTs (labelled as UST 7) and associated infrastructure were previously located in the central southern portion of the Precinct South and have been removed. A backfilled former UST pit, and associated hydrocarbon odour and residual impact, were identified during the target investigation undertaken in this area in 2014, and excavated and removed in 2023. • A review of historical information indicates that potentially two USTs and associated infrastructure were planned for installation in the north western portion of the Escarpment, in the vicinity of the current StairLink connecting the Site to the Hobart Cenotaph. The exact location of USTs was not provided in the documentation, and no record of UST installation has been located. However, as dolerite bedrock is shallow (approx. 0.5 m bgl) in this area, no indications of fuel impact have been observed in soil or groundwater, and no evidence of USTs were observed during construction of the StairLink in 2021, it is considered unlikely that a UST is present. There is the potential that more USTs are present at the Site that have not yet been identified.

Feature	Comment
Fuel Transfer Lines	Disused fuel transfer lines are known to be currently present in the northern portion of Audit Area 4 East and Regatta Point. Removal of the fuel line in Regatta Point is considered likely to occur as part of remediation of this area of the Site in the future. However, the remaining section of pipeline within Audit Area 4 East is within the land proposed to be handed to the control of the Tasmanian Department of State Growth, as discussed in **Section 1.6**. Portions of fuel lines present in the Precinct North, the Precinct South, and in the eastern section of the Promenade and Underground Carpark area have been excavated and removed in between 2019 and 2023. Removal of pipeline excavations have been validated (noting that Auditor acceptance of validation of pipelines in the Precinct South is still pending). Where pipelines could not be fully removed, they have been plugged with concrete as part of the removal process. At some locations where pipelines exited the Site, pipelines could not be fully removed to the Site boundary due risk of undermining fences or buildings, or high risk subsurface services along Evans Street, and sections of up to 2m in length may remain on Site. Locations where this occurred are noted on **Figure F5**.
Sewer (Main Hobart Pipeline)	The Sewer (Main Hobart Pipeline) currently traverses the central portion of the Site from southwest to northeast. Lead impacts are known to be present in soil around this sewer in the Precinct North area. A realignment of this sewer is planned to occur as part of the replacement of the WWTP to the east of the Site discussed in **Section 2.1.1**. The new sewer alignment will not be within Site boundaries, but will fall below Evans Street to the south and TasPorts land to the east. A sewer line also runs from the Main Workshop area connecting to the Sewer (Main Hobart Pipeline) in the general central portion of the Site. It is understood that both these sewer lines will be removed as part of the Site development.
Stormwater	Stormwater infrastructure is located in the general central portion of the Site traversing the Site in a north-south and east–west direction.
Seawalls/ Engineers Jetty	Seawalls: Historically established for land reclamation purposes. Engineers Jetty: Constructed on the historical outer edge of the former slaughter yard. GHD, 2014 identified the likely location of the Engineers Jetty in the general central portion of the Site and a seawall on the eastern Site boundary.
Former Building Footings	Remnant infrastructure associated with former buildings (such as footings) located across the Site. It is noted that select structures may have archaeological significance.
Telecommunication services	Telecommunications enter the Site in the north western portion of the Escarpment. An exclusion zone of 2 m applies around this telecommunications cable, and works should not be completed within this radius without consultation with the asset owner (Telstra Tasmania). Soil with lead impacts is known to be present within the exclusion zone. The depths of these services are typically between 0.6 m – 1.2 m below ground level (m bgl).
Other Services	Water, electricity, gas and communications services are located across the Site.

Feature	Comment
	Notably, a two power cable (one high voltage and one low voltage) are located within a single conduit in the south-western corner of the Site. A 3 m exclusion zone is in place around the high voltage power line, and maintenance of this exclusion zone is considered required due to the presence of gasworks impacts below the power lines.
Areas of notable impact	Soil and contamination treated by *in situ* solidification (ISS) as part of remediation in 2024 is located in the south-west portion of the Site. Non-Aqueous Phase Liquid (NAPL) impacts are present in soil or groundwater in the southern and central portions of the Site and are described in **Section 3.4**. Some areas of notable higher soil contamination have been identified, at locations where, due to either depth or Site boundaries, remediation excavation could not be continued to fully chase out and removed impacts. Areas of notable contamination are discussed in more detail in **Section 3.0**

2.5 Geology

2.5.1 Fill Material

The Site has been subject to significant filling (controlled or otherwise) since the early 1800's with up to 600 m of land reclaimed in stages from the original 1800's shoreline (Department of the Environment, *Australian Heritage Database*, 2007). Fill material has been encountered across the Site to depths of up to approximately 12.0 m bgl.

Fill material has been described as generally containing a combination of clays, sands, gravels, cobbles and bricks. Virgin Excavated Natural Material (VENM) consisting of crushed dolerite, or reused inert construction materials (crushed concrete and bitumen), has been used as backfill in areas in the Escarpment, the Precinct North, and the Promenade and Underground Carpark Area. The thickness of fill is variable across the Site (0.2 – 12.0 m bgl) and generally increases from north to south across the Site consistent with historical land reclamation activities.

Deeper fill material generally consists of silty sands, similar to the underlying natural marine deposits, indicating that the deeper fill material may be associated with reworked natural material or dredged material. PASS Type 1, as described in **Section 2.5.2** below, has been detected in some fill material.

Staining and odours consistent with gasworks and fuel storage has also been encountered in fill material at select locations.

2.5.2 Natural Soil

Two main natural soil types have been encountered at the Site including marine deposits (silty sands) and slope deposits (weathered Dolerite including clays, gravels and cobbles).

Marine deposits have generally been encountered in the south east portion of the Site, ranging in depth from 3.7 to 15.0 m bgl. Slope deposits generally underlay the marine deposits (with the exception of the northern portion of the Site where the marine deposits are absent). The slope deposits are generally encountered at near surface to 1.4 m bgl in the northern portion of the Site and 11.2 to 19.0 m bgl in the south eastern portion of the Site.

Dolerite bedrock underlies the fill and natural soils at the Site. Dolerite has generally been encountered at near surface in the northern portion of the Site and slopes down in the southerly and south easterly direction and has been encountered at depths up to 25.0 m bgl (GHD, 2014). GHD, 2014 also notes that there are potentially three bedrock highs (i.e. 'reefs') in the general central portion of the Site. The dolerite has been described as of high strength and slightly to highly fractured. A dolerite hill is located to the north of the Site, with the ground of the Hobart Cenotaph present, and exposed dolerite from quarrying of this area in the early 1800s is visible on the escarpment face along this boundary.

In the following instances, the interface between various natural soil types has been difficult to distinguish:

- Between fill material and natural marine sediments given the similar material type, and the possibility that natural soil of similar characteristics may have been used as fill on the Site previously.
- Between the changes from slope deposits to the underlying dolerite bedrock given the weathering of the slope deposits, which consist of fine to coarse cobbles and boulders similar to the dolerite.

The Site is mapped as having a low probability (6-70%) of Potential Acid Sulfate Soils (PASS), as indicated on LISTmap's Coastal Acid Sulfate Soils (0 – 20m AHD) layer (DNRET, 2025). An investigation of PASS was conducted at the Site in 2024 and 2025 and is reported in *Acid Sulfate Soil Investigation* (AECOM, 2025d), with results summarised below.

While Site soil generally has good Acid Neutralising Capacity (ANC), and Site groundwater is generally alkaline and should have a reasonable capacity to buffer against acidification, PASS which will require management measures, if dewatered or disturbed in quantities greater than 100 m^3 (DPIPWE, 2009), is present in:

- Saturated soil, and soil which has been intermittently saturated at the surface of the water table.
- Pockets of unoxidised estuarine sand in unsaturated fill.

PASS was considered in three types of soil, based on the results of assessment and the proposed future activities likely to occur at the Site:

- Type 1 – Estuarine material within the unsaturated fill across the Site.
- Type 2 – Saturated soil within 3 m of the top of the water table, or soil at the water table which may be intermittently wetted, which is considered more likely to be disturbed by direct excavation and construction activities, or by dewatering for construction.
- Type 3 – Saturated soil at greater than 3 m below the water table, which may be disturbed by piling activities, or other activities which disturb deeper soil. This soil is expected to be similar to Type 2, but may have historically had less opportunity for oxidation during land reclamation or due to groundwater fluctuations.

Plate 1 to **Plate 3** show examples of each type of PASS encountered. Requirements for future activities with potential to come into contact with or disturb PASS are provided in **Section 4.12.3**.

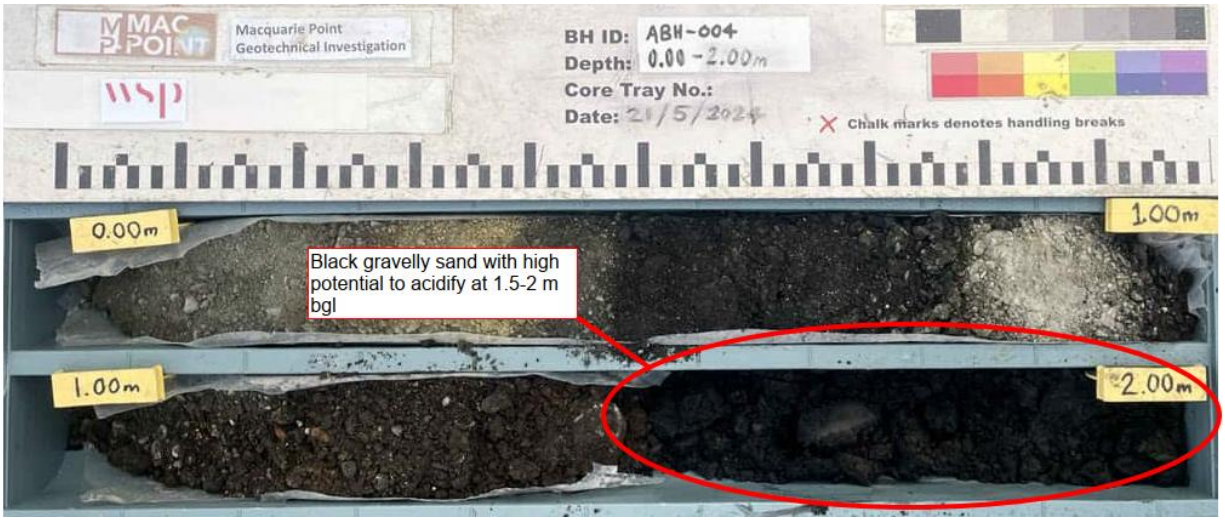

Plate 1 PASS Type 1 - Estuarine material in unsaturated fill (ABH-004 – Core Log at 0 to 2 m bgl) (AECOM, 2025d)

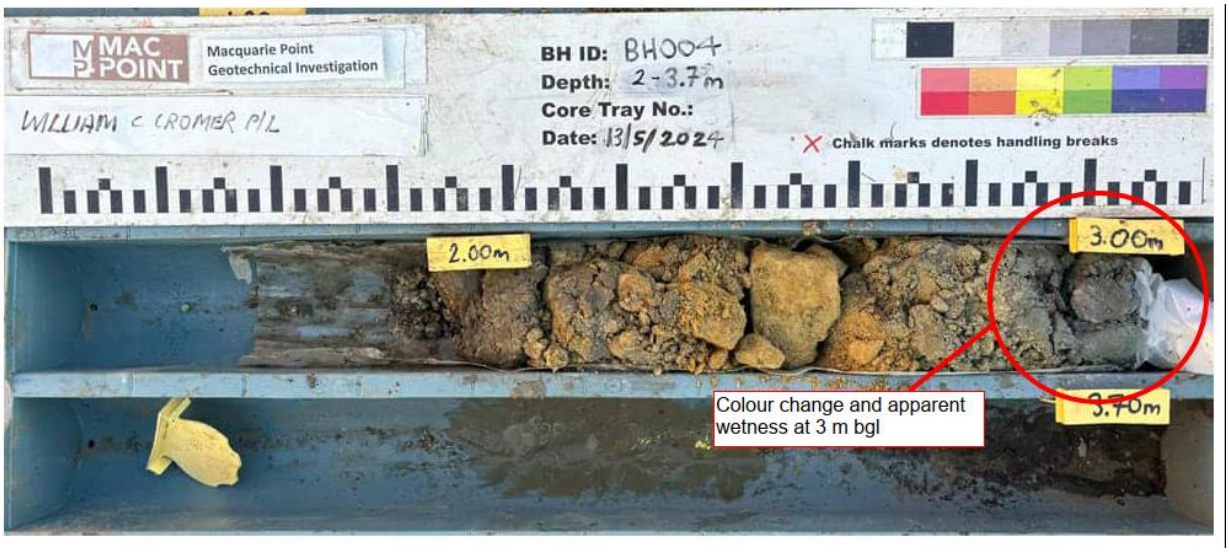

Plate 2 **PASS Type 2 - Intermittently saturated soil at the water table (BH-004 - Core Log at 2 to 3.7 m bgl) (AECOM, 2025d)**

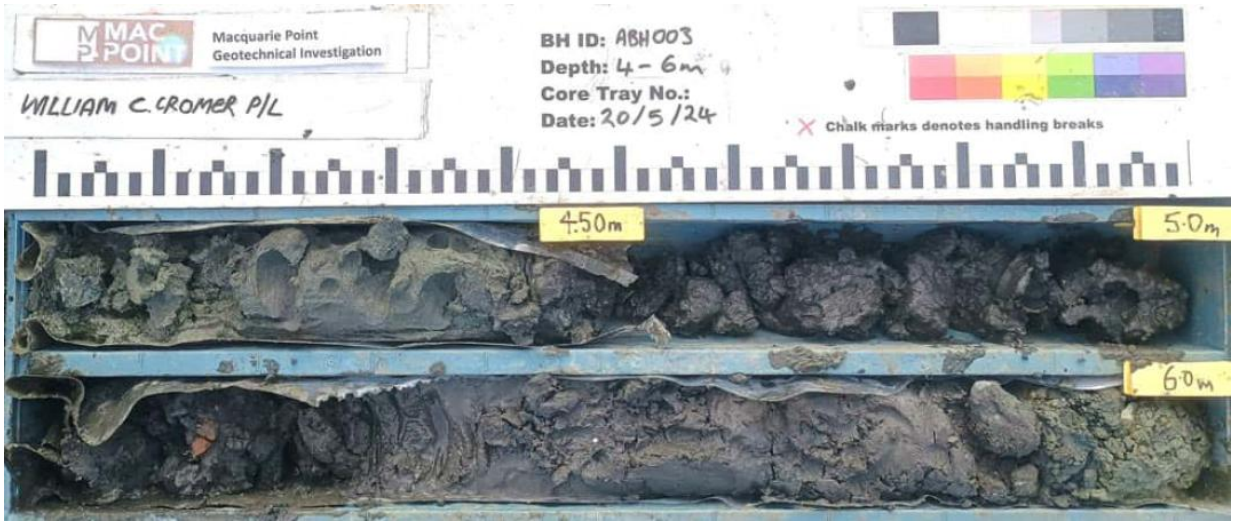

Plate 3 **PASS Type 2 and Type 3 - Saturated soil below the water table (ABH-003 - core log 4 to 6 m bgl) (AECOM, 2025d)**

2.6 Hydrogeology

The River Derwent is located approximately 280 m southeast of the Site boundary and Sullivans Cove is located approximately 170 m south west of the Site boundary.

Based on investigations completed to date, the Site is underlain by a single aquifer unit extending to greater than 25.0 m bgl (the maximum depth assessed). Groundwater has generally been encountered in fill material in the central, southern and eastern portions of the Site, extending into the underlying natural material including marine deposits, slope deposits and fractured Dolerite.

Observations from intrusive investigations have not identified any consistent confining layers between the fill material, natural sediments or the fractured Dolerite to indicate that the lithologies are hydraulically separated. This is supported by similar standing water levels (SWLs) reported for nested groundwater wells screened within different portions of the aquifer, which may indicate that the shallow and deeper portions are likely to be hydraulically connected.

During the last Site-wide groundwater monitoring event (GME), undertaken in June 2025 (AECOM, 2025c), groundwater was encountered below the Site between 1 to 5 m bgl, with deeper groundwater in

the north-west corner. Groundwater elevations ranged between 4.684 mAHD in BG1 in the northern portion of the Site, to 0.423 mAHD in off-Site well MW152, south of the south-east corner of the Site in an off-Site carpark.

Groundwater elevation contours generally followed the pattern of topographic elevation across the Site, indicating a relatively steep up-gradient flow direction to the south-east, prior to flattening out to a very gentle gradient across the central and south-eastern down-gradient areas. Groundwater flow direction followed the steep north-easterly slope towards Regatta Point further around the headland to the far north of the Site.

Groundwater is inferred to have southeast and southerly components of flow in the main area of the Site, with some westerly flow along the eastern boundary with TasPorts land which may be due to a buried seawall in this area, and northeasterly from Regatta Point. The inferred ultimate discharge points of Site groundwater are the River Derwent and Sullivans Cove

Other subsurface structures such as sewer mains (understood to be at a depth of approximately 4.0 m bgl), stormwater pipes, former fuel transfer lines and former sea walls may cause localised variations in groundwater flow direction, and the Hobart Rivulet, which passes north of the Site and through the northern portion of Audit Area 4 East, is considered to present a barrier to groundwater flow.

Testing of hydraulic conductivity across the Site and on TasPorts land to the east was conducted by AECOM in 2015 (AECOM, 2106b), by GHD in 2015 and by SKM in 2001, and was summarised in *Hydraulic Conductivity Interpretations* (GHD, 2015). **Table 7**, below, presents the results of GHD (2015).

Table 7 Adopted Hydraulic Conductivity (m/day) Statistics (GHD, 2015)

Material	Minimum	Maximum	Average	Geometric Mean	Number of Tests
All	0.0053	50	13	2.6	50
All (excluding 50m/day values)	0.0053	35	4.4	1.4	41
Fill	0.14	50	17	5.1	36
Fill (excluding 50m/day values)	0.14	35	6.1	2.4	27
Sediment / Marine Deposits	0.27	5.1	2.3	1.4	5
Weathered Dolerite	0.16	0.56	0.33	0.29	3
Dolerite	0.0053	1.4	0.62	0.25	6

The GHD (2015) interpretation of results noted that:

- Higher areas of high or very high hydraulic conductivity in fill, which are likely to be connected to surface water, were located only in wells in the TasPorts area to the east of the Site.

  Areas of high or very high hydraulic conductivity on the Site (which were identified in the centre of the Site, north-west of the Precinct South) appear to be hydraulically isolated from the coastal boundary, which may be due to either the distance from the Site to surface water, the influence of buried seawalls, or differences in the materials used as fill on- and off-Site.

- Hydraulic conductivity for sediment / marine deposits was calculated based primarily on groundwater wells screened in silts and sands. Wells screened in estuarine clays were not tested, but GHD (2015) notes that estuarine clay visibly appears to have significantly lower hydraulic conductivity.

- Variability in hydraulic conductivity in dolerite is attributed to fracture connectivity, with higher hydraulic conductivity in areas with higher numbers or connections of fractures in the bedrock.

The hydraulic conductivity testing undertaken in 2015 by AECOM (AECOM, 2016a) was undertaken to estimate the hydraulic conductivity of the different lithological units along the southern boundary of the Site. Outcomes of this assessment are listed on **Table 8** below.

Table 8 Southern Boundary Aquifer Tests (AECOM, 2016b)

Formation	Hydraulic Conductivity (m/day)	Test Location
Fill	0.52	MW122, MW123A, MW124A and MW126A
Marine Deposits	0.59	MW124B
Weathered Dolerite / Slope Deposits	0.26	MW123B and MW126B
Bedrock	5.3×10^{-3}	MW128B

3.0 On-Site Contamination

Remediation of the Site has been conducted at the Site to address impacts from contamination and enable future development. However, residual impacts remain on the Site where remediation could not be practicably conducted to completely remove contamination.

Residual impacts are not considered to represent unacceptable risks to users or the environment of the Site or surrounding areas, if managed in accordance with this SEMP.

The following sections of the SEMP provide a description of known residual contamination at the Site to inform those responsible for planning and conducting future Site activities.

3.1 Chemicals of Potential Concern

Based on the known Site history, **Table 9** below presents a summary of the Chemicals of Potential Concern (CoPC) that may be present based on known historical activities or uncovered during investigation of the Site

Table 9 Chemicals of Potential Concern Summary

Area	Historical Land Uses	Chemicals of Potential Concern
Goods Shed and Yard	• Freight storage and handling • Vehicle Maintenance. • Fuel Storage and Handling • Land Reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities. • Chlorinated solvents associated with vehicle maintenance activities. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.
The Escarpment	• Locomotive refuelling comprising fuel storage and transfer facilities • Railway maintenance workshop • Rail corridor and fuel transfer infrastructure historically located within the area • Concrete batching plant • Land reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities. • Chlorinated solvents associated with locomotive maintenance activities and the storage of hazardous materials. • Heavy metals, chlorinated solvents and hydrocarbons associated with workshop and maintenance areas. • Phosphorus and sulphur associated with locomotive washing. • ACM sourced from historical structures (i.e. cladding). • Hydrocarbons associated with the truck wash. • Heavy metals, chlorinated solvents and hydrocarbons sourced from the historical incineration of paint/ solvents. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.
The Promenade and Underground Carpark	• Locomotive refuelling comprising fuel storage and transfer facilities. • Locomotive maintenance. • Freight storage and handling. • Land reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel (diesel) storage and transfer activities. • LNAPL has been detected on groundwater. • Chlorinated solvents associated with locomotive maintenance activities. • Heavy metals, asbestos and PAHs sourced from materials used to backfill Roundhouse structures. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.

Area	Historical Land Uses	Chemicals of Potential Concern
The Precinct North	• Freight storage and handling. • Fuel storage and handing • Land reclamation	• TPHs, BTEXN, PAHs, and phenolic compounds associated with historical fuel (diesel) storage and transfer activities. • Chlorinated solvents associated with locomotive maintenance activities. • LNAPL has been detected on groundwater. • Metals[1] inferred to be due to historic land reclamation have been detected in fill. • PFAS associated with bulk off-Site fuel handing[2]
The Precinct South	• Freight storage and handling. • Fuel storage and handling • Land reclamation	• TPHs, BTEXN, PAHs, phenolic compounds, and lead associated with historical fuel storage and transfer activities undertaken adjacent to the Site's eastern boundary. • LNAPL has been detected on groundwater. • Metals[1] inferred to be due to historic land reclamation have been detected in fill. • PFAS potentially associated with bulk fuel handing which extended to the east of the Site, although portions of the Precinct South formed part of the bulk fuel storage facility[2]
The Gateway	• Former Hobart Gasworks. • Locomotive refuelling comprising fuel storage and transfer facilities. • Railway maintenance workshop. • Land reclamation	• TPHs, PAHs, BTEXN and phenols sourced from coal tar and tar oils, or from historical fuel storage and transfer activities. • Heavy metals, chlorinated solvents and hydrocarbons associated with workshop and maintenance areas. • Phosphorus and sulphur associated with locomotive washing. • ACM sourced from historical structures (i.e. cladding). • Chlorinated solvents associated with locomotive maintenance activities and the storage of hazardous materials. • Complex cyanides, free cyanides and metals sourced from spent oxides. • TPHs, PAHs and metals sourced from coke, coke breeze, ash and clinker residues. • TPHs and BTEX associated with light and drip oils. • DNAPL has been detected in soil. • Phenols, nitrates, sulphates, sulphides, ammonia and PAHs sourced from ammoniacal recovery wastes. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.

Area	Historical Land Uses	Chemicals of Potential Concern
Audit Area 4 East	• Rail corridor and fuel transfer infrastructure historically located within the area. • Land reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities. • Buried ACM has been identified in a section of Audit Area 4 East and is currently temporally capped with a concrete layer. • Metals[1] inferred to be due to historic land reclamation have been detected in fill
Regatta Point	• Public boating, yachting, and port activities. • Rail corridor • Fuel pipeline • Land reclamation • Metals	• Heavy metals, TPH/TRH, PAH, BTEXN, phenolic compounds, SVOC, VOCs, TBT, OCPs, cyanide, ammonia and ACM have all been identified as potential CoPC in Regatta Point based on current and historical uses. Field investigations of Regatta Point were conducted in late 2024, and a DSI with the outcomes is being prepared but is not yet issued. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.

Notes: TPHs – total petroleum hydrocarbons; TRH – total recoverable hydrocarbons; PAHs – polycyclic aromatic hydrocarbons; BTEXN – benzene, toluene, ethylbenzene, xylene, naphthalene; ACM – asbestos containing material; VOC – volatile organic compounds; SVOC – semi VOC; TBT – tributyl tin; OCP – organochlorinated pesticides; PFAS – Per- and Poly-Fluoroalkyl Substances; LNAPL – Light Non-Aqueous Phase Hydrocarbons; DNAPL – Dense Non-Aqueous Phase Hydrocarbons; 1 – aluminium, arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc; 2 - While review of historical information has not identified the use of products containing PFAS, PFOS has been detected in soil and groundwater in this area. There is potential for firefighting foams containing PFAS to have been applied as part of emergency response operations or for training purposes during bulk fuel storage in the short period between the adoption of PFAS-containing firefighting foam in the USA in 1967, and the cessation of bulk fuel storage in 1970.

In addition:

- Methane has been detected in soil vapour sampling, and at concentrations in groundwater which could potentially generate hazardous concentrations of vapour. It is considered likely that methane is present primarily due to the anaerobic degradation of organic materials in natural soil (former river- and sea-bed) which was buried during historic land reclamation, although fuel hydrocarbon impacts in soil and groundwater may also contribute some methane mass.

  While methane is non-toxic, it can accumulate and represent a risk of fire or explosion in structures or buried services.

- PASS has been detected in saturated natural soils.

Appendix C contains areas specific fact sheets which provide more detailed information on CoPC in each area of the Site which has had a CUTEP submission to the Environmental Auditor. The following areas have fact sheets prepared:

- The Goods Shed and Yard
- The Escarpment (Audit Area 4 West)
- The Promenade and Underground Carpark
- The Precinct North
- The Precinct South

The remaining areas of the Site, consisting of the Gateway and Audit Area 4 East, and Regatta Point and the Royal Engineers Building, if added to the Site, will have fact sheets prepared and added to this SEMP as investigation and remediation of these areas are completed.

3.2 Identified Soil Impacts

3.2.1 Fill Material

Shallow soil across the majority of the Site consists of fill material used for land reclamation or construction during the Site's history.

Soil samples collected during the investigation of the Site have been assessed against adopted Tier 1 Criteria for the following uses:

- Maintenance of Modified/Highly Modified Ecosystems
- Human Health
  - Low and Medium/High Density Residential
  - Recreation/Open Space
  - Commercial Industrial
  - Intrusive Maintenance Workers
- Buildings and Structures
- Aesthetics

The following CoPC have been detected in excess of one or more of the adopted Tier 1 criteria in soil samples collected from the Site:

- TRH – C_6–C_{16}, C_{10}-C_{40}
- Benzene, naphthalene, total xylenes
- PAHs – benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, Sum of PAHs
- Metals – arsenic, cadmium, chromium, copper, lead, nickel, zinc
- PFAS - PFOS

Further information on exceedances of the adopted Tier 1 Criteria for areas of the Site where a CUTEP submission has been made can be found in **Appendix C**. Although exceedances of the Tier 1 criteria are present in these areas, they may be managed by implementation of the safety and environmental control measures in this SEMP.

3.2.2 Natural Soil

The AECOM soil investigations undertaken between 2015 and 2025 identified a combination of copper, lead, nickel, zinc and TRH at concentrations in excess of the adopted Tier 1 screening criteria for the assessment of risk to human health and ecological receptors in natural soils at select locations.

In addition, assessment has identified PASS within saturated natural estuarine/alluvial soils below the water table (AECOM, 2025d).

3.2.3 Areas of Notable Impact

As part of the Environmental Audit process for sub-areas of the Site, the following areas of notable impact to soil have been identified:

Table 10 Soil Impacts - Areas of Notable Impact

Area	CoPC	Description
The Goods Shed and Yard	Lead	Areas of lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) were identified in soil proposed for removal as part of Site development and adjustment of the surface elevation of the Site. While removal of this soil is considered likely to occur as part of the development of the Site, these impacts should be considered in planning works prior to excavation or if the proposed development plan is altered.
The Promenade and Underground Carpark	Lead	Areas of lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) are present in the Promenade and Underground Carpark Area, generally at a depth of >2 m bgl. While removal of this soil is considered likely to occur as part of the development of the Site, these impacts should be considered in planning works prior to excavation or if the proposed development plan is altered. Lead-impacted soil may be present following development at two locations, G14 and H12, and should be considered in planning excavation activities.
	Asbestos	Isolated fragments of Asbestos Containing Material (ACM) have been uncovered in fill in this area. Anecdotal evidence indicated that trenches and service pits associated with the former Roundhouse which was present in this area may have been backfilled with building rubble including ACM, although investigation to date has not uncovered any.
The Escarpment	Lead	Lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) is present in the exclusion zone surrounding a telecommunications cable in this area.

Area	CoPC	Description
The Precinct North	Lead	Lead impacted soil which may present a risk to future Intrusive Maintenance Workers is present: • On the eastern site boundary • In the soil surrounding the Main Hobart Sewer line • In some soil locations at depths which are anticipated to be removed by Site development. • In one location (N10), lead impacted soil may be present at the base of the excavation following development. • At depths >2 m below the current Site surface elevation.
	Petroleum Hydrocarbons	Hydrocarbon impacted soil which may present a risk to future Intrusive Maintenance Workers is present on the eastern site boundary.
The Precinct South	Lead	Lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) may be present in the Precinct South at: • At 1 and 2 m bgl in soil bore BH67, noting that impacts are considered limited in volume and may have been removed or partially removed by remediation in 2020. • In some soil locations at depths which are anticipated to be removed by Site development. • At depths >2 m below the current Site surface elevation.
The Gateway	Coal Tar/DNAPL	Coal tar, associated with the historic Hobart Gasworks, has been detected in soil in the south and southwest sections of the of the Gateway area. Notable areas have been identified beneath the high voltage power cable exclusion zone on the western boundary of the Gateway, and trace tar may be present in soil in the area. In addition, tar plumes treated by ISS (Plume B, and the majority of Plume A) form hardened soil monoliths which have higher levels of contamination and should be treated as such if encountered by excavation.
	Lead	Lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) may be present in the Precinct South at: • In some soil locations at depths which are anticipated to be removed by Site development. • At depths >2 m below the current Site surface elevation. • In two locations (in validation samples collected from the base of the excavation which removed UST 6 and in BH88, which was advanced to assess the area where UST 1 to UST 5 were located [see **Table 6**]), lead impacted soil may be present at the base of the excavation following development.

Area	CoPC	Description
Audit Area 4 East	Asbestos	Fragments of corrugated roofing materials between 5 and 300 mm in size were detected within an embankment within Audit Area 4 East, adjacent to the boundary with the Escarpment.

In addition:

- Notably impacted soil is present in the vicinity of known NAPL impacts, as discussed in **Section 3.4**.
- As part of assessment and remediation prior to the update of the Site development plans in 2024, which informed the Contaminated Land Audit Reports for the Goods Shed and Yard, the Escarpment, the Promenade and Underground Carpark, and the Precinct North (see **Table 2**), it was not considered probable that intrusive maintenance workers would come into contact with soil greater than 2 m below the Site surface at the time of investigation, as changes in surface elevation (**Section 2.3**) were not planned at that time. Soil contamination which may represent a risk to intrusive maintenance workers, notably lead, may be present in soil greater than 2 m below the current surface.

These areas are shown on **Figure F5**. Further detail on the location and extent of these impacts, and management controls required for safe future works in the vicinity of these impacts, can be found in the area fact sheets in **Appendix C**, and should be consulted for prior to subsurface works in these areas.

If any future investigation, assessment, or development activity at the Site identifies other notable soil impacts, the SEMP must be updated to include these details in **Table 10** unless removed from the Site, with any such soil removal validated and recorded.

3.3 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) were routinely conducted for monitoring groundwater wells located on-Site between January 2015 and November 2019. Targeted GMEs have been conducted in 2022 in the Gateway and in 2023 in the Precinct South, and the most recent Site-wide GME was conducted in June 2025 (AECOM, 2025c).

Groundwater sample analytical results have been assessed against adopted Tier 1 Criteria for the following uses:

- Drinking water
- Irrigation
- Industry
- Stock watering
- Ecosystem protection
- Recreation - Primary and Secondary Contact
- Aesthetics
- Buildings and Structures
- Vapour Intrusion – Residential and Commercial/Industrial.

The following CoPC have been detected in excess of one or more of the adopted Tier 1 criteria in soil samples collected from the Site:

- Total Dissolved Solids (TDS)
- TPH - C_{10}-C_{36},
- TRH - C_{10}-C_{40}
- Benzene, naphthalene

- PAHs – anthracene, benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, dibenzofuran, phenanthrene, fluoranthene, 2.4-dimethylphenol
- Metals – aluminium, arsenic, boron, cobalt, copper, iron, lead, manganese, vanadium, zinc
- Ammonia (as N), chloride, sodium, phosphorus, sulphate
- Cyanide
- PFAS – PFOS
- Methane
- E. Coli[1]
- pH[1].

Further information on exceedances of the adopted Tier 1 Criteria for areas of the Site where a CUTEP submission has been made can be found in **Appendix C**. Although exceedances of the Tier 1 criteria are present in these areas, they may be managed by implementation of the safety and environmental control measures in this SEMP.

3.4 Non-Aqueous Phase Liquids (NAPL)

NAPL, consisting of both Light Non-Aqueous Phase Liquid (LNAPL) and Dense Non-Aqueous Phase Liquid (DNAPL), is currently known to be present in five locations on the Site, consisting of:

- LNAPL Plumes A1 and A2, in the Promenade and Underground Carpark area.
- LNAPL Plume B, in the Precinct South
- Tar (DNAPL) Plumes C and D, and a portion of Tar Plume A, in the Gateway

NAPL was previously known to be present in the following areas, but has been removed or immobilised by remediation work:

- LNAPL Plume A3, in the Precinct North
- The majority of Tar Plume A, and Tar Plume B, in the Gateway

The location and status of each NAPL Plume is listed on **Table 11**, and current or historic locations are shown on **Figure F5**.

Table 11 Known NAPL Impacts

ID	Location	Contaminants Identified	Inferred Contamination Source
Current NAPL Plumes			
LNAPL Plume A1	Central portion of the Site, Promenade and Underground Carpark	Metals, TPH, PAH	LNAPL (likely diesel) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c).
LNAPL Plume A2	Central portion of the Site, Promenade and Underground Carpark		No detectable LNAPL was present in wells associated with these plumes during gauging in June 2025, although other indicators (such as small volumes of LNAPL during well development or sheen on groundwater) were recorded.

[1] While E. Coli and pH are not “chemicals” of potential concern, they have been treated as such in assessment.

ID	Location	Contaminants Identified	Inferred Contamination Source
LNAPL Plume B	South eastern portion of the Site, Precinct South		LNAPL (likely a combination of diesel and petrol) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c). LNAPL in this area is considered co-sourced with the TasPorts land to the east, where the historic bulk fuel storage considered the original source of LNAPL in this area also occurred.
Tar Plume A (partial) (DNAPL)	The south-western boundary of the Site, the Gateway	Metals, TPH, PAH, BTEX, Phenolics	DNAPL is associated with tar from the production of coal gas which was previously undertaken in the Gateway and off-Site to the west. Tar Plumes C and D, and a portion of Tar Plume A, are located beneath the exclusion zone of a high voltage and power conduit and are not directly accessible. DNAPL is not considered mobile (AECOM, 2024a).
Tar Plume C (DNAPL)	The western boundary of the Site, the Gateway		
Tar Plume D (DNAPL)	The western boundary of the Site, the Gateway		
Former NAPL Plumes			
LNAPL Plume A3	Western portion of the Precinct North	Metals, TPH, PAH	LNAPL (likely diesel) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c).
Tar Plume A (partial) (DNAPL)	The location of a former horizontal retort in the south-west corner of the Site, the Gateway	Metals, TPH, PAH, BTEX, Phenolics	DNAPL is associated with tar from the production of coal gas which was previously undertaken in the Gateway and off-Site to the west. Remediation via ISS of these plumes was conducted in 2024 (AECOM, 2025b), and the remaining material is considered solidified and at no risk of mobilisation. The solidified Tar Plume B is further located within an intact tank base and walls which act as an additional layer of protection against any ongoing impact.
Tar Plume B (DNAPL)	The location of a former tar tank in the south-west portion of the Site, the Gateway		

A detailed assessment of LNAPL impacts and remediation conducted at Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c). This report concluded that:

- Further recovery of LNAPL is considered to be impracticable.
- The remaining LNAPL plumes are sufficiently stable and are not migrating.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a SEMP or

similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

The status of LNAPL Plumes was reviewed using updated data collected between 2020 and 2025 (AECOM, 2025c), which concluded that the status of the plumes was the same as in the previous assessment. No LNAPL was detected in wells associated with LNAPL Plumes A1, A2 and former LNAPL Plume A3, although indicators of LNAPL such as odours, staining, sheen, and LNAPL in groundwater removed during development were observed and trace LNAPL may remain in soil in the vicinity. LNAPL Plume B remains present on and extending beyond the Site boundary in the south-east and should be consider

The *Remediation Work Plan – The Gateway* (AECOM, 2023a) was developed in 2023 to provide a framework and methodology, among other works, for remediation of DNAPL impacts in the Gateway via *in situ* solidification (ISS).

Tar Plume B, and the majority of Tar Plume A, were treated by ISS in 2024 (AECOM, 2025b), and analytical and field data indicates that ISS was successful in increasing the unconfined compressive strength (UCS) and reducing the hydraulic permeability of soil in and surrounding the tar plumes such that detected DNAPL is not accessible and has limited risk of ongoing impact.

Initially, ISS was intended to be undertaken on all four identified Tar (DNAPL) plumes. However, Tar Plumes C and D, and a portion of Tar Plume A, were identified as not being accessible for ISS (AECOM, 2024c) due to the presence of an exclusion zone surrounding an active high voltage power cable along the western and southern boundary of the Gateway. These areas are not considered to be mobile or represent a risk to future on- or off-Site receptors under the proposed development of the Site, however, the locations of potential DNAPL and the cable exclusion zone, shown on **Figure F5**, should be considered during any future works in these areas and additional controls on future works in these areas which may disturb tar have been recommended and are included in **Section 4.9.**

In addition, controls around residual impacts relating to gasworks, including soil management and soil vapour intrusion, have been identified by investigation following ISS remediation and are included in **Section 4.8**.

However, on the basis of the above, further LNAPL or DNAPL remediation is not practicable or required for the proposed future development, noting that Auditor acceptance of DNAPL remediation is still pending. Restoration of groundwater Protected Environmental Values (PEVs) is not practicable, and groundwater management will be required as discussed in **Section 4.13**.

3.5 Soil Vapour

Soil vapour monitoring events have been conducted at targeted locations across the Site between 2015 and 2025 at locations where concentrations of VOCs and SVOCs in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected (as noted in **Section 3.2** and **3.3**), or in the vicinity of the LNAPL and DNAPL impacts (**Section 3.4**) to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Assessment of potential vapour intrusion risks conducted as part of the Site Suitability Statements issued between 2019 and 2021 (see **Section 1.6**), and in subsequent investigations and assessments, including re-assessment of data in light of proposed changes in Site development made in 2024 (**Section 2.3**), has concluded that:

- Assessment of soil vapour impacts associated with LNAPL plumes conducted between 2015 and 2019 concluded that LNAPL does not represent an unacceptable risk to future Site users via vapour intrusion at the Site surface elevations present at the time of assessment (AECOM, 2021c).

  However, a review of vapour intrusion, as part of the assessment of changes to risks from the updated development plan (AECOM, 2026a), identified that, due to the decrease in distance between hydrocarbon impacts and building slabs or any other structural voids, and a reduced vadose zone, hydrocarbon species (such as TRH and BTEXN) may represent a risk to future Site users.

- Soil vapour concentrations of benzene, naphthalene, and TRH >C8-C10 (aromatic) in the former gasworks area (the Gateway) represent an unacceptable risk to future users of the Site under the

proposed development. Assessment and remediation of the Gateway was not complete when earlier versions of the SEMP were issued.

- Methane concentrations have been detected in soil vapour and groundwater which represents a hazard to future buildings and structures in the central, southern, and eastern areas of the Site, in all assessment areas excluding the Escarpment, Audit Area 4 East, and Regatta Point.

  The methane risks beneath parts of the Site have been assessed at Characteristic Situation 3 (CS3) (AECOM, 2026a), as defined in *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020).

- Soil vapour has the potential to migrate under the base of large structures which extend across multiple areas of the Site, and could present risks in adjacent assessment areas following migration. Unlike the current proposed Site development (see **Section 2.3**), the Site development proposed prior to 2024 did not include structures which extended across multiple assessment areas. As a result, some vapour protection measures identified for individual areas are now considered to be required for adjacent areas.

Table 12, below, provides a summary of the assessed potential vapour risks for each assessment area. It is noted that:

- Any requirement for vapour mitigation or protection for each assessment area also applies to the entirety of any buildings or structures (including utility conduits) which are within and extend beyond the boundary of the assessment area, and under which soil vapour may potentially accumulate and migrate.
- Previous investigations have assessed that, where concentrations of TRH/BTEXN above vapour intrusion criteria have been reported in soil samples collected from below the water table, partitioning of TRH/BTEXN to the vapour phase will be dominated by groundwater concentrations. TRH/BTEXN vapour protection or mitigation is considered to be required for any structures which include excavation and construction below the water table.
- Vapour mitigation or protection may not be required if future assessment can demonstrate that no unacceptable risk to Site users is presented. Any such assessment must be prepared by a suitably trained and experienced environmental professional, and verified by an independent Environmental Auditor.

Table 12 Vapour risks identified by Assessment Area

Assessment Area	Summary of Vapour Risks	Vapour Protection or Mitigation Required	
		TRH/BTEX	Methane
The Goods Shed and Yard (Audit Area 1)	• No unacceptable TRH/BTEXN vapour risks have been detected from media within this area for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, the proposed changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including hydrocarbons in soil) in this area • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Sub-slab vapour sampling within the Goods Shed in 2015 did not detect potentially hazardous concentrations of methane, and methane intrusion has been assessed as not presenting an unacceptable risk for this building. However, methane concentrations in groundwater and in soil vapour in this area exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022). Future structures may not have the same ventilation as the Goods Shed (previously assessed in 2015), and methane may represent a risk in new structures or if the ground elevation is altered.	Yes	Yes[2]
The Escarpment (Audit Area 4 West)	• No TRH or BTEXN concentrations in soil have been detected at any depth which exceed the adopted vapour intrusion criteria for 0 – 1 m bgl for the proposed development land uses (commercial) or less sensitive land uses such as industrial or open space. As such, changes in Site elevation are not considered to represent a change in risk of TRH/BTEXN vapour intrusion from soil. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • TRH/BTEXN concentrations in groundwater are below the Site specific RC, which consider potential vapour intrusion as a risk pathway and an assumption of 1 m distance between groundwater and the bottom of building slabs or any other structural voids. • No methane concentrations above criteria have been detected in groundwater in this area.	Yes under the following conditions: - Groundwater present ≤1 m below the bottom of building slabs or any other structural voids. - Structures which extend beyond the Escarpment into an area which require TRH or BTEXN vapour protection or mitigation.	No

Assessment Area	Summary of Vapour Risks	Vapour Protection or Mitigation Required	
		TRH/BTEX	Methane
The Promenade and Underground Carpark (Lot E and UGC)	• No unacceptable TRH/BTEXN vapour risks have been detected for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including hydrocarbons in soil and LNAPL plumes) in this area. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Methane concentrations in groundwater and in soil vapour exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022).	Yes	Yes
The Precinct North (Lot B)	• No unacceptable TRH/BTEXN vapour risks have been detected for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including LNAPL plumes) in this area. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Methane concentrations in groundwater and in soil vapour exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022).	Yes	Yes

Assessment Area	Summary of Vapour Risks	Vapour Protection or Mitigation Required	
		TRH/BTEX	Methane
The Precinct South[1]	• No unacceptable TRH/BTEXN vapour risks have been detected for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including LNAPL plumes) in this area. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Sub-slab vapour and indoor air sampling within the existing Red Shed, and previous structure the SeaRoads Shed, in this area between 2015 and 2025 did not detect potentially hazardous concentrations of methane, and methane intrusion has been assessed as not presenting an unacceptable risk for these buildings. However, methane concentrations in groundwater and in soil vapour exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022). Methane may represent a risk in new structures or if the ground elevation is altered.	Yes	Yes
The Gateway[1]	• Benzene, naphthalene, and TRH >C8-C10 (aromatic) have been detected in soil vapour above the adopted criteria for commercial/industrial and residential uses, and DNAPL and trace impacts from former gasworks operations are present in soil and groundwater this area which may represent a risk of TRH/BTEXN vapour generation. • Methane has not been detected above adopted criteria in soil, groundwater, or soil vapour in this area. However, exceedances of criteria have been detected in adjacent areas, including in soil vapour and in up- and cross-gradient groundwater, and the presence of gasworks hydrocarbons which may degrade under anaerobic conditions and indicate a risk of methane generation in future.	Yes	Yes
Audit Area 4 East[3]	Environmental assessment of this area is not yet issued.	To be specified in future	
Regatta Point[3]	Environmental assessment of this area is not yet issued.	To be specified in future	

Notes: TRH – Total Recoverable Hydrocarbons; BTEXN – Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene; 1. Environmental Auditor assessment of these areas is not yet complete; 2. Methane has been assessed as not representing an unacceptable risk in existing buildings in this area. However, risks may be present for future structures as different construction or ventilation may be present; 3. Environmental assessment of this area is not yet issued.

Further detail of the requirements to be fulfilled for mitigations are presented in **Section 4.8**.

3.6 Asbestos

Asbestos or ACM fragments have previously been observed in the following locations at the Site:

- Isolated small ACM fragments have been observed at the surface and encountered in fill material in the Promenade and Underground Carpark, and the Escarpment areas and have been collected and removed by the Corporation or a licensed asbestos subcontractor.
- Larger ACM fragments (5 to 300 mm in size) have been encountered in the side of an embankment in Audit Area 4 East, and are currently beneath a capped area to prevent contact by Site users.
- ACM was detected in piping cladding in a former fuel line which was present beneath the Precinct North and Precinct South areas, but was removed by remediation work in 2020 and 2023. No sections of this pipeline with ACM cladding remaining are known to remain on-Site.
- Asbestos has been observed within the Goods Shed building in the southern portion of the Site.
- Anecdotal reports have identified that ACM may be present in service bays buried beneath the former Roundhouse in the Promenade and Underground Carpark area. No ACM has been observed in service bays which have been excavated and inspected to date, however.

The Corporation maintains an Asbestos Management Plan (MPMS-IMP-MP-WH-04-01) and Site Asbestos Register (MPMS-ELG-RG-WH-04-01), and the most recent versions of these documents, or any future documents which supersede them, must be made available to and complied with by anyone undertaking intrusive works at the Site.

In the event that potential ACM is encountered in soil during subsurface works, all activities are to cease immediately in the immediate work area. The Asbestos Management Plan MPMS-IMP-MP-WH-04-01) should be consulted and utilised to develop an appropriate response to the handling and management of ACM.

4.0 Management of Environmental Risks

4.1 Overview

The following sections provide details of measures to be implemented to manage potential human health risks from the environmental condition of the Site.

This SEMP provides a framework for soil and groundwater management measures associated with subsurface works such as the excavation, disposal and/ or reuse of soil and importation of fill material, as well as the requirements and maintenance of barriers designed to mitigate direct and indirect contact with contaminated soils.

As previously noted, should any activities need to occur at the Site that are not currently covered in the SEMP, then the Site Owner/ Manager should update the SEMP to include these activities, where relevant. Alternatively, should the requirement for a more specific environmental management application be determined, a Construction Environment Management Plan (CEMP) may be required which addresses the proposed tasks and how the works shall comply with the general requirements of the SEMP. It is likely that a CEMP will be required during any future significant construction or development programs which occur on the Site.

The following is a list of appropriate legislative and regulatory guidelines that have been considered in the production of this SEMP:

- National Environment Protection Council, *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended in May 2013) [ASC NEPM]
- Tasmanian Government *Environmental Management and Pollution Control (Waste Management) Regulations 2010*
- Tasmania EPA (2018) Information Bulletin No. 105, *Classification and Management of Contaminated Soil for Disposal* (IB105).

4.2 Preventative Exposure Measures

Preventative exposure measures provided in this SEMP can be categorised as follows:

- **Physical Barriers**: Placement/maintenance of a permanent barrier (i.e. concrete, asphalt, clean soil etc.) to mitigate unrestricted access/exposure to the underlying contamination (as described in **Section 4.6**) and a vapour mitigation barrier to prevent vapour intrusion (as discussed in **Section 4.8**).
- **Administrative Measures** such as:
  - Management plans/documents (such as this SEMP or a WHSP) that provide control of the activities and/or use of the areas of the Site as described in **Section 4.3**.
  - Planning controls as described in **Section 4.4**.
  - Exclusion zones as described in Section **4.9**.
  - Site inductions.
- **Personal Protective Equipment (PPE)** as described in **Section 4.5** to mitigate exposure to potentially harmful chemicals in soil and groundwater during subsurface works.

In some cases, it may be necessary to employ multiple preventative exposure measures, beyond the SEMP, that act as a contingency (or 'fail-safe'). For example, two physical barriers (e.g. concrete and plastic marker layer), or a physical barrier (concrete) combined with an administrative barrier (management plan).

4.3 Work Health and Safety Plan

It is recognised that as part of current and proposed future uses of the Site, it may be necessary to undertake intrusive works. Such activities increase the exposure to potentially impacted materials and therefore protective measures are to be adopted prior to work commencing.

Any works conducted on the Site should be undertaken in accordance with a WHSP. This WHSP should provide guidance with respect to the minimum PPE requirements where workers are likely to come into contact with potentially contaminated materials. Specific Safe Work Method Statements (SWMS) for each task to be performed should also be included in the WHSP.

ANY COMPANY/CONTRACTOR ENGAGED TO CONDUCT SUBSURFACE WORKS AND/OR EARTHWORKS ON THE SITE MUST PREPARE A SITE-SPECIFIC WHSP COVERING THEIR WORKERS AND PLANNED ACTIVITIES.

The following is an overview of WHS considerations for any works that may be undertaken, at a minimum, at the Site:

- Identification of WHS roles and responsibilities
- Evaluation of the Site hazards and the risks associated with these hazards
- Risk assessment methods and the risk control measures
- Details on work practices and restrictions, assessment of anticipated protection levels (including PPE), controls on access to the Site and decontamination
- Methodology for handing and management of soil and groundwater in accordance with **Section 4.12** and **Section 4.13** (if required)
- Detail regarding appropriate ventilation of the work area
- First aid and emergency procedures
- The notification of accidents and other matters
- Environmental monitoring protocols.

Appropriate WHS measures should be established by the contractors for personnel involved in subsurface works at the Site. The levels of protection and the procedures specified in this section are related to contamination issues only and do not represent a WHSP for the Site.

The ultimate responsibility and authority for the health and safety of the individual rests with the individual themselves and their colleagues. Each worker is responsible for exercising utmost care and good judgement in protecting his or her own health and safety and that of fellow workers. It is the responsibility of Site owners and those working on Site to bring any observed potentially unsafe condition or situations to the attention of any worker or contractor. Should workers find themselves in a potentially hazardous situation, they should immediately discontinue the hazardous procedure and take effective corrective or preventative action.

All incidents and/or near misses pertaining to works carried out on Site should be reported immediately to the owner or occupier of the area of the Site in which they occur.

4.4 Planning Controls

Development of the Site as described in **Section 2.3** is intended under the following restrictions:

- Development of an area will not proceed without an area-specific Contaminated Land Audit Report and Site Suitability Statement issued by an Environmental Auditor approved under Section 37 of the *Macquarie Point Development Act 2012*.

  Currently, Auditor approval is being sought for the Site uses described in **Section 2.3** and shown on **Figure F2**. Modifications in Site uses or development (i.e. planning for residential uses in an open space area) will require approval by a Contaminated Land Auditor and may require other controls or management measures. The SEMP must be updated if there are any changes in land use, or in controls or mitigations for environmental risks.

- The Site surface will be covered with either hardstand and/or an engineered break layer, as specified in **Section 4.6** of this SEMP, which shall be implemented to provide a framework for ongoing maintenance and management of the Site during future use. This break layer should be instated if any existing Site structures are removed (i.e., such as the proposed relocation of the Goods Shed to the Escarpment)
- ACM has been previously identified within the Goods Shed building (see **Section 3.6** and separate procedures/documents *MPMS-IMP-MP-WH-04-01 – Asbestos Management Plan* and *MPMS-ELG-RG-WH-04-01 – Site Asbestos Register*).

  Prior to commencement of building-related works within the Goods Shed, or any other structures or areas where ACM is identified (i.e., old pipe lagging), a suitably qualified occupational hygienist must be consulted to confirm the nature and extent of ACM in the work area (if any), and to provide advice regarding the locations and management of ACM, including removal if practicable.
- If the Goods Shed is not relocated as proposed, the existing hardstand and flooring (including the slab, raised platform areas, crawl spaces and hard coverings etc.) must remain *in situ*.
- Any conduits or services at a depth of >2 m below the current Site level must be installed in protective shrouds or in trenches/corridors of clean fill. It is noted that as part of the proposed development of the Site, surface elevations in some areas of the Site will be decreased by up to 4.5 m in some areas of the Site (see **Figure F3**), and protective shrouds/clean soil corridors should be considered required for all subsurface services in areas where surface elevation is decrease by more than 1 m from the current level.
- The potential exists for methane, TRH and/or BTEXN migration into buildings or structures within the Promenade and Underground Carpark, the Precinct North, the Precinct South, and the Gateway areas(including continuous structures which extend beyond these areas). Protection against vapour intrusion must be included in work planning and in building and service design and installation, as described in **Section 4.8**.
- Future development in the vicinity of ISS-treated material in the Gateway must conform to the following requirements:
  - Any future structure over ISS-treated material must consider the bearing strength required by the footings of the building and maintain the integrity of ISS-treated material.
  - Any piling should avoid ISS-treated material if possible. If piling through ISS-treated material is unavoidable, the piling methodology should be planned and implemented to prevent fracturing of ISS-treated material to the extent practicable.
  - The tank walls and base present surrounding Tar Plume B are considered a secondary barrier against leaching of contaminants, and should be left intact as part of future development in this area. Any penetrations in the tank wall or base (i.e., if structural piles are required) must be sealed to prevent liquid ingress/egress.
  - No subsurface services should be installed in contact with or through ISS-treated material.
  - Any disturbance or removal of ISS-treated material should implement measures to minimise potential fracturing or cracking of any material which remains *in situ*.

  It is noted that a Contaminated Land Audit Report has not yet been issued for the Gateway area of the Site, and requirements for management of ISS-treated material in the Gateway may be subject to change in the future depending on the requirements of the Contaminated Land Audit Report.
- The proposed final surface elevations of the northern and north-western portion of the Multipurpose Stadium and Associated Concourse, and of the underground carpark in the north-west of the Site, have the potential to approach or be below the inferred groundwater elevation in these areas.

  Where future development causes (or is expected to cause) surface levels to be lowered or groundwater levels to rise in parts of the Site, such that the depth to groundwater beneath a building slab or any other structural void becomes less than 1 m bgl, design and construction must include measures to prevent:

- Groundwater and/or LNAPL from entering into buildings and structures, or reaching the Site surface. If groundwater drainage is included in protective measures, any drained groundwater must be considered potentially contaminated waste and be removed by a licensed waste transporter, discharged under a trade waste agreement, or otherwise disposed of in a manner which does not represent any unacceptable environmental risk.
- Drainage infrastructure and management of groundwater must consider the potential for dissolved methane to off-gas and the risks which may be generated if this occurs, and include management or mitigation measures.

Any dewatering must also consider potential exposure and oxidation of PASS in saturated soil, as described in **Section 4.12.3**.

4.5 Personal Protection Equipment

It is the responsibility of the contractor carrying out the works on-Site to develop SWMS for works to be undertaken, including the relevant PPE to be worn by the Site workers. This SWMS should be approved by the owner or occupier of the area of Site where works are occurring. The typical minimal level of PPE required for subsurface works includes:

- Neck to toe high visibility clothing
- Hard hat when working with plant equipment (i.e. excavator or similar)
- Protective gloves (Note: Impervious gloves are to be worn if there is potential for contact with potentially contaminated soil and/or groundwater. Gloves should be checked regularly for wear and tear and replaced when necessary).
- Steel-toed boots
- Safety glasses.

Additional PPE for areas of notable contamination should be assessed by Site Safety representatives, including:

- Dust masks, or other measures to mitigate against potential soil dust inhalation, for areas of notable soil contamination noted in **Section 3.2.3** and shown on **Figure F5**.
- Breathing protection and protection such as disposable coveralls for work near NAPL or former gasworks areas.

A first-aid kit, with eye wash bottle and manual should also be available in the work area for intrusive works.

VOC emissions, consisting of fuel hydrocarbon or methane vapours, may become present during excavation, stockpiling and remediation activities involving impacted soils. Vapour monitoring, for example by use of handheld multi-gas monitors, should be undertaken during works where vapour may be generated, with equipment procedures for operation and calibration and applicable action levels must be included in WHSPs.

4.6 Physical Barriers

At present, the Site surface consists of a mixture of:

- Intact concrete or asphalt covering, in:
  - The south, south-east and eastern areas around the Goods Shed, Red Square, the carpark area, and the former SeaRoad Shed Slab.
  - The central western area around 8A Evans Street.
  - The northern portion of the Site along the Escarpment
- Crushed concrete gravel or imported clean VENM over areas of previous excavation, including:
  - The south-west corner (crushed concrete from a former warehouse slab in the area)

- The centre of the Site (imported VENM).

The following is to be considered with regard to the management of potential human health risks at the Site:

- The Site surface should be maintained with hardstand or an earthen cap to prevent direct human access to soil. In the event that the existing hardstand is partly or wholly removed, and/or changes to the configuration and/or penetrations are made, the following would be required:
  - Further assessment to evaluate potential impact to future users.
  - Reinstatement of hardstand, or placement of an earthen cap.

  It is noted that confirmation of the design of all proposed hardstand or earthen cap areas (i.e. thickness and material type) with a Contaminated Land Auditor is required prior to placement.
- In the event that the existing hardstand is partly or wholly removed, and/or changes to the configuration and/or penetrations are made, the following minimum design barrier shall be installed, unless otherwise agreed to with a Contaminated Land Auditor. Note that consideration will need to be given to the intended use of the hardstand area during the design process to ensure the hardstand is suitable for the anticipated loads (e.g. light or heavy vehicles):
  - *Layer 1*: Orange mesh para-webbing (or similar) placed as an indicator barrier over exposed soils to alert Site users/ maintenance workers.
  - *Layer 2*: Sub-grade/ base material (minimum 0.6 m) certified as 'Fill Material' in accordance with Tasmanian EPA Bulletin 105 and be geotechnically suitable.
  - *Layer 3*: Surface covering such as concrete or asphalt at a thickness suitable for the intended use (e.g. light or heavy vehicles). Asphalt shall be a minimum 30 mm thickness to allow for longevity of the barrier.
- Any drains in future basement or subterranean structures must have a physical barrier (i.e., a grate or mesh) to prevent direct contact with any potential groundwater infiltration to drains.

Modifications of the land use and/or the configuration of the Site surface may result in a potential human health risk due to exposure to contamination in the subsurface. This includes (but is not limited to) the following:

- Construction of new buildings.
- Modification of existing buildings.
- Any subsurface excavation works.
- Modification of the existing surface profile (specifically with respect to excavation and/or levelling of soil).
- Modification of the existing surface coverings (e.g. replacing a concrete area with turf).

Section 4.12 provides further guidance with respect to conducting excavation works on the Site. It is critical that in the event that the existing physical barriers are modified or removed during any future works, then they must be reinstated to a minimum of the same standard/quality that exists at that location currently.

In the event that variation from the barrier requirements within this SEMP are required, the suitability of the proposed barriers should be confirmed with a Contaminated Land Auditor prior to implementation.

4.7 Establishment of Plants and Vegetation

Where possible, landscaped areas and gardens should be established in above ground planter boxes on hardstand and not directly over exposed soil.

Where gardens are proposed in-ground, if proposed planting consists of shallow rooted vegetation only, the following barrier system shall be installed as a minimum:

- *Layer 1*: Orange mesh para-webbing (or similar) placed as an indicator barrier over exposed soils to alert Site users.

- *Layer 2*: Earthen cover (minimum 0.6 m) certified as 'Fill Material' in accordance with Tasmanian EPA Bulletin 105.
- *Layer 3*: Surface coverage (comprising shallow rooted vegetation).

If establishment of deeper rooted vegetation, including the establishment of trees, garden and vegetation area design must conform to the designs attached as **Appendix H**, and meet the following requirements:

- Soil imported for in-ground planting must be Level 1 – Fill Material, as defined in Information Bulletin No 105 – Classification and Management of Contaminated Soil for Disposal (IB105) (EPA, 2018).
- No plants intended for consumption are to be included in any in-ground planting on the Site, and no plants grown in-ground should be consumed.
- The potential size of plant root structures should be considered when selecting species for cultivation on the Site. Planting structures should have sufficient volume for the plants to develop without requiring root structures to penetrate the earthen liners and extend beyond the clean-fill soil.
- The earthen liner and barrier layers included in planting designs are to be installed above the Site water table.
- In-ground planting is only to occur in open space use areas. No in-ground planting is to occur within Site buildings (i.e., within atriums, foyers, or arboretums).
- Trees, or any other deep-rooted plants, which are cultivated on the Site should be excavated and removed as soon as possible if any of the following occurs:
  - Death or significant rot/reduction in size;
  - Toppling/knocking over by wind or impact;
  - Any other event which whereby the original Site soil may be accessible to Site users
- In the event that plant removal occurs:
  - Removal of all root structures must be included.
  - If root structures have extended and pierced the earthen liner and/or indicator barrier layer, these must be repaired and restored as part of removal of the plant(s).

Any alternative planting arrangement must be reviewed by a suitably qualified and experienced environmental professional, and documented as unlikely to represent an unacceptable environmental risk to users of the Site or adjacent areas prior to installation.

4.8 Vapour Intrusion Protection

Known Site contamination or former uses have introduced contamination which may present a risk of vapour generation at hazardous levels.

For construction or other short to medium term intrusive Site modification or improvement projects, WHSPs must include a consideration of monitoring of vapour levels of work zone, with particular consideration of:

- Hydrocarbon and fuel vapours (including both concentrations harmful to health, and potential explosive concentrations) for work in the area of NAPL plumes (including solidified DNAPL plumes) or fuel/gasworks infrastructure.
- Hydrogen cyanide (HCN) gases in disturbance of the former gasworks area of the Site.
- Soil methane is unlikely to accumulate in open excavations or trenches, as dissipation from wind or natural air movement typically exceeds any accumulation which may occur from diffusion from soil impacts. However, potential methane accumulation in small or enclosed structures should be considered.

WHSPs should document monitoring requirements and identified action levels based on health or risk documentation for vapours during works, as discussed in **Section 4.4**.

In addition, as discussed in **Section 3.5**, vapour mitigation or protection systems for TRH/BTEXN and methane are considered required for any new structures within or extending beyond the boundaries of the Goods Shed and Yard, the Gateway, the Precinct South, the Precinct North, and the Promenade and Underground Carpark areas.

Future building and utility design in these areas, or any structures which include these areas in their footprint, must have gas protection systems in place as follows:

- Methane – The protection system must include the sufficient protection measures for CS3, as defined in *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020).

  Table 8 in EPA NSW (2020) provides required gas protection guidance values based on the land use. Based on the current proposed development of the Site, a gas protection guidance value of 2 is considered required (AECOM, 2026a).

- TRH/BTEXN – A vapour mitigation system that provides a protection level equivalent to that specified for CS3 is considered appropriate for VOCs (EPA NSW, 2020), including TRH/BTEXN, if it is:
  - Suitably resistant to Site-specific CoPC identified, TRH and BTEXN, including long-term durability.
  - Has at least one layer of redundancy, where each layer is capable of independently providing the protection required.
  - Has calculated vapour fluxes or venting rates (if a ventilation layer is used) which demonstrate no unacceptable risk to users of the building or structure, as described in EPA NSW (2020).

- Design and construction documentation must include:
  - Demonstrated compliance with the required gas protection guidance value.
  - A documented testing and verification method for vapour intrusion mitigation measures, with reference to Appendix 7 – Verification and construction quality assurance, of EPA NSW (2020).
  - Have documented procedures for ongoing maintenance and inspection of vapour protection systems, including post-construction monitoring of venting layers if used, and requirements for restoration of any vapour protection systems which are damaged or penetrated by future activities.

As noted in **Section 4.7**, inground plants (such as atrium vegetation) must not be established over gas protection systems, to prevent potential roots from penetrating protection layers.

Any design and/or installation of vapour protection measures will require independent oversight and sign-off by an Environmental Auditor, or other suitably qualified and independent verifier.

Scoring and description of potential vapour mitigation measures, taken from Table 9 of EPA NSW (2020), are provided on **Table 13** below, with further detail on each measure found in EPA NSW (2020). A required vapour protection guidance value may be met by a combination of measures but must equal or exceed the requirement.

Table 13 Gas Protection Guidance Values (EPA NSW, 2020)

Measure or System Element	Score	Comments
Venting and dilution measures		
Passive sub-floor ventilation with very good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 0.3 metres per second (m/s)[(a)]	2.5	The design of the venting layer (i.e. granular medium with inlet/outlet pipes versus open-void or modular drainage system)[(b)] must be considered when modelling steady-state concentrations
Passive sub-floor ventilation with good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 1 m/s and below 2.5% v/v at a wind speed of 0.3 m/s)[(a)]	1.5	If post-installation testing of passive ventilation indicates that it cannot meet this requirement, inlets and outlets must be upgraded. If this is unsuccessful, it will be necessary to retrofit an active system
Sub-floor ventilation with active abstraction or pressurisation	2.5	Not appropriate for NEPM HIL A residential settings because robust management systems, including alarms, must be in place to ensure long-term operation and maintenance. Achieving the full score requires a design with adequate redundancy and full coverage of the building footprint.
Ventilated car park (basement or undercroft)	4.0[(d)]	Assumes that the car park is vented to deal with exhaust fumes in accordance with BCA[(c)] requirements. The design of a car-park and the specifications of its ventilation system need to be considered in assigning an appropriate score of up to four.
Horizontal soil barriers beneath building footprint		
Horizontal clay or amended soil barriers designed to achieve defined permeability and diffusivity of the gases of concern placed, compacted and tested under appropriate engineering supervision	[(d)]	Requires appropriate engineering input and integration with the building design from the earliest possible stage. This must consider the effects of any proposed piling on the gas regime
Floor slabs		
Reinforced concrete ground-bearing floor slab or waffle pod slab	0.5	At a minimum, it is good practice to install ventilation in all foundation systems to relieve pressure. Breaches in floor slabs, such as joints, have to be effectively sealed against gas ingress to maintain performance
Reinforced concrete ground-bearing foundation raft slab with limited service penetrations cast into slab	1.0	
Reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints	1.5	
Fully tanked basement	2.0[(d)]	The design of a basement and the specifications of its ventilation system need to be considered in assigning an appropriate score. Fully tanked means designed to be waterproof under the range of groundwater conditions likely at the site, to the extent that supplementary internal drainage is not required

Measure or System Element	Score	Comments
Membranes		
Proprietary gas-resistant membrane with a gas transmission rate for the gases of concern on the site that is certified and appropriate to the overall design of the gas protection system. It should be installed by a specialist to an appropriate level of workmanship with documented internal construction quality control (CQC), including integrity testing (e.g. tracer gas or smoke testing), under independent construction quality assurance (CQA) carried out by a certified specialist[(e)] or appropriately qualified and experienced professional with independent verification of the entire process[(f)]	2.0	Membrane performance depends on the membrane material and thickness specified, design and quality of the installation, protection from and resistance to damage after installation, and the integrity of joints in membranes that require joints. Materials that offer some degree of self-sealing and repair are preferred. Long-term performance depends on the durability of the material, including its resistance to chemical degradation in the environment in which it is installed
Monitoring and detection (alarms)		
Intermittent monitoring using hand-held equipment	0.5	Monitoring and alarm systems are only valid as part of a combined gas protection system. Where fitted, permanent systems should be installed in the underfloor venting system but can also be provided in the occupied space as a back-up
Permanent monitoring system installed in the occupied space of the building	1.0	
Permanent monitoring system installed in the underfloor venting or dilution system	2.0	
Pathway intervention external to building footprint		
Vertical barrier	(g)	Required for residential and public buildings at CS 4 and above
Vertical venting systems (source depressurisation)	(g)	

Notes: *(a) Verified by post-construction monitoring; (b) See Appendix 6 of EPA NSW (2020); (c) Building Code of Australia; (d) Score depends on site-specific conditions and design; (e) For example, Geosynthetic Certification Institute – Inspectors Certification Program; (f) See Appendix 7 of EPA NSW (2020); (g) Score depends on site-specific conditions and design, but scores of 4.0+ should be achievable*

4.9 Exclusion Zones

Exclusion zones related to sensitive underground services are currently present on the Site and require controls and consideration in work planning. The known services with established exclusion zones are listed on **Table 14** below, and shown on **Figure F5**.

It is noted that other potential exclusion zones, or underground services which represent a risk if disturbed by intrusive works, may be present or installed by other parties in the future. Any intrusive works undertaken on the Site should consider the potential for underground services in work planning.

Table 14 Known Exclusion Zones

Exclusion Zone	Extent and Area	Requirements and Comments
Hobart Main Pipeline (Sewer) Asset owned by TasWater	3 m around the Hobart Main Pipeline, which passes through the central portion of the Site.	Approval from TasWater is required to undertake construction or groundwater disturbance activities within the exclusions zone, with requirements described in *Guidelines for Building near Sewer or Water Pipelines* (TasWater, 2017). It is noted that this sewer line is being realigned off-Site, and is expected to be removed as part of Site development.

Exclusion Zone	Extent and Area	Requirements and Comments
Telecommunication Cables Assets owned by Telstra Tasmania	2 m around the telecommunication cables in the Escarpment in the north-west area of the Site.	Any requirements to work near these assets should be confirmed with the asset owner prior to commencement. It is noted that these cables are likely to be removed as part of development of the Site, although it is not known if this has been explicitly proposed or discussed with the asset owner.
High voltage (HV) and low voltage (LV) power cables in a single conduit. Assets are owned by TasNetworks	3 m around the HV cable 0.5 m around the LV cable The cables are located on-Site, or have exclusion zones which extend onto the Site, in the south-west corner within the Gateway	Any requirements to work near these assets should be confirmed with the asset owner prior to commencement. It is noted that areas of potentially elevated contamination have been identified within these exclusion zones, and additional controls (below this table) are required for any activity in the exclusion zones, or if the cables are removed as part of future development.

It is noted that:

- Lead concentrations in soil within the sewer and telecommunication exclusion zones exceeds the Site derived Remediation Criteria (RC), listed in **Appendix G**, for intrusive maintenance workers, and potential exposure to lead in soil should be considered when planning intrusive work within the exclusion zones.

  In the event that these services are disconnected and/or removed from the Site:

  - Remediation of soil via excavation may be considered. Any such remediation would require validation by a suitability qualified and experienced environmental professional.
  - If lead impacted soil is not removed and validated, the records that these areas should be considered as having potentially elevated soil contamination (**Section 3.2.3**) should be maintained. Any subsurface services within these areas should be installed in clean soil corridors or protective shrouds to reduce potential exposure during future intrusive maintenance works.

- Potential NAPL and former gasworks waste, referred to as Tar Plumes A (in part), C and Tar Plume D and described in **Section 3.4**, has been identified within the exclusion zone around the power cables in the south-west corner of the Site.

  In the event that intrusive works are undertaken within the exclusion zone around these power cables:

  - PPE and monitoring requirements suitable for work near potential DNAPL should be incorporated in safety documentation and procedures. At a minimum, monitoring for volatile organic compounds (VOCs) and hydrogen cyanide (HCN) with appropriately maintained and calibrated monitoring equipment should be undertaken, with suitable action levels for any detectable concentrations of potentially hazardous vapour.
  - The high and low voltage cables are understood to be installed within a conduit of clean soil. Tar was not encountered at the base of the conduit during installation. In the event that maintenance on the cables is required, work should be limited to within this soil conduit and vertical excavation should be limited to the extent practicable.
  - If the conduits are removed or otherwise decommissioned and the exclusion zone removed, documentation of Tar Plumes C, D, and the portion of Tar Plume A not treated by ISS should be maintained in the SEMP and considered in planning intrusive work in those areas.

    A barrier layer should be maintained over the areas of potential impact as described in **Section 4.6**.

4.10 Chemical Exposure

The following CoPC have been identified in soil, groundwater, and soil vapour at concentrations above the adopted assessment criteria in past investigations and may pose a potential human health risk during future intrusive work:

- Heavy metals
- PAHs
- TRHs
- BTEXN
- ACM
- Methane
- NAPL, including solidified NAPL

A summary of the potential symptoms of exposure is provided in **Appendix D**. Potential exposure to these CoPC should be managed through the implementation of measures provided in a Site-specific WHSP (refer **Section 4.3**).

Other CoPC which may be present at the Site based on historical uses and information, but which have not been detected at potentially hazardous concentrations, are listed in **Section 3.1**.

4.11 Unexpected Finds

In the event that unexpected finds are encountered during intrusive works which have the potential to cause harm to human health or the environment, works shall cease and the area isolated. The Site supervisor and owner/occupier should then immediately be informed.

An unexpected find may include (but not be limited to):

- ACM (see **Section 3.6**)
- USTs
- Redundant pipework and abandoned services (as discussed in **Section 2.4**)
- Historic artifacts (Aboriginal and European) (see **Section 4.11.1**).
- Former gasworks infrastructure
- Stained, odorous, or discoloured soil
- Groundwater at a shallow depth than anticipated.

The material should be appropriately assessed by an experienced environmental or health and safety practitioner (depending on what the material is) and disposed/treated in a suitable manner with consideration to the guidance outlined in **Section 4.12**. Historic or artifact finds should be managed as described in **Section 4.11.1**

It should be noted that during previous Site investigations, redundant pipes and other abandoned services have been encountered which are not on any records and the origin and purpose of which remains unknown. There remains further potential for unidentified pipes to be discovered during subsurface works, and ACM has been detected in bituminous cladding of some pipelines previously removed from the Site. Underground service location surveys are to be completed prior to the commencement of subsurface works and due caution taken as part of any excavation.

Further to the above, if subsurface works are to be undertaken within the Gateway area, or in proximity to the former Hobart Gasworks, reference is made to recommendations provided in Workplace Standards Tasmania *Safety Alert No. 1 September 2010* with regard to working near historical gas infrastructure.

4.11.1 Protocol for Management of Unanticipated Archaeological Discoveries

The potential exists for unexpected Aboriginal and European artifacts to exist in Site soil. Portions of the Escarpment, Gateway and Promenade and Underground Carpark areas have been identified as a Place of Archaeological Significance in the *Sullivans Cove Planning Scheme.*

The following outlines the protocol for managing Unanticipated Historic (European) Archaeological Discoveries. Separate legislative and procedural requirements exist for Aboriginal heritage and these are documented in the Corporation's procedure *MPMS-MPDC-PC-ES-05-01 - Unanticipated Discovery Plan - Aboriginal Heritage*.

Archaeological investigations have taken place at Macquarie Point since 2008 through a series of test and controlled excavations, principally at the western end of the site. These works assist in understanding subsurface archaeological conditions and the potential of certain locations within Macquarie Point to contain archaeological features. Based on these insights, some inferred judgements have been made on:

- The potential, or likelihood for particular areas to contain subsurface archaeology; and
- The likely significance of such features or deposits.

Figure 3 shows the inferred areas archaeological sensitivity of the Site based on works completed to date (MPDC, 2024b), consisting of:

- High Sensitivity. High archaeological sensitivity is present within a single location of Macquarie Point in an area of the original ground surface with demonstrated or historically documented high levels of preservation. This area is highly sensitive both in terms of Aboriginal and early colonial archaeological potential.
- Moderate Sensitivity. Areas of moderate archaeological sensitivity include two places that are within or near to the original shoreline but may not have been heavily or moderately disturbed by twentieth century or late nineteenth century industrial development. These areas may be covered by fill or built upon by later development but there remains a reasonable probability that significant historical or Aboriginal materials are retained, although it is likely they are in a disturbed or secondary context. Any significant archaeological materials that are present may be intermittent or truncated. While twentieth century or late nineteenth century construction has left structural remnants that has not resulted in the total removal of the early soil profile.
- Area Cleared Through Excavation. The archaeological potential of these areas has been previously realised through past archaeological excavations.
- Low Sensitivity. These areas are distinguished by disturbances associated with twenty-first, twentieth century or late nineteenth centuries' industrial development. The pre-colonisation ground surface in this area may be entirely removed or stripped back to bedrock. These locations may also be the site of significant land reclamation. The potential for isolated pockets of redeposited archaeological material remains but is considered to be very small. There is a very low likelihood for Aboriginal cultural material to be present even in secondary contexts.
- Indeterminate or Nil Sensitivity. This rating of sensitivity reflects a lack of determination or a positive assessment of nil archaeological sensitivity across the broader areas of the site as documented in earlier reports and sensitivity mapping. It denominates areas for which detailed subsurface information is lacking but which have not been considered to contain any significant archaeological material. The inclusion of an area within this level of sensitivity rating is not intended as a definitive statement of its sensitivity but rather indicates that while previous sensitivity mapping may have considered the historical development of this area, there has been no assertion of archaeological potential.

The "Royal Engineers Building and Stone Post" (shown on **Figure 3** as 2 Davey Street 'Royal Engineers Building') and the Goods Shed are listed on the Tasmanian Heritage Register and require additional protection and consideration of heritage for development. The Goods Shed is proposed to be moved to the north of the Site, and no development of the Royal Engineers Building is proposed at this time. The former location of Lord's House adjacent to the Royal Engineers Building and the Rivulet

Diversion Tunnel (referred to elsewhere in this document and other reports as the Hobart Rivulet) are also of historic interest, but are not registered as heritage features.

Areas of Aboriginal sensitivity, where shell middens have been observed, are also known to be present in Regatta Point.

Figure 3 Areas of Inferred Archaeological Sensitivity (MPDC, 2024b)

However, it is highly likely that unanticipated archaeology will be encountered during excavation works because of the diversity and widespread nature of past development on the site and the limited insights available from historical research and excavations.

To account for such finds, project specifications for works must consider the potential for dealing with unanticipated discoveries. The Sullivans Cove Planning Scheme 1997 includes specific requirement as part of its requirements for Archaeological Sensitivity Reports, terming such protocols a ‘watching brief’.

Features may include but not be limited to the exposure of handmade clay bricks or sandstone blocks forming walls or surfaces, or artefacts such as fragments of ceramic, bottle glass, bone, shell or other items. Where such material is found, or where doubt exists, excavations within the area should cease pending attendance on site and receipt of advice from a qualified archaeologist, at which point, depending on the findings, it may also be necessary to involve Hobart City Council in discussions.

What if any further archaeological management is required will depend on the significance of the discovery. This will largely be a question of its thematic context; its potential to provide new and important information; and its condition. Management may vary from no further action, to recording of exposed features, to further archaeological monitoring, testing or controlled excavation in accordance with Parts 4 to 8 of the Tasmanian Heritage Council's *Practice Note 2: Managing Historical Archaeological Significance in the Works Application Process.*

4.12 Soil Management Plan

The management of soils at the Site must have regards to the provision of both the *Environmental Management and Pollution Control Act 1994* and IB105.

4.12.1 Excavated Material

In the event soil needs to be excavated, the contamination status of the soil must be determined and a waste classification assessment completed (discussed in **Section 4.12.4**).

If excavated materials are stored on-Site, they must be stockpiled in a designated area, or otherwise stored in soil drums, waste skip or other containment which prevents contact with Site surfaces or loss of soil via erosion, and must be labelled as contaminated, until the material is removed, reinstated, or otherwise disposed of.

The stockpiling area is to be on hardstand or high-density polyethylene (HDPE) sheeting. Stockpiles should be appropriately managed to prevent the loss of suspect soils as dust (via wind erosion), or stormwater runoff.

This may involve:

- Covering, or spraying the stockpiles to keep the soil damp to mitigate wind erosion.
- Construction of silt fences and other measures to capture and prevent runoff from the area.
- Establishment of exclusion zones or barriers to prevent access and contact with soil by unauthorised people.

Stockpiling for an extended period of time should be avoided in order to mitigate potential environmental impacts such as dust and odour generation, and stormwater and sediment run off. Exclusion zones or barriers should be maintained around excavations to prevent access by unauthorised people who may fall into excavations or come into contact with the soil.

Soils with potentially high levels of contamination encountered during excavation work must be separated and stockpiled from other non-odorous, visibly clean soils, and assessed by a suitably experienced environmental practitioner. Soils which should be separated in this way may be identified by one or more of the following attributes:

- Containing coke, ash, coal tar, ACM fragments, or other visually evident contamination
- Highly odorous (i.e. putrescible, aromatic or hydrocarbon odours)
- Visibly stained (i.e. hydrocarbon staining or other)
- Soil which appears to have been in contact with groundwater
- Soil excavated from the areas of notable soil impacts as noted in **Section 3.2.3**.

4.12.2 Dust Management

This section is applicable to works associated with subsurface excavation and soil movement. It is expected that normal operation of the Site, or intended future uses, will not require the implementation of dust and odour controls.

The following measures that can be undertaken to assist with mitigating issues associated with dust and odours should be considered when planning soil excavation or movement on the Site:

- Minimise movement of vehicles on exposed surface areas
- Minimise excavation and movement of soils
- Dampen down vehicle tracks with water or undertake wheel washing
- Trucks transporting soil around and off-Site should have their loads covered with tarpaulins (or similar) to prevent the emission of dust and/or odour
- Dampen down exposed soil in excavations, or in stockpiles, to minimise dust generation
- Dampen down exposed soil, stockpile, or loads, with an environmentally appropriate odour suppressant solution
- Avoid excavating soil on windy days, due to the increased likelihood of dust and odour generation and transport
- Cover exposed soil (i.e. stockpiles) with netting, matting or plastic sheeting if necessary, to minimise generation of dust and odours.

4.12.3 Acid Sulfate Soil

This section is applicable to works associated with subsurface excavation and movement of soil at or near the water table, where greater than 100 m^3 in volume of soil will be disturbed or potentially exposed to atmospheric oxygen.

PASS located in saturated materials at or near the water table has the potential to oxidise and form Actual Acid Sulfate Soil (AASS) if disturbed or exposed to oxygen. The extent and characteristics of PASS detected at the Site are described in *Acid Sulfate Soil Investigations* (AECOM, 2025d), which requires:

- Future activities at Macquarie Point should identify all activities which have the potential to disturb or expose (i.e., dewater) PASS at the Site, and:
  - The SEMP and CEMPs should include overarching management obligations for disturbance of ASS and/or water table drawdown via dewatering.
  - A scope specific Acid Sulfate Soil Management Plan (ASSMP) and Dewatering Management Plan (DWMP) should be developed for each discrete works package involving civil and general earthworks activities, water table drawdown via dewatering, and any other significant soil disturbance activities or changes to natural groundwater and surface water systems.

    These documents should be prepared by those undertaking works which may disturb PASS, and must include:
    - Estimated volumes and action criteria for PASS which may be disturbed by the proposed works.
    - Procedures for the handling of disturbed PASS, including verification of neutralisation, groundwater generated by dewatering, and monitoring of Site environmental conditions in the vicinity of PASS disturbances.
    - Contingency measures which are specific, measurable, and attainable, and can be implemented in a timely manner in the event that action criteria or trigger values are exceeded.
- Future structures and infrastructure at the Site should consider the potential effects of sulfides and possible acidification in design and selection of materials, and adopt appropriate mitigation measures to prevent degradation of materials overtime.
- Any groundwater, or run-off which may have come into contact with PASS, should be considered as potentially contaminated. pH and the potential to acidify should be considered in assessment any such water prior to disposal

4.12.4 Characterisation for On-Site Reuse/ Off-Site Disposal

Tasmanian EPA Information Bulletin No. 105, *Classification and Management of Contaminated Soil for Disposal* (IB105) (EPA, 2018) provides guidance with regard to the classification of contaminated soil for disposal purposes. Two categories of Fill Material were introduced by amendment of the *Environmental Management and Pollution Control Act 1994* (the EMPCA) and the *Environmental Management and Pollution Control (Waste Management) Regulations 2020* in 2021, and clarified by *Clean fill Type 1 and type 2 – Declaration of pollutant levels* (EPA, 2022).

Soil at the Site excavated and removed from the Site as part of remediation work between 2015 and 2024 has typically been characterised as Level 2 – Low Level Contaminated Soil due to the presence of:

- Metals (arsenic, cadmium, chromium (total), copper, lead, mercury, nickel, tin, zinc)
- TPH (>C10-C36)
- PAHs

It is noted that total concentrations of PAHs (generally benzo(a)pyrene and Sum of PAHs) and lead in excess of the Level 2 criteria have been detected in Site soil. However, Section 2 of IB105 states that "*Generally, where a leachable concentration is prescribed in Table 2* [of IB105] *that value takes precedence over the total concentration and is used as the sole determinant of the final classification for disposal…*"

Leachate concentrations of benzo(a)pyrene, benzo(a)pyrene toxicity equivalence quotient (TEF), and lead have typically been reported below the Level 2 criteria. However, total concentrations of these CoPC have been, and should be for future soil, considered when determining disposal scenarios.

Based on analytical results available for soil which remains *in situ* at the Site, it is expected that remaining soil will have similar characteristics. Small areas of other possible characterisations may exist, consisting of:

- Level 1 – Fill Material, which has been identified on-Site in:
  - Areas where clean fill has been imported and no contaminating activities have occurred, such as bedding sand beneath recent slabs.
  - Natural rock (dolerite bedrock) which has been excavated and crushed.
- Level 3 – Contaminated Soil, which has been identified on-Site in:
  - Areas of elevated hydrocarbon impact where bulk fuel storage has previously occurred, such as proximity to known LNAPL plumes.
  - Areas of elevated metals concentration in fill material.
  - Areas of leachable PAHs or tar traces in the former gasworks area in the southwest corner of the Site (the Gateway).

Due to the heterogeneous nature of soil at the Site, excavated soil or other materials from the Site must be stockpiled (or stored within a skip/drums) and appropriately characterised for on-Site reuse or off-Site disposal by a suitable qualified environmental practitioner on a case by case basis.

It is noted that in accordance with IB105, on-Site remediation, treatment and/or reuse is the preferred approach to the management of contaminated soil.

A recommended approach for characterising excavated materials is provided in the following sections.

4.12.4.1 Soil Assessment and Sampling

Any assessment of soil, including any sampling program to determine acceptable on-Site reuse or off-Site disposal scenarios, should be planned and undertaken by a suitability qualified and experienced environmental practitioner.

Any such assessment should consider the history of the source area and potential sources of contamination, and any previous investigations or available analytical data, in order to identify CoPC in the soil to be assessed. Additional sampling, if required, should be conducted in line with the guidelines

and practices in the ASC NEPM and other guidance or commonly accepted reference methodologies, and should include quality assurance and quality control sampling such as intra- and inter-duplicate samples and analytical blanks.

Soil should be sampled at a suitable rate for assessment and identification of contaminants. IB105 defines 1 sample per 25 m^3 for waste classification, but statistical assessment methodologies, such the approach provided in *IWRG702 - Industrial Waste Resource Guidelines: Soil Sampling for Waste Soils* (IWRG702) (EPA Victoria, 2024) may be appropriate for larger volumes with EPA approval.

4.12.4.2 On-Site Reuse

To assess the suitability for excavated materials to be reused on Site, it is recommended that soil data be screened against the Site derived Remediation Criteria (RC) developed by AECOM (refer AECOM, 2016, 2025a) and listed in **Appendix G**. The RC are based on generic assumptions regarding future land use including:

- An engineered break layer will be present at the ground surface to mitigate the potential for future Site users (with the exception of Maintenance Workers) to have direct contact with soils or groundwater.
- Groundwater extraction will not be undertaken except for investigative or remediation purposes.
- A SEMP (this document) will be in place in the future to maintain/manage the surface cover. The SEMP is likely to be included as part of the Site suitability statement provided by the Site Environmental Auditor.
- Adjacent off-Site land uses include open space, commercial/industrial and residential areas. As these potential land uses have been considered on the Site, the derived RC are considered to also be protective of potential exposures to off-Site receptors (e.g. via groundwater migration beyond the Site boundary).
- It is considered that potential exposure to workers undertaking remediation and/or development activities can effectively be mitigated through the implementation of an appropriate Construction Environmental Management Plan. The CEMP will be prepared during the planning stage for any future remediation and/or development activities.

Soil should be analysed for, at a minimum:

- Heavy Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, vanadium, and zinc)
- TPH
- BTEX
- PAH
- Cyanide
- Phenolic compounds.

In addition:

- At least 30% of samples should be analysed for a full suite of the compounds listed in IB105, with the exception of tributyltin, which has not been detected or historically used on Site.
- If it is suspected that other contaminants may be present (e.g. asbestos), these should also be included in the analytical suite.
- If >100 m^3 of soil has been excavated from below or within 1 m of the water table, it should be managed as PASS as described in **Section 4.12.3**. Soil should only be considered for reuse if neutralisation of any potential acidification has been confirmed by laboratory analysis, typically by either chromium reducible sulfate (CRS) or suspension peroxide oxidation and combined acidity sulfate (SPOCAS) analysis.

Where compounds are reported below the interim RC, soils may be reused on-Site and covered with an impervious barrier (i.e. placement of physical hardstand). In cases where compounds are reported above the interim RC, an appraisal as to whether the material is suitable for on-Site reuse (with

consideration to the implementation of additional management controls) should be undertaken by an appropriately experienced environmental practitioner.

4.12.4.3 Off-Site Disposal

If off-Site disposal of excavated material is planned, stockpiles or waste in soil drums must be sampled and analysed for waste characterisation purposes prior to removal from Site in accordance with IB105.

Material should be sampled at a rate of 1 sample per 25 m^3 (or three samples as a minimum) and analysed for compounds listed on Table 2 of IB105. Alternative sampling suites and/or density may be accepted by EPA and waste disposal facilities, but any change from the sample suites and sample density should be determined by a suitably qualified environmental practitioner.

If >100 m^3 of soil has been excavated from below or within 1 m of the water table, it should be managed as PASS as described in **Section 4.12.3**, and neutralisation should be confirmed by laboratory analysis prior to any off-Site disposal.

Table 15 below provides an overview of soil disposal options with reference to IB105.

Table 15 IB105 – Waste Classification Summary

EPA Classification	Disposal/ Treatment Options	Requirements
Level 4 (Contaminated Soil for Remediation)	• On-Site remediation • Off-Site remediation • Storage pending availability of treatment	• No direct disposal to landfill • EPA Environmental Approval and transport certificates must be used • Vehicles must hold EPA permit (unless exemption issued)
Level 3 (Contaminated Soil)	• On-Site remediation • Off-Site remediation • Licensed landfill	• Disposal to licensed facility • EPA Environmental Approval and transport certificate system must be used • Vehicles must hold EPA permit (unless exemption issued)
Level 2 (Low Level Contaminated Soil)	• On-Site remediation • Off-Site remediation • Licensed landfill	• Disposal to licensed landfill • EPA Environmental Approval and transport certificate system must be used • Vehicles must hold EPA permit (unless exemption issued)
Level 1 (Fill Material)	• Unrestricted	• Disposal should not adversely impact the environment or human health

A Waste Management Plan (as detailed in Section 5.2 of IB105) must be prepared and submitted to EPA for approval for disposal of any material which is classified as *Level 2 (Low Level Contaminated Soil)* or above.

Soils and excavated materials classified as *Level 4 (Contaminated Soil for Remediation)* must be remediated (either on-Site or off-Site) and are typically unable to be disposed directly to landfill without treatment.

Any proposed disposal site must be legally able to accept the quantities and contaminant profile of any material proposed for off-Site disposal.

4.12.5 Imported Material

Any materials imported to the Site for use as fill will be required to meet the environmental and geotechnical requirements specified for the particular end use. Material should comply with the

requirements for reuse as defined in IB105 and should be assessed and below the site specific RC as defined in **Appendix G**.

Compaction of backfill should be applied such that the reinstated areas will not settle.

4.12.6 Surface Reinstatement and Barrier Restoration

Where hardstand has been removed to facilitate excavation activities, it is recommended that the surface be reinstated with like materials (i.e. concrete with concrete), or with a physical barrier which fulfils the requirements described in **Section 4.6**.

4.12.7 Material Tracking

A record of excavated soil and stockpile movements, including, but not limited to, the location of materials excavated, quantities, descriptions of materials encountered (including observations of potential contamination), laboratory test certificates, disposal location, and tip dockets, should be maintained by the Site owner or occupier for any work involving the import, excavation, or other movement of soil at the Site. This tracker should be kept with Site records for future reference.

The form of tracking may be determined by those managing or conducting the works, however an example materials tracking register is attached as **Appendix E**.

4.13 Groundwater Quality Management Plan

A Site-specific Groundwater Quality Management Plan (GQMP) is attached as **Appendix F**, and must be implemented at the Site in order to allow:

- Maintenance of knowledge on the condition of Site groundwater elevation, flow direction, and chemical characteristics and record any changes which may arise over time or as Site condition changes.
- Assess if unacceptable risks to on- and off-Site human and ecological receptors may be presented by changes in groundwater conditions, and to identify what additional assessment, mitigation, or remediation actions are required.

The GQMP includes:

- A summary of the regulatory framework applicable to the assessment and management of groundwater at the Site.
- Data Quality Objectives (DQOs) for groundwater monitoring events (GMEs) at the Site.
- Methodologies for ongoing monitoring and sampling of groundwater.
- Key groundwater risks.
- Trigger levels and contingencies.

The GQMP should be reviewed and updated at the same frequency and conditions as the SEMP (**Section 5.4**), or as otherwise identified within the GQMP. Ongoing groundwater monitoring at the Site within the GQMP may only cease with Environmental Auditor verification of the final GME report which recommends cessation of groundwater monitoring.

4.14 Noise Control

Works with heavy plant or other equipment which has the potential to cause noise above background levels should be conducted in accordance with the most recent version of *MPMS-MPDC-FW-MP-04-02 - Construction Noise & Vibration Management Framework*, or have otherwise documented procedures and methodologies which comply with the *Environmental Management and Pollution Control (Noise) Regulations 2016*.

Noise and vibration controls should consider and include:

- Receptors on- and off-Site who may be affected by noise and vibration.

- Acceptable levels of noise and vibration generation, including Noise Management Levels and alarm levels
- Potential sources of noise and vibration, and allowable hours of operation
- Mitigation and monitoring procedures

5.0 Implementation

The SEMP is an active document, which needs to be considered by all parties/stakeholders who may plan or undertake works which come into contact with Site soil or groundwater or access confined spaces where groundwater or soil vapour infiltration may occur. Any parties carrying out such works at the Site shall satisfy themselves that suitable safety and environmental controls have been implemented as part of their proposed works program.

Should any activities by the Site owner or occupier, or with their consent, need to occur on the Site that is not currently covered in the SEMP, then the SEMP should be updated to include these activities. Alternatively, as stated in **Section 4.1**, a CEMP may be required which specifically addresses the proposed tasks and how the works shall comply with the general requirements of the SEMP.

5.1 Site Inspection

Visual inspections of the Site should be undertaken by the Site owner or occupier (or nominated representative) annually to assess the surface condition of the Site. Where excavations have taken place, and excavations have been backfilled, the surface is to be reinstated with an impervious barrier (i.e. placement of physical hardstand).

If significant works are undertaken, or breaches or damages to surface protections are detected, inspection of the affected area should be undertaken at the time of works, and at the completion of modifications of the area, or repairs to damaged surface coverings.

Where this has not been undertaken, corrective actions will be required to reduce the risk to an acceptable level to such an extent that it no longer presents an unacceptable risk to human health or the environment.

A register of the completion of visual inspections and documentation associated with works completed subsequent to inspections identifying the need for corrective actions should be maintained by the Site owner or occupier, as noted in **Section 5.5**.

The register of inspections should include (but not be limited to) the following:

- Time and date of the inspection and/or incident
- Details of any visual indications of changes to surface conditions at the Site
- Details regarding the cause (suspected or known) of the breach
- Details and documentation associated with works undertaken in the reinstatement of surface condition
- Details of any systems or procedures implemented to prevent similar breaches or deteriorations in the future.

5.2 Incident Management

All environmental incidents should be recorded, and if an incident or potential incident is likely to cause significant impacts to people or the environment, the Site owner or occupier should be immediately notified.

Environmental incidents, accidents or mishaps include:

- An incident or actual environmental impact.
- A near miss, where an incident has occurred, but no environmental impact occurred.
- Observations of potentially hazardous or unsafe situations.

Records shall be kept by the Site owner or occupier of any environmental incidents, hazardous situations, unusual events and the corrective action taken. A representative of the Site owner or occupier should investigate the cause of any emergency so that necessary changes in work practices can be made to prevent the incident recurring.

5.3 Corrective Actions

In the event that Site conditions result in an accidental or unintentional risk to human health or the environment without implementation of appropriate exposure minimisation measures, isolation of the affected area should be undertaken and steps taken by the most suitable and effective means to prevent exposure to Site personnel or the environment.

Following this, the SEMP should undergo a review of all procedures to minimise the potential for future exposure of impacted material. Corrective actions should be completed in a manner and timing as directed by the Site owner or occupier.

Following the incident or accident, a documented review of the incident should be undertaken by the Site owner or occupier (or their nominated representative). The review should be tasked with identifying the cause of the incident and providing recommendations on alternative procedures or systems to be implemented at the Site and/or within the SEMP to prevent/minimise the likelihood of the incident reoccurring.

5.4 Document Revision

A review of the SEMP should be undertaken by the Site owner/occupier:

- Every three years, based on the range of 1 to 5 years provided in *Environmental Management Plan Guidelines* (DCCEEW, 2024).
- If significant changes in Site use or environmental condition (i.e., a chemical release) occur.
- If significant changes to environmental legislation occur
- Within three months of any design variance being reviewed and accepted by a suitably qualified and experienced Contaminated Land Auditor prior to construction (**Section 1.2**).

Reviews should consider the following, and identify if any update or revision of the SEMP is required:

- Any non-compliances with the SEMP that have not been rectified
- Means of improving environmental compliance
- Changes legislation or guidelines that impact any part of the SEMP or use of the Site
- Proposed changes in the way the areas of the Site are used or any changes in the surrounding land use which may impact upon exposure pathways.
- Any design variances (i.e., proposed designs which did not comply with the wording of the SEMP) which have been reviewed and verified as not introducing any unmanaged or unacceptable environmental risks by a suitably qualified and experienced Contaminated Land Auditor (see **Section 1.2**).

Any changes or updates to the SEMP should be recorded in **Appendix N**. The Site owner/occupier (or their designated delegate) must communicate any changes and provide the most recent version of the SEMP to any contractors or other workers who are undertaking Site activities which may come into contact with soil or groundwater.

5.5 Record Keeping

The Site owner or occupier will be responsible for keeping documents relating to the implementation of the SEMP, including (but not limited to):

- Documentation generated by the activities in **Section 5.1** to **5.3**, including records of Site inspections, environmental incidents, and corrective actions.
- The most recent specific procedures which are referenced in this SEMP, or any subsequent replacements, consisting of:
  - *MPMS-MPDC-PC-ES-05-01 - Unanticipated Discovery Plan - Aboriginal Heritage*
  - *MPMS-MPDC-FW-MP-04-02 - Construction Noise & Vibration Management Framework*

  - *MPMS-IMP-MP-WH-04-01 – Asbestos Management Plan*
  - *MPMS-ELG-RG-WH-04-01 – Site Asbestos Register*
- The outcomes of additional environmental assessments or modifications in the future Site uses.
- Any design variances (i.e., proposed designs which did not comply with the wording of the SEMP which have been reviewed and verified as not introducing any unmanaged or unacceptable environmental risks by a suitably qualified and experienced Contaminated Land Auditor (see **Section 1.2**).
- A SEMP maintenance register (including superseded versions of the SEMP), Site inspection documents, permits and approvals for environmental work, and training records of people who have been inducted onto the SEMP.
- Documentation of the following:
  - Materials tracking and disposal
  - Unexpected finds
  - Environmental incidents which occur on Site
  - Any other environmental investigations or records, such as records of annual GMEs conducted under the GQMP (**Appendix F**).

The SEMP and any records of environmental activities must be provided by the previous Site owner to the new owner in the event of any land sale or transfer, which changes control of all or a portion of the Site.

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7.0 Limitations

AECOM Australia Pty Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of the Macquarie Point Development Corporation and only those third parties who have been authorised in writing by AECOM to rely on this Report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract titled *Macquarie Point Development Project – Proposal for Report Updates – Acid Sulfate Soil and SEMP* dated 19 September 2025.

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report is dated 10-Apr-2026, and is based on the information reviewed and referenced in the Report text at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This Report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the site.

Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

Appendix A

Figures

List of Attached Figures

Figure F1 Site Location

Figure F2 Site Layout and Proposed Development

Figure F3 Current and Proposed Final Surface Elevations

Figure F4 Current Groundwater Wells and Soil Vapour Bore Locations

Figure F5 Subsurface Features

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metres

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LEGEND

- Regatta Grounds Boundary
- Macquarie Point Site Boundary

SITE LOCATION

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure

F1

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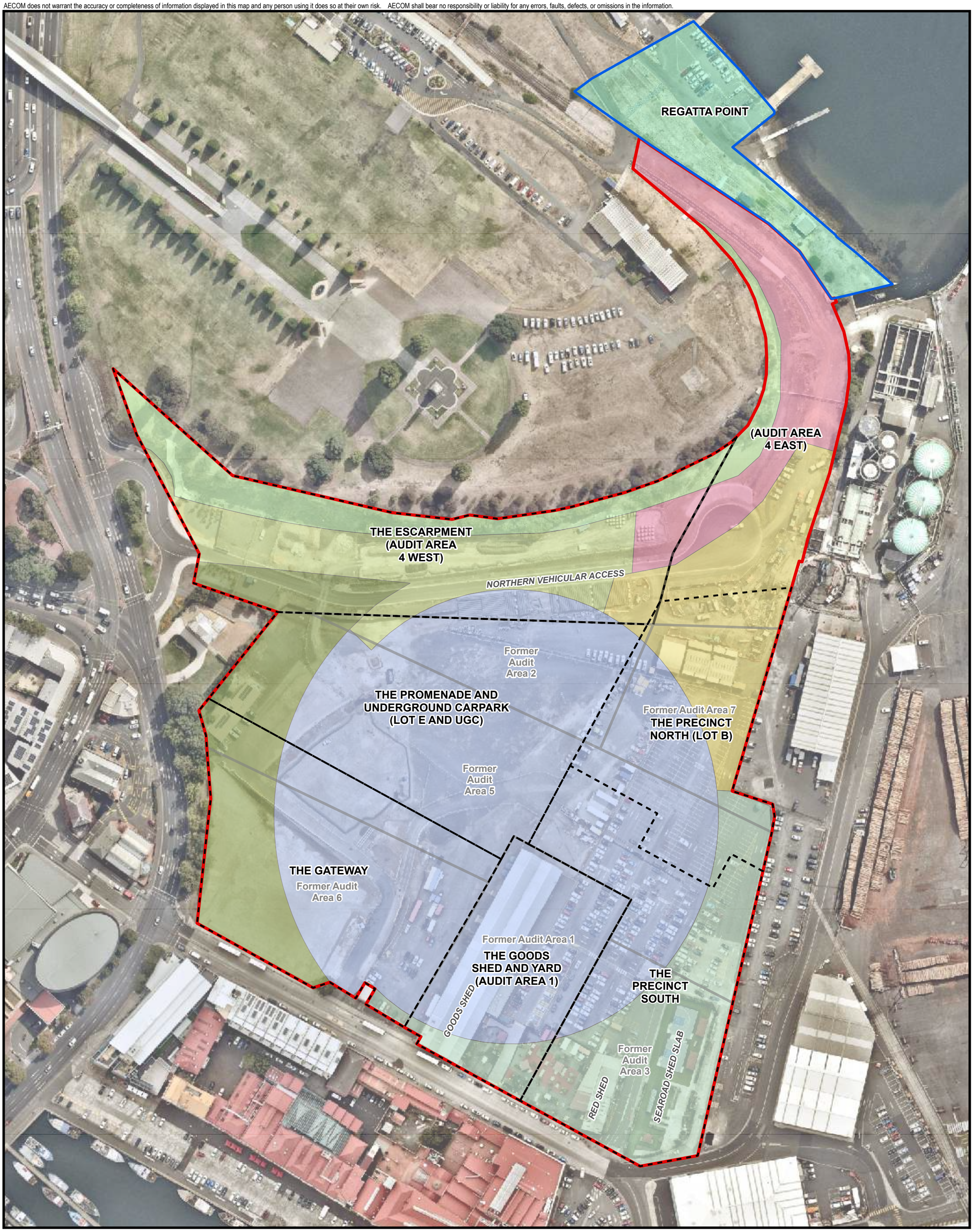

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Legend

- Regatta Point Boundary
- Assessment Area
- Former Audit Areas
- Site Boundary

Proposed Future Land Use

- Aboriginal Culturally Informed Zone
- Residential Development and Public Foreshore Zone
- Paved area and extension to the Aboriginal Culturally Informed Zone
- Multipurpose Stadium and Associated Concourse Zone
- Complementary Integrated Mixed Use Zone
- Royal Engineers Building and Land
- Antarctic Facilities Zone
- Transport Corridor
- Vegetated Area

SITE SETTING AND LAYOUT

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure
F2

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REGATTA POINT

THE ESCARPMENT (AUDIT AREA 4 WEST)

(AUDIT AREA 4 EAST)

Final level - 4.8 mAHD

Final level - 1.7 mAHD

THE ROYAL ENGINEERS BUILDING AND LAND

THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC) (PART AUDIT AREAS 2 AND 5)

Final level - 3.0 mAHD

THE PRECINCT NORTH (LOT B) (AUDIT AREA 7 AND PART AUDIT AREAS 2,4 AND 5)

THE GATEWAY (AUDIT AREA 6 AND PART AUDIT AREA 5)

Final level - 3.3 mAHD

THE GOODS SHED AND YARD (AUDIT AREA 1)

THE PRECINCT SOUTH (AUDIT AREA 3 AND PART AUDIT AREA 5)

Final level - 2.9 mAHD

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DATUM GDA 1994, PROJECTION MGA ZONE 55

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Legend

- Regatta Point Boundary
- Current Assessment Area Boundary
- Site Boundary

Final Surface Level

- Final level - 1.7 mAHD
- Final level - 2.9 mAHD
- Final level - 3.0 mAHD
- Final level - 3.3 mAHD
- Final level - 4.8 mAHD

CURRENT AND PROPOSED FINAL SURFACE ELEVATIONS

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure
F3

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metres

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Legend

- 2025 Groundwater Well
- Existing Groundwater Well
- 2025 Soil Vapour Bore
- Existing Soil Vapour Bore
- Reinstated and Resurveyed Existing Well
- TasPorts Well
- Assessment Area Boundary
- Site Boundary

CURRENT GROUNDWATER WELLS AND SOIL VAPOUR BORE LOCATIONS

Macquarie Point Development Corporation

Site Environment Management Plant

Macquarie Point, Hobart, TAS

Figure
F4

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DATUM GDA 1994, PROJECTION MGA ZONE 55

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metres

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Legend

- Assessment Area
- Regatta Point Boundary
- Site Boundary
- Sea Wall
- Sealed Pipe
- Potential Buried Railway
- Engineer's Jetty (Buried)
- HV Conduit
- LV Conduit
- City of Hobart Services
- Stormwater pipeline
- Sewer (Main Hobart Pipeline)
- Former Sewer pipeline
- Naval oil pipeline
- Water pipeline
- Diesel Pipeline (Remaining)
- Oil Line (Remaining)
- Fuel Line (Remaining)
- Telecommunication Cables
- Lead impacted soil on Site boundary
- Petroleum impacted soil on Site boundary
- Buried and capped ACM
- Previous UST Location
- Lead impacted soil to be excavated as part of development
- Lead impacted soil may be present at base of excavation following development excavation

SUBSURFACE FEATURES

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure F5

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\09\Precinct_South_CUTEP\F4_A3P_Subsurface_Features.mxd)

A3 size

Appendix B

SEMP Distribution and Sample Induction Register

Site Owners/Occupiers - SEMP Distribution List

Date	Revision	Area of Site	Owner / Occupier	Contact Name	Contact No.
15-Oct-2021	A	Whole Site	Macquarie Point Development Corporation	Greg Cooper	0400 165 638
22-Oct-2021	0				
17-Nov-2021	1				
18-Dec-2024	2				
30-Sep-2025	3				

SEMP Induction Form

Date	Name	Company	Position/ Responsibility	Contact No.	Signature

Appendix C

Area Specific Contamination Fact Sheets

Macquarie Point Site Environment Management Plan

Area Specific Contamination Fact Sheets

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1.0 Goods Shed and Yard Contamination Summary

Historical activities undertaken within The Goods Shed and Yard area have resulted in the presence of residual soil and groundwater contamination. Multiple phases of soil, groundwater and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil and groundwater impacts in this area of the Site.

No further remediation of the Goods Shed and Yard is planned or considered required at this time.

1.1 Identified Soil Impacts

Fill has been identified beneath the Goods Shed and Yard area from the surface to depths of 7 – 10 m below ground level (bgl). Field observations indicated that fill material is heterogeneous comprising silts, sands with dolerite gravels and cobbles with occasional rubble, glass, metal fragments, coal, coke and ash. A slight hydrocarbon odour was noted at two sampling locations (BH36 and MW127), and a slight hydrocarbon sheen was also noted during the drilling of the soil bore for groundwater well MW127.

The field observations and the presence of Chemicals of Potential Concern (CoPC) above the adopted soil investigation (Tier 1) criteria are likely to have occurred as a result of the placement of fill material associated with the former Hobart Gasworks, or potentially from impacted fill material imported to the site for land reclamation.

Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH) / Total Recoverable Hydrocarbons (TRH) and select metals were reported in soil above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs):

- Residential, Recreation/ Open Space or Commercial/ Industrial Land Uses
- Maintenance of Modified and Highly Modified Ecosystems.

Table 1 below provides a range of concentrations of CoPC (or general CoPC groups) identified within the Goods Shed and Yard area that have been reported above the adopted Tier 1 criteria.

Table 1 Summary of Soil Analytical Results – The Goods Shed and Yard

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Lead	<5	1,640
Nickel	<2	77
Copper	<5	248
Zinc	6	2,820
TRH (C_{10}-C_{40})	<50	10,500
Benzene	<0.1	0.8
Total PAHs	<0.5	2,310

1.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Goods Shed and Yard area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at locations K14, L18, L13, M13 and M14. As a result, there is potential for Intrusive Maintenance workers within the Promenade and Underground Carpark area to come in contact with these soils.

However, based on the overall statistical assessment of shallow lead impacts in this area conducted against the Maintenance Workers Site Derived RC, remediation of these impacts is not considered as required (AECOM, 2021a). It is further noted that these locations will be excavated and removed as part of Site development.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m bgl (i.e. below or in deeper soil next to the Underground Carpark) must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP

1.1.2 Asbestos

Whilst asbestos has not been identified in soil during previous environmental investigations, there is potential that Asbestos Containing Material (ACM) may be encountered during intrusive works or require management as part of building refurbishment activities within the Goods Shed and Yard area.

Asbestos has been noted within the Goods Shed building.

1.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for wells located within the Goods Shed and Yard area since January 2015.

Over this timeframe, groundwater samples have had concentrations reported of a combination of arsenic, cobalt, iron, manganese, zinc, ammonia, sodium, chloride, TDS and sulphate, above the adopted Tier 1 assessment criteria for groundwater PEVs.

Table 2 below provides a range of CoPC concentrations (or general CoPC groups) identified within The Goods Shed and Yard area that have been reported above the adopted Tier 1 criteria.

Table 2 Summary of Groundwater Analytical Results – the Goods Shed and Yard

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Arsenic	<0.001	0.021
Cobalt	<0.001	0.012
Iron	0.46	34
Manganese	0.004	2.48
Zinc	<0.005	0.23
Ammonia	<0.001	26
Total Dissolved Solids (TDS)	38	3,650
Sodium	<1	930
Chloride	3	4,400
Sulphate	<1	930

2.0 The Escarpment (Audit Area 4 West) and Audit Area 4 East Contamination Summary

Historical activities undertaken within the Escarpment and the Audit Area 4 East areas have resulted in residual soil and groundwater contamination. Multiple phases of soil and groundwater investigations have been undertaken to assess the nature and extent of contamination.

The following sections provide an overview of identified soil and groundwater impacts at these areas of the Site. It is noted that remediation of soil impacts in the Escarpment area was conducted in late 2019 and early 2020 as reported in *Audit Area 4 – Remediation Validation* (AECOM, 2020b).

No further remediation of the Escarpment is planned or considered required at this time. However, further remediation and Auditor approval is required for Audit Area 4 East prior to future development.

2.1 Identified Soil Impacts

In the Escarpment and Audit Area 4 East areas, fill material consists of crushed stone/ballast, silt and clayey gravels with occasional rubble, brick and wood fragments.

Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH) / Total Recoverable Hydrocarbons (TRH) and select metals were reported in soil above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs):

- Residential, Recreation/ Open Space or Commercial/ Industrial Land Uses
- Maintenance of Modified and Highly Modified Ecosystems.

Table 3 below provides the range of concentrations of Chemicals of Potential Concern (CoPC) (or general CoPC groups) identified within the Escarpment and Audit Area 4 East areas that have been reported above the adopted Tier 1 investigation criteria.

Table 3 Summary of Soil Analytical Results – the Escarpment and Audit Area 4 East

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Lead	<5	1,070
Nickel	3	62
Arsenic	<5	552
Copper	12	828
Zinc	16	1,220
TPH (C_{16}-C_{34})	<100	4,170
TPH (C_{10}-C_{16})	<50	5,680
TPH (C_{10}-C_{16}) (minus Naphthalene)	<50	5,670
TPH (C_6-C_{10}) (less BTEX[1])	<10	53
Benzo(a)pyrene	<0.5	46.4
Total PAHs	<0.5	464
Naphthalene	<0.5	17
Dibenz(a,h)anthracene	<0.5	7.1
Indeno(1,2,3-c,d)pyrene	<0.5	24.3

Note: 1. BTEX – benzene, toluene, ethylbenzene and xylenes

2.1.1 Lead Impacted Soil in Telecommunications Cable Exclusion Zone (the Escarpment)

During remediation works in the Escarpment, a lead concentration of 1,600 mg/kg was reported in soil validation sample CB-EX-41, collected from the boundary of the 2 m buffer zone surrounding the major telecommunications cable in the former Concrete Batching Plant area of the Escarpment. The location of the lead detection is shown on **Plate 1** below.

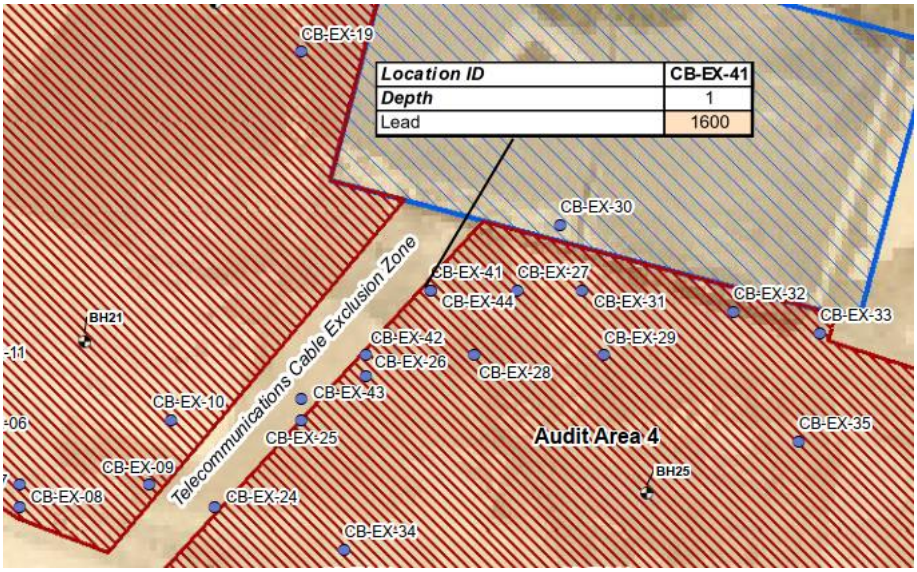

Plate 1 Location of lead in soil detection in telecommunication cable exclusion zone

Due to the risk of damage to the cable from excavations in this area, the asset owner (Telstra) did not give approval for excavation of soil in the exclusion zone. The impact was assessed as localised and not typical of the material in the exclusion zone in the Remediation Validation report (AECOM, 2020b), and soil present within the exclusion zone has been isolated from clean fill using a 200 µm plastic liner (shown on **Plate 2** below).

Plate 2 The Escarpment - Liner on the Western Boundary of the Telecommunications Cable

Future works in this area should consider the potential for lead impacts to be present if this soil is to be disturbed.

2.1.2 Asbestos in Audit Area 4 East

On 9 July 2020, contractors (Pitt & Sherry Pty Ltd) working for the Macquarie Point Development Corporation detected fragments of Asbestos Containing Material (ACM) in the embankment within Audit Area 4 East adjacent to the boundary with the Escarpment. The following was noted with regard to these fragments:

- The ACM encountered consisted of fragments of corrugated roofing material between 5 to 300 mm in size.
- ACM was typically encountered 400 – 600 mm below the ground surface.

All encountered ACM and surrounding soil were removed when encountered and the area was assessed by an occupational hygienist to be free of visual ACM. The hygienist indicated that the number of ACM fragments present appeared to increase in the northwest of the area cleared and may be present in the adjacent embankment in that direction.

The location where ACM was detected, and the potential area to the northwest, has been added to the Site Asbestos Register, and both areas are shown on **Plate 3** below.

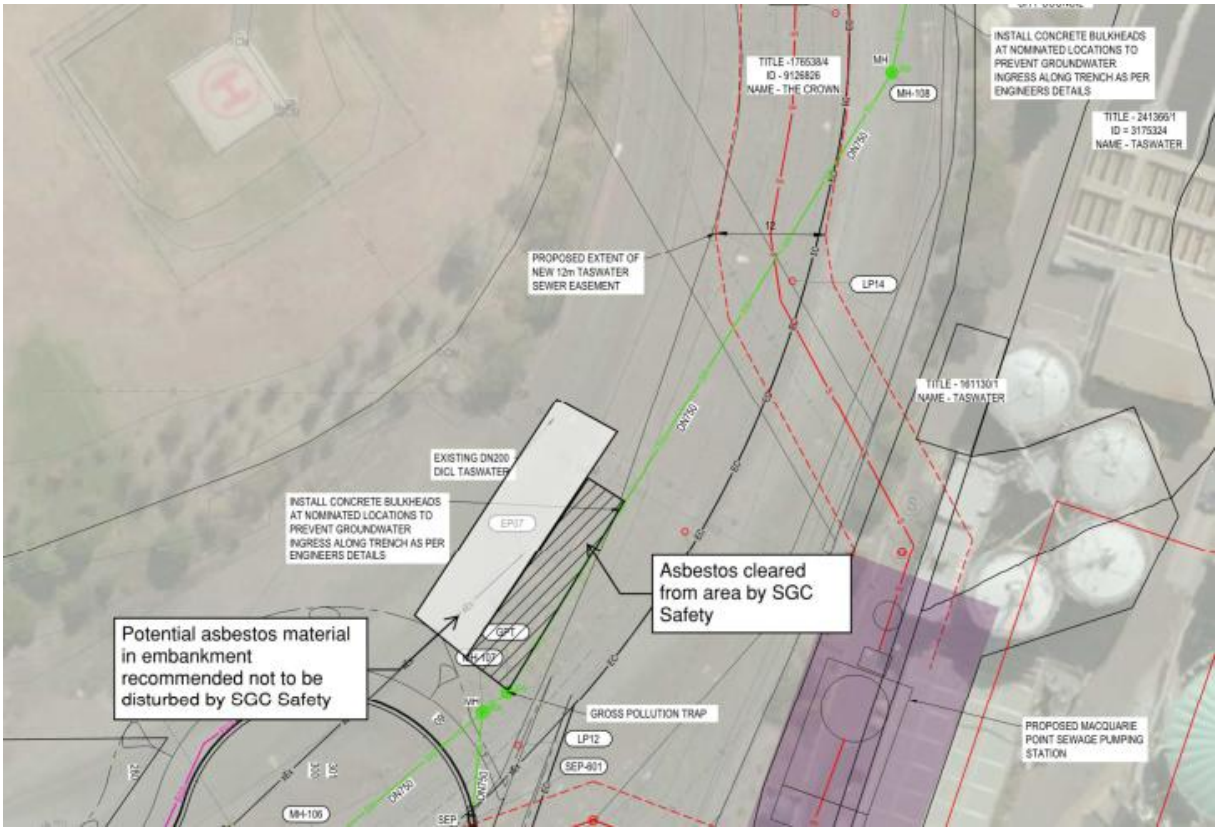

Plate 3 Audit Area 4 East - Area of ACM Encountered

2.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for wells located within these areas since February 2015.

Over this timeframe, groundwater samples have reported concentrations of a combination of aluminium, iron, manganese, arsenic, boron, copper, vanadium, zinc, phosphorus, ammonia, total dissolved solids (TDS), chloride, sodium, BTEXN, TRH and PAHs above the adopted Tier 1 assessment criteria for select groundwater PEVs.

Table 4 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Escarpment and Audit Area 4 East that have been reported above the adopted Tier 1 criteria.

Table 4 Summary of Groundwater Analytical Results – the Escarpment and Audit Area 4 East

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Aluminium (Filtered)	1.38	1.38
Iron (Filtered)	<0.05	6.22
Manganese (Filtered)	<0.001	5.1
Arsenic (Filtered)	0.001	0.019
Copper (Filtered)	<0.001	0.03
Vanadium (Filtered)	<0.01	0.18
Zinc (Filtered)	<0.005	0.143
Phosphorus	1.2	1.2
Ammonia as N	<0.01	3.84
Total Dissolved Solids (TDS)	460	9010
Chloride	10	8890
Sodium	30	6300
Benzene	<0.001	0.003
Naphthalene	<0.001	0.332
Dibenzofuran	<0.005	0.015
pH (pH units)	7.21	11.1
TPH C10 - C36 (Sum of total)	<0.05	1.57
TPH >C10 - C40 (Sum of total)	<0.1	1.55
TPH >C_{10}-C_{16} minus Naphthalene (F2)	<0.05	1.59
Anthracene	<0.001	0.007
Fluoranthene	<0.001	0.007
Phenanthrene	<0.001	0.035
PFAS		

3.0 The Promenade and Underground Carpark Contamination Summary

Historical activities undertaken within the Promenade and Underground Carpark area have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, light non-aqueous phase liquid (LNAPL) and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil, groundwater, LNAPL and soil vapour impacts at the Promenade and Underground Carpark area.

Remnant infrastructure associated with a former rail Roundhouse may be present in the central area of the Promenade and Underground Carpark.

Soil, groundwater and LNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – Audit Areas 2 and 7 and Pipeline Removal* (AECOM, 2021d) and the *Goods Shed Remediation Validation Report* (AECOM, 2021e). The *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c) report contains a detailed assessment LNAPL remediation conducted.

No further remediation of the Promenade and Underground Carpark is planned or considered required at this time.

3.1 Identified Soil Impacts

Within the Promenade and Underground Carpark area and the surrounding buffer zone, fill material typically consisted of sand and gravel with occasional anthropogenic material including coal, coke, slag, ceramics, glass, metal fragments, wire, timber/wood, bone, rubber and general building rubble including brick, concrete and pipes.

Concentrations of a combination of Chemicals of Potential Concern (CoPC) including Polycyclic Aromatic Hydrocarbons (PAHs) [naphthalene, benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, sum of PAHs], Total Recoverable Hydrocarbons (TRHs) [TRH >C_{10}-C_{16}, TRH >C_{16}-C_{34}, TRH >C_{34}-C_{40}, aliphatic TRH >C_{10}-C_{12}, aromatic TRH >C_{10}-C_{12}, aliphatic TRH >C_{12}-C_{16}, aromatic TRH >C_{12}-C_{16}, TRH C_6-C_{10} (minus BTEX) (F1), TRH >C_{10}-C_{16} (minus Naphthalene) (F2)] and metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc) in soil were reported above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs) and Site Derived Remediation Criteria (RC):

- Human Health – Direct Contact – Residential (low, and medium/high density), Recreation/ Open Space, and Commercial/ Industrial land uses.
- Human Health – Vapour Intrusion – Residential and Commercial/ Industrial land uses.
- Maintenance of Modified and Highly Modified Ecosystems.
- Aesthetics.
- Remediation Criteria – Residential (slab-on-grade with unknown construction or multi-storey building, low rise slab-on-grade, and building with basement), Commercial (slab-on-grade with unknown construction or multi-storey building, and working within a basement) and Maintenance Workers.

Table 5 below provides the range of CoPC concentrations (or general CoPC groups) identified within the Promenade and Underground Carpark area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 5 Summary of Soil Analytical Results – the Promenade and Underground Carpark

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Arsenic	<2	576
Cadmium	<0.4	29
Chromium	<2	314
Copper	<5	2,280
Lead	<5	20,100
Nickel	3	86
Zinc	8	55,70
TRH >C10-C16	<50	15,500
TRH >C16-C34	<100	15,500
TRH >C34-C40	<100	2,920
Aliphatic TRH >C10-C12	<10	504
Aromatic TRH >C10-C12	<10	114
Aliphatic TRH >C12-C16	<10	2,790
Aromatic TRH >C12-C16	<10	1,170
TRH C6-C10 (minus BTEX) (F1)	<10	114
TRH >C10-C16 (minus Naphthalene) (F2)	<50	15,500
Naphthalene	<0.5	39.7
Benzo(a)pyrene	<0.05	156
Benz(a)anthracene	<0.5	157
Benzo(b)fluoranthene	0.9	4.6
Benzo(k)fluoranthene	<0.5	64.7
Dibenz(a,h)anthracene	<0.5	20
Indeno(1,2,3-cd)pyrene	<0.5	66.2
Sum of PAHs	<0.5	1,810

3.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Promenade and Underground Carpark area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at locations J06, J08, J10, J12, I13, H10, H12, H12, G11, G13 and F11. As a result, there is potential for Intrusive Maintenance workers within the Promenade and Underground Carpark area to come in contact with these soils. These locations will

be excavated and removed as part of the Site development, however elevated lead may be present at the base of the excavation at I13 and G13.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m below the current Site level must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP.

3.1.2 Asbestos

Anecdotal information indicates that pits and service trenches in the southern portion of the Promenade and Underground Carpark area were backfilled with building rubble including asbestos. No bulk asbestos or Asbestos Containing Material (ACM) has been encountered in investigations to date, however minor ACM has been encountered as seven isolated fragments. Under current and proposed future development, while the Site is maintained with hardstand or an engineered break, potential ACM within the soil does not have a complete source-pathway-receptor linkage to Site users. However, the potential for ACM to be present should be considered in future works which may disturb soil in this area and managed as discussed in the Site Environment Management Plan (SEMP).

3.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Promenade and Underground Carpark area since January 2015.

Since 2015, groundwater samples have reported concentrations of a combination of CoPC including total dissolved solids (TDS), metals (arsenic, copper, iron, lead, manganese, zinc), inorganics (ammonia, sodium, boron), TRH [TRH C_{10}-C_{36} fraction (sum), TRH >C_{10}-C_{40} fraction (sum), TRH C_{10}-C_{16} fraction (sum) (minus naphthalene)] and PAHs [naphthalene, benz(a)anthracene, benzo(a)pyrene, anthracene, phenanthrene, fluoranthene] above the following adopted Tier 1 assessment criteria for groundwater PEVs and Site Derived RC:

- Drinking water (health and aesthetics)
- Recreation (primary and secondary contact)
- Maintenance of Ecosystems (90% ecosystem protection level)
- Irrigation
- Vapour Intrusion (from groundwater)
- Remediation Criteria – Residential (unknown construction or multi-storey building)

Table 6 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Promenade and Underground Carpark area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 6 Summary of Groundwater Analytical Results – the Promenade and Underground Carpark

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Total Dissolved Solids	40	5,420
Arsenic	<0.001	0.032
Copper	<0.001	0.011
Iron	<0.05	6.72
Lead	<0.001	0.017
Manganese	0.002	5.47

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Zinc	<0.001	0.063
Ammonia (as N)	<0.01	8.43
Sodium	3.7	363
Boron	<0.05	0.78
TRH C10-C36 fraction (sum)	<0.050	4.05
TRH >C10-C40 fraction (sum)	<0.100	3.95
TRH C10-C16 fraction (minus naphthalene) [F2]	<0.050	2.01
Naphthalene	<0.001	0.0015
Benz(a)anthracene	<0.001	0.0014
Benzo(a)pyrene	<0.0005	0.0011
Anthracene	<0.001	0.0054
Phenanthrene	<0.001	0.016
Fluoranthene	<0.001	0.0069

3.3 Identified LNAPL Impacts

Environmental investigations completed on the Site to date have historically identified three Light Non-Aqueous Phase Liquid (LNAPL) plumes in or adjacent to the Promenade and Underground Carpark area, referred to as LNAPL Plume A1, LNAPL Plume A2 and LNAPL Plume A3.

The LNAPL in these plumes is understood to comprise predominantly diesel fuel, as well as fuel oils associated with diesel engine operation (e.g. lubricants, engine oils). The probable source of LNAPL is historic locomotive refuelling activities during operation the Roundhouse Refuelling Area.

No measurable LNAPL was present in any wells in the vicinity of these plumes when last gauged in June 2025, although indicators of LNAPL, including sheen, odours, and small volumes of LNAPL when developing wells in the vicinity were observed. Measurable LNAPL was last detected in LNAPL Plumes A1 and A2 in November 2019, and in LNAPL Plume A3 in July 2017, although no monitoring was conducted on the plumes between 2019 and 2025 due to Site activities.

A detailed assessment of LNAPL impacts and remediation conducted at the Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c), and was reviewed in *Soil, Groundwater and Soil Vapour Investigation 2025* (AECOM, 2025c). Both these reports concluded that:

- Further recovery of LNAPL is considered to be impractical.
- The LNAPL plumes are sufficiently stable.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a SEMP or similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

On this basis, further LNAPL remediation is not practicable or required. However, restoration of groundwater PEVs is not practicable, and groundwater management will be required as discussed in the main body of the SEMP.

3.4 Identified Soil Vapour Impacts

Soil vapour monitoring events have been conducted across the Site between 2015 and 2019, including at soil vapour wells within and immediately adjacent to the Promenade and Underground Carpark area, at locations where concentrations of Volatile Organic Compounds (VOCs) and Semi-VOCs (SVOCs) in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected, or in the vicinity of the LNAPL plumes to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Assessment of potential vapour intrusion risks associated with the LNAPL plumes undertaken in *Soil Vapour and Indoor Air Investigations 2019* (AECOM, 2021b) surmised that soil vapour impacts associated with the LNAPL plumes do not present an unacceptable risk to the planned future uses of the Promenade and Underground Carpark area.

Soil vapour investigations identified that methane exists in potentially hazardous concentrations in the subsurface within the Promenade and Underground Carpark area (at SV12, SV27S and SV27D) as well as the surrounding area (at SV14 and SV16). The risk from soil methane in the area assessed has been calculated as CS2 – Low Risk, as defined by *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020), and appropriate mitigation measures should be included in future building design in this area or when conducting works in potentially enclosed spaces, such as pits, trenches or conduits, in these areas.

It is noted that if the Underground Carpark is ventilated in accordance with Building Code of Australia (BCA) requirements to deal with exhaust fumes, it should also provide sufficient protection from methane infiltration as per EPA NSW, 2020. If the Underground Carpark is not designed and constructed to BCA standards, methane protection measures should be advised by a qualified environmental practitioner and approved by a Contaminated Land Auditor.

4.0 The Precinct North Contamination Summary

Historical activities undertaken within the Precinct North area have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, light non-aqueous phase liquid (LNAPL) and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil, groundwater, LNAPL and soil vapour impacts at the Precinct North area.

Soil, groundwater and LNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – Audit Areas 2 and 7 and Pipeline Removal* (AECOM, 2021d) and the *Goods Shed Remediation Validation Report* (AECOM, 2021e). The *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c) report contains a detailed assessment LNAPL remediation conducted.

No further remediation of the Precinct North is planned or considered required at this time.

4.1 Identified Soil Impacts

Subsurface investigations have identified that the Precinct North area is underlain by fill material extending up to 8.2 m below ground level (bgl). Fill material is described as silty sand with dolerite gravels and cobbles with a range of anthropogenic materials including rubble, glass and metal fragments, coal, coke, ash, brick, rubber, timber, wires and fabric. Following remediation and soil excavation in 2020 (AECOM, 2021d), portions of the Precinct North area have been backfilled with fill material and crushed dolerite sourced from either other sections of the Site or imported Virgin Excavated Natural Material (VENM). Underlying the fill material is natural sands, clays, gravels and dolerite bedrock.

During historic land reclamation activities undertaken across the broader Site, sea walls were constructed consisting of a combination of timber and stone. A sea wall is understood to run approximately parallel to the eastern boundary of the Precinct North area.

Concentrations of a combination of Chemicals of Potential Concern (CoPC) including Polycyclic Aromatic Hydrocarbons [PAHs] (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, 7,12-dimethylbenz(a)anthracene, indeno(1,2,3-cd)pyrene, Sum of PAHs), Total Recoverable Hydrocarbons [TRH] (aliphatic C_{10}-C_{12}, aliphatic C_{12}-C_{16}, aromatic C_{10}-C_{12}, aromatic C_{12}-C_{16}, C_6-C_{10}, C_{10}-C_{16}, C_{16}-C_{34}, C_{34}-C_{40}), naphthalene, and heavy metals (arsenic, copper, lead, nickel, zinc) in soil were reported above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs) and Site Derived Remediation Criteria (RC):

- Human Health – Direct Contact – Residential (low, and medium/high density), Recreation/ Open Space, and Commercial/ Industrial land uses.
- Human Health – Vapour Intrusion – Residential and Commercial/ Industrial land uses.
- Maintenance of Modified and Highly Modified Ecosystems.
- Aesthetics.
- Remediation Criteria – Residential (slab-on-grade with unknown construction or multi-storey building, low rise slab-on-grade, and building with basement), Commercial (slab-on-grade with unknown construction or multi-storey building, and working within a basement) and Maintenance Workers.
- Remediation Criteria - Potential Future Residential, Commercial/Light Industrial Workers or Intrusive Maintenance Workers

Table 7 below provides the range of CoPC concentrations (or general CoPC groups) identified within the Precinct North area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 7 Summary of Soil Analytical Results – The Precinct North

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Arsenic	<2	184
Copper	<5	1,800
Lead	<5	1,340
Nickel	3	68
Zinc	8	10,200
TRH C_6-C_{10} (minus BTEX[1])	<10	152
TRH >C_{10}-C_{16} (minus Naphthalene)	<50	17,995
TRH >C_{10}-C_{16}	<50	18,000
TRH >C_{16}-C_{34}	<100	16,000
TRH >C_{34}-C_{40}	<100	3,310
Aliphatic TRH >C_{10}-C_{12}	<50	1,420
Aromatic TRH >C_{10}-C_{12}	<50	140
Aliphatic TRH >C_{12}-C_{16}	<50	6,590
Aromatic TRH >C_{12}-C_{16}	<50	2,540
Naphthalene	<0.5	184
Benzo(a)pyrene	<0.5	141
Benz(a)anthracene	<0.5	148
Benzo(b)fluoranthene	2.1	128
Benzo(k)fluoranthene	<0.5	68.9
Chrysene	<0.5	140
Dibenz(a,h)anthracene	<0.5	18.7
7,12-dimethylbenz(a)anthracene	<0.5	3.8
Indeno(1,2,3-cd)pyrene	<0.5	59.2
Sum of PAHs	<0.5	2,330

Note: 1. BTEX – benzene, toluene, ethylbenzene and xylenes

4.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Precinct North area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at K06, L08, M09 and N10. As a result, there is potential for Intrusive Maintenance workers within the Precinct North area to come in contact with these soils. These locations will be excavated and removed as part of the Site development, however elevated lead may be present at the base of excavation at N10.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m bgl (i.e. below or in deeper soil next to the Underground Carpark) must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP.

4.1.2 Boundary Impacts

Soil samples collected at seven locations on the eastern boundary of the Precinct North area reported exceedances of Site Derived RC for proposed future uses:

- Two locations (OL-EX-288/1.5 and OL-EX-59/0.9) reported exceedances of the RC for Future Commercial Workers for Total Petroleum Hydrocarbons (TPH) C_{10}-C_{16} (minus Naphthalene).
- Five locations (OL-EX-75/0.5, OL-EX77/1.0, OL-EX-79/0.2, OL-EX-293/1.15, OL-EX-294/1.05) reported exceedances of the RC for Future Intrusive Maintenance Workers for lead.

These samples do not represent an unacceptable risk for future uses of the area as the impacted areas are limited and delineated by samples within 5 m from within the excavation boundary or base, and impacted soils which had the potential to extend onto the Site were excavated and removed during remediation works in 2020 (AECOM, 2021d). These areas should be considered when conducting works along the Site boundary in these areas.

4.1.3 Hobart Main Sewer Soils

During remediation works in 2020 (AECOM, 2021d), excavation of impacted soils was limited by the presence of the Main Hobart Pipeline, a sewer line which runs through the Precinct North area. The owner of the sewer, TasWater, required an exclusion zone for excavation which did not allow excavation to depths of greater than 1 m below ground level (bgl) within 3 m of the sewer location.

Soil was excavated to a depth of 1 m bgl in this exclusion zone. However, lead concentrations in excess of the RC for Future Intrusive Maintenance Workers for lead were detected in the soil within the exclusion zone and should be considered and appropriate controls put in place for future works in this area.

4.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Precinct North area since January 2015.

Since 2015, groundwater samples have reported concentrations of a combination of CoPC including: total dissolved solids (TDS), metals (arsenic, boron, copper, iron, lead, manganese, zinc), inorganics (ammonia, chloride, cyanide, sodium), TRH (C_{10}-C_{16}, C_{10}-C_{36}, C_{10}-C_{40}), PAHs (naphthalene, benz(a)anthracene, benzo(a)pyrene, anthracene, phenanthrene, fluoranthene, 2,4-dimethylphenol, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene) and E. Coli above the following adopted Tier 1 assessment criteria for groundwater PEVs and Site Derived RC:

- Drinking water (health and aesthetics)
- Recreation (primary and secondary contact)
- Maintenance of Ecosystems (90% ecosystem protection level)
- Irrigation
- Buildings and Structures
- Vapour Intrusion (from groundwater)
- Remediation Criteria – Residential (unknown construction or multi-storey building)

Table 8 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Precinct North area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 8 Summary of Groundwater Analytical Results – the Precinct North

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Total Dissolved Solids	240	1,690
Arsenic	<0.001	0.009
Boron	0.2	0.69
Copper	<0.001	0.011
Iron	15.5 (one sample only)	
Lead	<0.001	0.013
Manganese	0.026	2.46
Zinc	<0.005	0.134
Ammonia (as N)	<0.01	22.1
Chloride	11	664
Cyanide	<0.004	0.29
Sodium	8	547
TRH C10-C36 fraction (sum)	<0.05	12.6
TRH >C10-C40 fraction (sum)	<0.1	12.2
TRH C10-C16 fraction (minus naphthalene)	<0.1	6.19
Naphthalene	<0.005	0.232
Benz(a)anthracene	<0.001	0.095
Benzo(a)pyrene	<0.001	0.0985
Anthracene	<0.001	0.142
Phenanthrene	<0.001	0.317
Fluoranthene	<0.001	0.254
2,4-Dimethylphenol	<0.001	0.0062
Benzo(k)fluoranthene	<0.001	0.0346
Chrysene	<0.001	0.0974
Dibenz(a,h)anthracene	<0.001	0.0114
Indeno(1,2,3-cd)pyrene	<0.001	0.0434
Pyrene	<0.001	0.228

4.3 Identified LNAPL Impacts

Environmental investigations completed on the Site to date have historically identified three LNAPL plumes in or up groundwater gradient of the Precinct North area, referred to as LNAPL Plume A1, LNAPL Plume A2 and LNAPL Plume A3.

No measurable LNAPL was present in any wells in the vicinity of these plumes when last gauged in June 2025, although indicators of LNAPL, including sheen, odours, and small volumes of LNAPL when developing wells in the vicinity were observed. Measurable LNAPL was last detected in LNAPL Plumes A1 and A2 in November 2019, and in LNAPL Plume A3 in July 2017, although no monitoring was conducted on the plumes between 2019 and 2025 due to Site activities.

A detailed assessment of LNAPL impacts and remediation conducted at the Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c), and was reviewed in *Soil, Groundwater and Soil Vapour Investigation 2025* (AECOM, 2025c). Both these reports concluded that:

- Further recovery of LNAPL is considered to be impractical.
- The LNAPL plumes are sufficiently stable.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a Site Environment Management Plan (SEMP) or similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

On this basis, further LNAPL remediation is not practicable or required. However, restoration of groundwater PEVs is not practicable, and groundwater management will be required as discussed in the main body of the SEMP.

4.4 Identified Soil Vapour Impacts

Soil vapour monitoring events have been conducted across the Site between 2015 and 2019, including at soil vapour wells within and immediately adjacent to the Precinct North area, at locations where concentrations of Volatile Organic Compounds (VOCs) and Semi-VOCs (SVOCs) in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected, or in the vicinity of the LNAPL plumes to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Assessment of potential vapour intrusion risks associated with the LNAPL plumes undertaken in *Soil Vapour and Indoor Air Investigations 2019* (AECOM, 2021b) surmised that soil vapour impacts associated with the LNAPL plumes do not present an unacceptable risk to the planned future uses of the Precinct North area.

Soil vapour investigations identified methane exists in potentially hazardous concentrations in the subsurface within the Precinct North area (at SV14, SV16, SV17 and SV18). The risk from soil methane in the area assessed has been calculated as CS2 – Low Risk, as defined by *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020), and appropriate mitigation measures should be included in future building design in this area or when conducting works in potentially enclosed spaces, such as pits, trenches or conduits, in these areas.

5.0 The Precinct South Contamination Summary

Historical activities undertaken within Precinct South have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, light non-aqueous phase liquid (LNAPL) and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil, groundwater, LNAPL and soil vapour impacts at the Promenade and Underground Carpark area.

Soil, groundwater and LNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – Audit Areas 2 and 7 and Pipeline Removal* (AECOM, 2021d), the *Goods Shed Remediation Validation Report* (AECOM, 2021e) and the *Precinct South Remediation Validation Report* (AECOM, 2024d). The *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c) report contains a detailed assessment LNAPL remediation conducted.

No further remediation of the Precinct South is planned or considered required at this time.

5.1 Identified Soil Impacts

Subsurface investigations have identified that the Precinct South is underlain by fill material extending up to 12 m below ground level (bgl). Fill material is described as silty sand with dolerite gravels and cobbles with a range of anthropogenic materials including rubble, glass and metal fragments, coal, coke, ash, brick, rubber, timber, wires and fabric. Following remediation and soil excavation in 2020 and 2023, portions of the Precinct South have been backfilled with fill material and crushed dolerite sourced from either other sections of the Site or imported Virgin Excavated Natural Material (VENM). Underlying the fill material is natural sands, clays, gravels and dolerite bedrock.

During historic land reclamation activities undertaken across the broader Site, sea walls were constructed consisting of a combination of timber and stone. A sea wall is understood to run approximately parallel to the eastern boundary of the Precinct South. Buried rail lines may be present in the eastern and southern portions of the Precinct South.

Concentrations of a combination of Chemicals of Potential Concern (CoPC) including metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), cyanide (total), TRH, PAHs, MAHs, and PFAS in soil were reported above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs) and Site Derived Remediation Criteria (RC):

- Human Health – Direct Contact – Residential (low, and medium/high density), Recreation/ Open Space, and Commercial/ Industrial land uses.
- Human Health – Vapour Intrusion – Residential and Commercial/ Industrial land uses.
- Maintenance of Modified and Highly Modified Ecosystems.
- Aesthetics.
- Remediation Criteria –Commercial (slab-on-grade with unknown construction or multi-storey building, and working within a basement) and Maintenance Workers. It is noted that residential use is not proposed in the Precinct South and soil results were not assessed against residential use RC in the DSI and CUTEP report (AECOM, 2026b).

Table 9 below provides the range of CoPC concentrations (or general CoPC groups) identified within the Precinct South that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 9 Summary of Soil Analytical Results – The Precinct South

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Arsenic	<2	374
Cadmium	<0.4	28
Chromium	<2	866

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Copper	<5	1,400
Lead	<5	8,000
Nickel	<2	160
Zinc	<5	13,000
Cyanide (total)	<1	1,040
TRH C_6-C_{10} (minus BTEX[1])	<10	847
TRH >C_{10}-C_{16} (minus Naphthalene)	<50	6,910
TRH >C_{16}-C_{34}	<100	20,700
TRH >C_{34}-C_{40}	<50	3,550
Aliphatic TRH >C_8-C_{10}	<5	918
Aliphatic TRH >C_{10}-C_{12}	<50	636
Aromatic TRH >C_{10}-C_{12}	<50	204
Aliphatic TRH >C_{12}-C_{16}	<50	2,440
Aromatic TRH >C_{12}-C_{16}	<50	1,910
Naphthalene	<0.005	273
Benzo(a)pyrene	<0.005	449
Benzo(a)pyrene Toxic Equivalency Quotient (TEQ) (Limit of Reporting)	1.2	639
Sum of PAHs	<0.5	7,800
PFOS	<0.0005	0.0132

Note: 1. BTEX – benzene, toluene, ethylbenzene and xylenes

5.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Precinct South area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at location M12 and BH67 (shown on **Figure F5**). As a result, there is potential for Intrusive Maintenance workers within the Precinct North area to come in contact with these soils.

Based on the overall statistical assessment of shallow lead impacts in this area conducted against the Maintenance Workers Site Derived RC, remediation of these impacts is not considered as required (AECOM, 2026b). Additional PPE, such as dust masks, and procedural controls to minimise any potential inhalation or ingestion of soil with elevated lead impacts during construction or intrusive works. It is further noted that the majority of these locations will be excavated and removed as part of the Site development.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m bgl (i.e. below or in deeper soil next to the Underground Carpark) must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP

5.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Precinct South area since January 2015.

Since 2015, groundwater samples have reported concentrations of a combination of CoPC including: total dissolved solids (TDS), metals (arsenic, boron, copper, iron, lead, manganese, zinc), inorganics (ammonia, chloride, cyanide, sodium), TRH (C_{10}-C_{16}, C_{10}-C_{36}, C_{10}-C_{40}), PAHs (naphthalene, benz(a)anthracene, benzo(a)pyrene, anthracene, phenanthrene, fluoranthene, 2,4-dimethylphenol, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene) and E. Coli above the following adopted Tier 1 assessment criteria for groundwater PEVs.

- Drinking water (health and aesthetics)
- Recreation (primary and secondary contact)
- Maintenance of Ecosystems (90% ecosystem protection level)
- Irrigation
- Buildings and Structures
- Vapour Intrusion (from groundwater).

No exceedances of Site derived RC have been detected in groundwater.

Table 10 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Precinct South area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 10 Summary of Groundwater Analytical Results – the Precinct South

CoPC	Unit	Minimum Concentration	Maximum Concentration
Total Dissolved Solids	mg/L	150	28,000
Arsenic	mg/L	<0.001	0.064
Aluminium	mg/L	<0.01	0.32
Boron	mg/L	<0.001	1.71
Cadmium	mg/L	<0.0001	0.0002
Chromium	mg/L	<0.001	0.127
Iron	mg/L	0.04	455
Lead	mg/L	<0.001	0.157
Manganese	mg/L	0.198	6.35
Zinc	mg/L	<0.001	7.29
Ammonia (as N)	mg/L	0.71	60
Total nitrogen (as N)	mg/L	6	47.8
Chloride	mg/L	4	14,100
Sodium	mg/L	12	3,420
Sulphate (as SO_4)	mg/L	<1	1,510
Calcium	mg/L	19	3,070

CoPC	Unit	Minimum Concentration	Maximum Concentration
Cyanide (total)	µg/L	<4	260
Phosphorus	mg/L	<0.01	1.7
E.coli	mg/L	<1	1,700
TRH C_6-C_{10} (minus BTEX)	µg/L	<20	3,1000
TRH C_{10}-C_{16} fraction (minus naphthalene)	µg/L	<50	4,530
TRH >C_{10}-C_{40} fraction (sum)	µg/L	<100	8,240
Aliphatic TRH >C_8-C_{10}	µg/L	<20	1,040
Aliphatic TRH >C_{12}-C_{16}	µg/L	<20	1,640
Benzene	µg/L	<0.5	7
Ethylbenzene	µg/L	<1	4
Naphthalene	µg/L	<1	57
n-propylbenzene	µg/L	<5	3,033
Benz(a)anthracene	µg/L	<1	63
Benzo(a)pyrene	µg/L	<0.3	42
Anthracene	µg/L	<1	135
Phenanthrene	µg/L	<1	336
Fluoranthene	µg/L	<1	174
1-methylnaphthalene	µg/L	<2	237
Chrysene	µg/L	<1	64
Indeno(1,2,3-cd)pyrene	µg/L	<1	5
Pyrene	µg/L	<1	191
PFOS	µg/L	<0.001	0.38
Methane	µg/L	3,270	24,000

5.3 Identified LNAPL Impacts

Environmental investigations completed on the Site to date have historically identified one LNAPL plume within the Precinct South, referred to as LNAPL Plume B, and three LNAPL plumes up groundwater gradient of the Precinct South, referred to as LNAPL Plume A1, LNAPL Plume A2 and LNAPL Plume A3.

Measurable LNAPL has not been detected in LNAPL Plumes A1 and A2 since November 2019, and in LNAPL Plume A3 since July 2017, although it is noted that these plumes were not monitored between

2019 and 2025 due to other Site activities in the area. LNAPL was present in LNAPL Plume B in June 2025 (AECOM, 2025c), consisting of:

- 20-50 mm in MW3
- 20-42 mm in PW02
- 62-81 mm in S8

LNAPL globules were also noted on the interface probe when gauging well MW154, and limited LNAPL (4-70 mm) has been intermittently detected in MW5 in December 2023 and February 2024.

A detailed assessment of LNAPL impacts and remediation conducted at the Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c), and was reviewed in *Soil, Groundwater and Soil Vapour Investigation 2025* (AECOM, 2025c). Both these reports concluded that:

- Further recovery of LNAPL is considered to be impractical.
- The LNAPL plumes are sufficiently stable.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a Site Environment Management Plan (SEMP) or similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

On this basis, further LNAPL remediation is not practicable or required. However, restoration of groundwater PEVs is not practicable, and groundwater management will be required as discussed in the main body of the SEMP.

5.4 Identified Soil Vapour Impacts

Soil vapour monitoring events have been conducted across the Site between 2015 and 2025, including at soil vapour wells within and immediately adjacent to the Precinct South area, at locations where concentrations of Volatile Organic Compounds (VOCs) and Semi-VOCs (SVOCs) in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected, or in the vicinity of the LNAPL plumes to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Potential soil vapour from TRH, BTEXN and methane may be generated within the Precinct South and requires mitigations as discussed in the main body of the SEMP.

Appendix D

Summary of CoPC

Summary of Chemicals of Potential Concern

The following information has been compiled from the June 1997 National Institute of Occupational Health and Safety (NIOSH) *Pocket Guide to Chemical Hazards*, 1998 American Conference of Governmental Industrial Hygienists (ACGIH) *Guide to Occupational Exposure Values, Agency for Toxic Substances & Disease Registry* (ATSDR), the Australia Government *Asbestos Safety and Eradication Agency*, and representative material safety data sheets (MSDS).

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are formed as a result of the incomplete burning of organic material. The most common health effects associated with PAHs are linked to its carcinogenic effects. The primary route of exposure to PAHs during this project is contact with contaminated soils which can lead to entry through ingestion, inhalation (dust) or open wounds. This necessitates the use of appropriate protective clothing and proper decontamination procedures.

Total Petroleum Hydrocarbons (TPH)

TPH is a term used to describe several hundred chemical compounds that originate from crude oil. The compounds in various TPH fractions can affect the body in different ways. Health effects include central nervous system depression, irritation of the throat, skin, eyes, and stomach, breathing difficulties, in addition to impacts on blood, immune system, liver, spleen, kidneys, developing foetus, and lungs. The primary route of exposure to TPH during this project will be through handling tar impacted material. Appropriate PPE must be worn at all times while handling TPH contaminated material.

Phenolic Compounds

Phenolic compounds, also known as phenols, are a wide range of chemical compounds characterised by one or more hydroxyl groups bonded directly to an aromatic hydrocarbon ring. Phenolic compounds naturally occur in biological processes (typically by plants and micro-organisms) in small quantities, but can be generated in higher quantities by industrial processes such as manufacturing of drugs, resins, dyes, fertilisers, explosives, paint removers, textiles, and coke.

Phenolic compounds may have a diverse range of exposure indicators, but typically cause irritation in the nose, throat, eyes, and skin. Acute exposure to phenol (the simplest and most commonly used phenolic compound) causes an increased respiration rate, followed by a decreased respiration rate, decreased body temperature, cyanosis, muscular weakness, weak or occasionally rapid pulse, coma, and/or death. Chronic exposure to phenol is typified by systemic problems. These include vertigo, digestive difficulties, skin eruptions, nervous problems and headaches. Death may occur when liver or kidney problems become severe.

Phenolic compounds will enter the body by breathing, through the skin or by ingestion.

Benzene, Toluene, Ethyl-benzene, and Xylenes (BTEX)

These chemicals are often found in products such as paints and coatings, and are constituents of petroleum products, particularly gasoline, jet fuels, kerosene. All of the BTEX chemicals can produce neurological impairment, and exposure to benzene can additionally cause haematological effects including aplastic anaemia and acute myelogenous leukemia. The primary route of exposure to BTEX during this project is the inhalation of vapours. This necessitates the use of appropriate protective clothing including respiratory equipment where necessary.

Chlorinated Solvents

Chlorinated solvents are a large family of chemical compounds that contain chlorine, for example, carbon tetrachloride, trichloroethylene (TCE), or methylene chloride. They are used for a wide variety of commercial and industrial purposes, including degreasers, cleaning solutions, paint thinners, pesticides,

resins, glues, and a host of other mixing and thinning solutions. Exposures can lead to short-term or long-term health effects, depending on the manner by which they entered your body and the amount of exposure. Short-term side effects may include dizziness, fatigue, headaches, and/or skin rashes. Long-term side effects may include chronic skin problems, and/or damage to the nervous system, kidneys, or liver. Some chlorinated solvents are also known to cause cancer, in both humans and animals.

Workers can be exposed to chlorinated solvents through the absorption of solvents, through inhalation and skin contact.

Heavy Metals

Large amounts of heavy metals may cause acute or chronic toxicity (poisoning). Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Heavy metals may enter the human body through ingestion, inhalation, or absorption through the skin. Appropriate protective equipment must be worn and proper decontamination procedures must be adhered to.

Total Dissolved Solids (TDS)

TDS consist of inorganic salts and small amounts of organic matter that are dissolved in water. **TDS** comprise sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate, nitrite and phosphates. No health effects have been associated specifically with or directly attributable to high TDS concentrations, although the health effects of individual components of TDS must be considered separately. Indirectly, high TDS water, being less palatable, might discourage consumers from drinking tap water, leading to use of potentially less healthy water (from alternative sources, natural or manufactured) and/or other less healthy drinks.

Sodium

Sodium is a natural component of water and essential to human life. The guideline value for sodium in drinking water is based on aesthetic considerations (taste threshold); while high sodium may be likely to give water a salty taste, it is unlikely to present a health concern. When consumed, sodium is readily absorbed by the body. It is present in all body tissues and fluids and its concentration is maintained by the kidney. High concentrations give rise to the sensation of thirst. Excessive sodium intake, usually via diet, can aggravate chronic congestive heart failure and increase blood pressure. Reduced sodium intake can reduce the blood pressure of some individuals with hypertension.

Asbestos Containing Material (ACM)

Asbestos is a naturally occurring mineral fibre which is strong, flexible, and can insulate from heat and electricity. Because of these properties, historically asbestos has been commonly used in the construction of homes and buildings and is understood to have been used in roofing material as bonded asbestos at Macquarie Point. It can be encountered as friable (generally crumbling material with potential to generate fibres) or non-friable (bonded). Asbestos is a known carcinogen and exposure to asbestos fibres can lead to a number of diseases, including pleural disease, asbestosis, lung cancers, and mesothelioma. In the event that potential asbestos containing material (ACM) is encountered in soils during intrusive works, all activities are to cease immediately in the work area. A suitably experienced occupational hygienist should be consulted to provide advice regarding the removal and management of ACM in soils prior to works re-commencing.

Methane

Methane is a colourless, odourless and highly flammable gas. It can be produced in soil from the decay under anoxic (low oxygen) conditions of carbon containing materials, including nature materials such as plant or animal matter, or from carbon impacts such as TPH.

Low levels of methane are not expected to cause adverse health effects. Higher concentrations can reduce oxygen levels in the air and lead to mood changes, slurred speech, vision problems, memory loss, nausea, vomiting, facial flushing and headaches. In severe cases, low oxygen levels can lead to

changes in breathing and heart rate, balance problems, unconsciousness and, if over a long period, death.

Methane is also potentially flammable in higher concentrations. If present in soil, methane has the potential to pool in confined spaces

Per- and Poly-fluoroalkyl Substances (PAHs)

PFAS are manufactured chemicals that have been used for more than 50 years. PFAS makes products non-stick, oil- and water-repellent, and fire, weather- and stain-resistant, and has been used in a range of consumer products, such as carpets, clothes, food packaging and paper, and have also been used in firefighting foams, pesticides and stain repellents.

PFAS encapsulates a broad recognised range of compounds which can have different chemical, environmental and biological properties. However, PFAS are typically soluble, very stable and tend to resist degradation, and may bioaccumulate in humans or ecological receptors.

PFAS is widespread and it is likely that most people in Australia have low levels of different PFAS in their bodies following exposure to everyday household objects, primarily through inhalation, ingestion, or skin contact.

There is currently limited evidence of human disease or other clinically significant harm from PFAS exposure. Some studies have found association between people exposed to specific PFAS chemicals and increased cholesterol or uric acid levels in the blood, reduced kidney function, altered indicators of immunological function, altered levels of thyroid and sex hormones, lower birth weights, later ages for starting menstruations/earlier menopause, and increased risk of testicular/kidney cancer.

It is noted that the noted associations have not been determined as direct health causes at this time.

Appendix E

Materials Tracking Register

Materials Tracking Register

Name / Representative	
Company /Organisation	
Description of Works	
Page No. of	

Table 1 Materials Tracking Register

Date	Origin[1]	Approximate Volume (m^3)	Sampled (Y/N)	Destination[2]	Description and Comments[3]

Notes: 1. Include a description of the location where the soil was excavated and a grid location (where possible); 2. This may be off-Site disposal, placement in stockpile, re-use on the Site. Provide a description of the location where soils are to be re-used and/or stored, including a grid location (where possible), and records of any approvals such as EPA Environmental Approvals for off-Site disposal; 3. Include soil type (including waste classification), any odours or other indicators of contamination and sampling undertaken; 4. Table provided above is an example of a soil materials tracking register for simple earthworks. Large scale earthworks may require a different tracking system; 5. The completed form should be returned to the Site Manager (or delegate) and retained on file for reference.

Appendix F

Groundwater Quality Management Plan

Prepared for
Macquarie Point Development Corporation
ABN: 92 657 409 841

Groundwater Quality Management Plan

Macquarie Point

16-Feb-2026
Macquarie Point Development Project

Groundwater Quality Management Plan

Macquarie Point

Client: Macquarie Point Development Corporation

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1.0 Introduction

1.1 General

The Macquarie Point Development Corporation (MPDC; the Corporation) has engaged the services of AECOM Australia Pty Ltd (AECOM) in the role of Project Remediation Consultant to assist with the development, implementation and ongoing oversight of a remediation strategy for the Macquarie Point site in Hobart, Tasmania (the Site). The Site location is presented on **Figure F1**, and layout on **Figure F2**.

This Groundwater Quality Management Plan (GQMP) has been prepared to document the requirements for ongoing groundwater monitoring and management at the Site.

1.2 Purpose and Objectives

The overall purpose of the GQMP is to document the requirements and provide a framework for ongoing groundwater monitoring at and adjacent to the Site, in order to allow identification of any changes in groundwater condition which may affect the risk status associated with groundwater within or emanating from the Site.

To meet this purpose, the objectives of the actions to be undertaken under this GQMP are to allow:

- Maintenance of knowledge on the condition of Site groundwater elevation, flow direction, and chemical characteristics and record any changes which may arise over time or as Site condition changes.
- Assess if unacceptable risks to on- and off-Site human and ecological receptors may be presented by changes, and to identify what additional assessment, mitigation, or remediation actions are required.

This GQMP forms part of, and should be read in conjunction with, the Site Environment Management Plan (SEMP) (AECOM, 2026). The SEMP documents:

- Stakeholder roles and responsibilities
- Relevant Site setting information
- Ongoing environmental management requirements.

If as part of future revisions, the GQMP is separated from the SEMP or the Site is sub-divided and separate GQMPs are developed for sub-areas, the information from the SEMP and any changes which have occurred must be incorporated into the new or updated GQMP.

The GQMP includes the following to support the SEMP and overall management of environmental impacts at the Site:

- A summary of the regulatory framework applicable to the assessment and management of groundwater at the Site.
- Data Quality Objectives (DQOs) for groundwater monitoring events (GMEs) at the Site.
- Methodologies for ongoing monitoring and sampling of groundwater.
- Key groundwater risks
- Trigger levels and contingencies.

1.3 Use of Groundwater at the Site

Groundwater at the Site has impacts and contamination from historic industrial land use, and should not be extracted or used for any purpose other than:

- Environmental monitoring, assessment, or remediation.

- Short-term removal during development or construction of the Site (i.e., removal of groundwater in slurry from pile installation, removal of groundwater which has entered excavations)
- Groundwater drainage measures for structures, which meet the requirements described in Section 4.4 of the SEMP.

Any groundwater extracted at the Site should be considered as potentially contaminated, and removed by a licensed waste contractor, or alternatively treated and disposed to sewer under a Site-specific Trade Waste Agreement (subject to regulatory approval). The potential for dissolved methane in groundwater to degas and enter surrounding air should be considered in any handling of Site groundwater.

2.0 Regulatory Framework

2.1 Environmental Management and Pollution Control Act 1994

The *Environmental Management and Pollution Control Act 1994* (the EMPCA) forms the basis of environmental legislation in Tasmania.

Any activities undertaken must comply with the EMPCA.

2.2 State Policy on Water Quality Management 1997

The *State Policy on Water Quality Management 1997* (the SPoWQM) was issued:

To achieve the sustainable management of Tasmania's surface water and groundwater resources by protecting or enhancing their qualities while allowing for sustainable development in accordance with the objectives of Tasmania's Resource Management and Planning System.

The SPoWQM defines Protected Environmental Values (PEVs) for Tasmanian groundwater, which have been assessed for the Site in **Section 4.1**.

2.3 Macquarie Point Development Corporation Act 2012 and the Site Environmental Audit

In 2015, the *Macquarie Point Development Corporation Act 2012* (the Act) was amended to enable the accreditation of an environmental auditor under Tasmanian legislation. The amended Act enables the Director of the Tasmanian Environment Protection Authority (EPA) to accredit an auditor. Mr David Lam of Tetra Tech Coffey has been appointed as the Environmental Auditor for the Site and has been accredited as an auditor recognised by the amended Act.

Where there is limited, or a lack of, suitable guidance in Tasmania for the audit, the amended Act allows for the Auditor to defer to other suitable interstate guidance. In this instance, the guidelines supporting the Victorian EPA Environmental Audit Framework have been adopted, as it is the home state of the appointed Auditor.

It is noted that Victorian legislation which defines the Audit process was updated and superseded by the *Environment Protection Act 2017* (the EP Act), which came into effect on 1 July 2021, and contains significant changes to Audit methodology and terminology under the Victorian framework. Under Section 478 of the EP Act, existing Audits where an Auditor has been engaged prior to 1 July 2021, and the Audit has not been completed by 1 July 2021, can be conducted under either the EP Act or the previous framework defined in the *Environment Protection Act 1970*. To maintain continuity with the portions of the Audit already completed, the Site Audit is currently continuing under the previous framework and terminology.

The role of the Auditor is to review the progression of investigation, and remedial planning and execution works at the Site. It is understood that the Auditor shall ensure that the works are carried out in compliance with local Tasmanian legislation and guidelines with consideration given to the requirements of the Victorian EPA Environmental Audit Framework.

The ultimate outcome of the Environmental Audit is to obtain a Site Suitability Statement as part of a Contaminated Land Audit Report for each area of the Site. Each Site Suitability Statement contains, or is expected to contain, requirements for implementation of the SEMP which this GQMP forms part of.

2.4 State Policies and Projects (Macquarie Point Precinct) Order 2025

The Tasmanian Government Department of State Growth announced in September 2022 that the Site is the preferred location for a mixed-use precinct, including a multipurpose stadium. Details of the proposed development of the Site were released in the Precinct Plan (MPDC, 2024).

The proposed development of a multipurpose stadium at the Site was classified as a Project of State Significance (PoSS) by the Governor of Tasmania on 16 October 2024, and *State Policies and Projects (Macquarie Point Precinct) Order 2025*, (the Order) was introduced to Tasmanian State Parliament in October 2025. The Order was approved by the Tasmanian House of Assembly on 13 November 2025

and by the Tasmanian Legislative Council on 4 December 2025 and provides conditions and approval for development of the Multipurpose Stadium at the Site.

Schedule 5 of the Order provides general environmental conditions for development of the Site. The conditions in the Schedule, and in the Order in general, are consistent with the *Macquarie Point Development Corporation Act 2012*, and in general require completion of a Site Suitability Statement for each area of the Site prior to development of that specific area.

No changes to the Environmental Audit of the Site, or the overall process and requirements for issue of Site Suitability Statements, arise from the Order. The Order does require that Site Suitability Statements be issued and implemented for each area of the Site where development is to occur.

3.0 Data Quality Objectives

Guidance regarding the development of Data Quality Objectives (DQOs) has been referenced from the following primary documents:

- National Environment Protection Council, *National Environment Protection* (*Assessment of Site Contamination*) Measure 1999, *Schedule B2: Guideline on Site Characterisation* (as amended May 2013) [ASC NEPM].
- New South Wales Environment Protection Authority (NSW EPA) *Contaminated Land Guidelines: Sampling Design Part 1 – Application* (EPA NSW, 2022).
- United States Environmental Protection Agency (US EPA), *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4) (US EPA, 2006).

The process of establishing appropriate DQOs is defined by the seven-step planning approach presented in the ASC NEPM and summarised in **Table 1** below.

Table 1 Data Quality Objectives

Step	Data Quality Objective Step Summary
1	***State the Problem*** – Summarise the problem that will require new environmental data, identify the resources available to resolve the problem and develop a conceptual site model (CSM) based on available information prior to the commencement of the site investigation.
2	***Identify the Goal of the Study*** – Identify the decisions that need to be made and the new environmental data required to support the identified decisions. Develop a decision statement linking the principal project objective(s) to the possible actions that will address the problem.
3	***Identify Information Inputs*** – Identify the information needed to support any decision and whether new environmental data will be needed.
4	***Define the Boundaries of the Study*** – Specify the spatial and temporal aspects of the environmental media that the data must represent to support decision(s).
5	***Develop the Analytical Approach*** – Define the parameter of interest, specify the action level, and integrate information from Steps 1–4 into a single statement that gives a logical basis for choosing between alternative actions.
6	***Specify Performance or Acceptance Criteria*** – Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data.
7	***Develop the Plan for Obtaining Data*** – Identify the most resource-effective sampling and analysis design for generating the data that is required to satisfy the DQOs.

The GQMP scope and methodology have been designed to meet the nominated DQOs. Discussion regarding the approach to be adopted, relative to the seven steps presented in **Table 1,** is provided in the following sections.

3.1 Step 1 – State the Problem

At completion of the Environmental Audit, the Site must be considered suitable for the proposed use. However, Site development or changes in the future may change groundwater conditions and the risk profile of groundwater contamination. Groundwater conditions must be monitored and assessed during and following development to allow identification of any changes in condition which may alter the level of risk assessed from groundwater impacts.

This GQMP has been developed to document the approach to the ongoing monitoring and assessment of groundwater quality at the Site, in order to identify if changes in groundwater conditions occur in the

future which may represent potential risks to users of the Site or adjacent land or water bodies. Preparation, maintenance, and implementation of the GQMP is a requirement of the SEMP (AECOM, 2026), and of the Site Suitability Statements issued for the Site.

3.2 Step 2 – Identify the Goal of the Study

The decision identification component of the DQO process represents the key issues that need to be considered to resolve the problems identified in Step 1. These include:

- Is groundwater elevation and flow consistent with historical conditions and with the assumptions which form part of assessment of the risk profile for groundwater at the Site?
- Are analyte concentrations within surface water and groundwater above background levels?
- Do the concentrations identified exceed the relevant criteria and do they indicate a change in risk or the potential for an unmanaged risk at the Site, which required action?
- Are the contaminants identified consistent with the understanding of the Site history?
- Is the investigation approach scientifically suitable and defensible and is it consistent with relevant guidelines?
- Are any of the trigger conditions met and are further actions required?

Overall, the decision making statement for this GQMP is:

- *Potential risks from Site groundwater must be monitored and sufficient information gathered to assess and monitor potential risks. If changes occur which introduce unacceptable risks, a process to enable implementation of suitable management measures is required.*

3.3 Step 3 – Identify the Information Inputs

To allow assessment of the data against the decision goals listed in **Section 3.2**, various inputs will be considered as follows:

- Field observations of aesthetic impacts or potential contamination (e.g., odours and phase separated hydrocarbons [light non-aqueous phase liquids; LNAPL]) and of groundwater elevation and inferred flow directions.
- Laboratory analysis of representative groundwater samples.
- Planned and implemented changes to the Site and surrounding areas, such as development activities, land use, and any other features of note relating to groundwater.
- Anecdotal information and previous investigation data (where available)

3.4 Step 4 – Define the Boundaries of the Study

The spatial boundaries (geographical limits) and lateral extent for data collection and decision making for the investigations are defined and illustrated by the Site boundaries and off-Site groundwater monitoring wells shown on **Figure F3**.

The vertical extent works will be limited the maximum depth of groundwater wells listed on **Table T1**.

The temporal bound of each study will be the period of groundwater sampling, with reference to historic Site groundwater data collected between 2015 and 2025.

3.5 Step 5 – Develop the Analytical Approach (or Decision Rule)

Data collected via implementation of the GQMP must be sufficiently representative of the media sampled to satisfy the purpose and inform the conclusions and recommendations of each GME, and further develop the CSM.

The following analytical approach will be undertaken:

- The scope of each GME will be developed with consideration of previous investigations, recommendations, data gaps, and overall Site knowledge (refer to **Section 6.1**).
- All samples will be collected by suitably qualified/experienced field scientists.
- All samples will be analysed for the target chemicals of potential concern (CoPC), which will be identified prior to each GME. Analysis must be conducted by analytical laboratories, which have current accreditation from the National Association of Testing Authorities (NATA) for the analysis requested.
- All sample analysis results will be compared to the adopted criteria (refer to **Section 4.0**).
- Field and laboratory quality assurance/quality control (QA/QC) sampling requirements will be identified prior to each GME.
- Data quality indicators (DQIs) (**Section 4.4**) will be used to validate the data quality.

The decision rules will be:

- If comparison of groundwater data to the relevant screening criteria (outlined in **Section 4.0**) identifies exceedances, increasing concentration trends, or data gaps or discrepancies from the proposed sampling plan, the contamination impacts will be subject to further investigation, assessment, remediation, or management; otherwise, environmental conditions will be deemed suitable for the proposed future uses and environmental values associated with the Site based on the available data.
- If the GME results suggest potential unacceptable risk, or if there remains insufficient information, recommendations shall be made on further assessment, management, or remediation measures.
- If the QA/QC data meets the Data Quality Indicators (DQIs) adopted (outlined in **Section 4.4.1**) to assess the precision and accuracy of the data, the data will be considered to be suitable for interpretive use. Data that fail to meet the DQIs will be assessed for their significance, then if required, managed using corrective actions (where possible) such as re-analysis of suspect samples, re-analysis of data and/or procedures, acceptance of data with acknowledged limitations/bias, or the data may be discarded.

3.6 Step 6 – Specify Performance or Acceptance Criteria

A decision error in the context of the decision rule presented in Step 5 would lead to either underestimation or overestimation of the potential risks associated with a particular analyte. Decision errors may include:

- Limitations in available Site history information
- Constraints associated with the ability to access certain areas of the Site, or off-Site locations
- Errors in the sampling plan
- Collection of samples that are not representative of the subject media
- Analytical errors
- Data not representative of Site conditions.

It is intended that the findings of the groundwater quality monitoring will provide sufficient information to inform decision making regarding potential risks, for example:

- Data will be reviewed and outliers within data sets will be identified and discussed in the context of Site characterisation for potential risks to human health and the environment
- If the criteria are not exceeded and the potential risk is considered acceptably low, an appropriate risk close out statement will be used
- If the criteria are exceeded, appropriate further assessment and contingency actions will be identified to further evaluate and, if necessary, manage the potential risk.

The quality of the data collected will be assessed on a range of factors including:

- Documentation and data completeness
- Reference to relevant guidance documents
- Consistency of methodology
- Data quality including comparability, representativeness, precision, and accuracy for data collection and analysis.

Assessment criteria for groundwater DQIs are listed in **Section 4.4**.

3.7 Step 7 – Develop the Plan for Obtaining Data

This GQMP has been developed to document the plan to obtain the required data, in order to meet the data quality objectives of this investigation identified in Steps 1 to 6 above.

The scope of works will be carried out to a level of accuracy and confidence consistent with the requirements of the ASC NEPM.

4.0 Environmental Values and Assessment Criteria

4.1 Protected Environmental Values

An appraisal of PEVs of groundwater has been undertaken with reference to the SPoWQM.

Table 1 from the SPoWQM (presented on **Plate 1** below) identifies PEVs for groundwater which are possible to be achieved on the basis of the groundwater total dissolved solids (TDS) concentrations.

Table 1 Environmental Values and Uses of Groundwater Classified by the Level of Total Dissolved Solids (mg/L)

Category TDS (mg/L)	A Less than 1000	B 1000-3500	C 3500-13000	D greater than 13000
Protected Environmental Value				
Drinking Water (1)	*			
Irrigation	*	*		
Industry	*	*	*	
Stock	*	*	*	
Ecosystem Protection	*	*	*	*

"*" Denotes an environmental value which can be achieved given the level of dissolved solids

(1) Where groundwaters have TDS levels below 500 mg/L, TDS levels should be maintained below these levels wherever practicable.

Plate 1 SPoWQM Table 1 - Environmental Values and Uses of Groundwater Classified by the Levels of TDS (mg/L)

Based on the reported TDS concentrations during previous groundwater investigations, Site groundwater is considered to be representative of Category A in accordance with the SPoWQM. For the purposes of ongoing assessment, all PEVs should be considered.

In addition, recreation (primary and secondary contact), aesthetics, buildings and structures, and human health (vapour intrusion) have been included as PEVs for groundwater at the Site.

4.2 Tier 1 Assessment Criteria

Groundwater assessment criteria have been identified for each groundwater PEV considered relevant for the Site, as discussed in **Section 4.1**, using the reference documents provided in **Table 2** below.

Adopted criteria values for specific CoPC are provided in **Appendix C**.

The Tier 1 assessment criteria have been derived to initially screen and identify precluded PEVs. The risk-based Remediation Criteria (the RC) presented in **Section 4.3** have been derived on a Site-specific basis for assessment of risks to the human health from groundwater impacts.

Table 2 Adopted Tier 1 Screening Criteria - Groundwater

Protected Environmental Value	Adopted Assessment Criteria	Rationale
Drinking Water	• NHMRC Australian Drinking Water Guidelines (amended 2018) Aesthetics • NHMRC Australian Drinking Water Guidelines (amended 2018) Human Health • PFAS NEMP (2025) Where no high reliability NHMRC guideline values are available, screening values have been adopted from the following sources: • WHO (2017) Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First Addendum • US EPA RSLs (2020) Tap Water Quality • Health Canada (2020) • NZMH (2018) Drinking Water Standards	• Whilst it is noted that groundwater at the Site is unlikely to be extracted for drinking water purposes, this PEV has been conservatively considered for the purposes of groundwater assessment.
Irrigation	• ANZECC (2000) Short Term Trigger Values (STV) for Irrigation Water	• STV have been adopted on the basis of the surrounding land use, where ongoing irrigation of plants and garden beds is unlikely to occur. STV can be tolerated for up to 20 years of irrigation.
Industry	• Due to the wide and varied potential industrial uses of groundwater, water quality requirements for use in industrial processes are assessed on an industry-specific basis.	• Groundwater at the Site is unlikely to be used for industrial purposes. In the absence of any standard or reliable criteria to apply for this PEV without a specific planned industrial use, this PEV has not been considered.
Stock	• ANZECC (2000) Livestock Drinking Water Quality	• Based on the Site setting, it is unlikely that groundwater would be used for stock watering purposes. However, for the purpose of assessing this PEV, the ANZECC (2000) guidance has been adopted.

Protected Environmental Value	Adopted Assessment Criteria	Rationale
Ecosystem Protection	• ANZG (2018) 90% level of ecosystem protection (marine water) • PFAS NEMP (2025) Interim Marine 95% (slightly to moderately disturbed) level of ecosystem protection (interim marine) Where no high reliability guideline values are available in ANZG (2018), screening values have been adopted from the following sources: • ANZG (2018) low to moderate reliability trigger values (marine) • ANZG (2018) 90% level of ecosystem protection (marine water) draft guidelines released for public comment on 29 June 2020 • US EPA (2013) Ambient Water Quality Criteria (chronic – Marine) • US EPA (2006a) Region 3 Mid-Atlantic Biological Technical Assistance Group (BTAG) Screening Benchmarks (marine) • RIVM (2001) Dutch Intervention Values (DIV) for TPH • There are currently no relevant Australian guidelines for TRH in groundwater. Therefore, for the purpose of this assessment, the Netherlands Ministry of Housing - DIV (2000) for Mineral Oil has been adopted	• The nearest surface water ecosystems that may receive groundwater discharge, i.e. River Derwent and Sullivans Cove, would be characterised as a moderately to highly disturbed (i.e. active port area) marine environment according to the ANZECC (2000) definitions. As such, the assessment criteria based on 90% level of ecosystem protection (marine) have been adopted, with the exception of identified bioaccumulative CoPC where the 95% level of ecosystem protection (interim marine) has been conservatively adopted, consisting of: - PFAS - Mercury - PAHs (anthracene, phenanthrene, fluoranthene, and benzo(a)pyrene).
Recreation (Primary Contact)	• NHMRC (2008) Guidelines for Managing Risk in Recreational Water • PFAS NEMP (2025)	• NHMRC (2008) recommends applying Australian Drinking Water Guidelines - *Health* (NHMRC, 2018), adjusted for a 10 fold decrease in ingestion of water.
Recreation (Secondary contact)		• Primary Contact Recreation criteria have been conservatively adopted to assess secondary contact.
Aesthetics	• NHMRC Australian Drinking Water Guidelines (amended 2018) Aesthetic	• This may relate to aesthetic issues associated with the presence of objectionable odours, colours, taints, visible floating material, foam, oil or grease or ‘dirty’ water.

Protected Environmental Value	Adopted Assessment Criteria	Rationale
Buildings and Structures	• AS 2159 – 2009	• Building and structures have been assessed on the basis of concrete piles in a mild exposure classification scenario in high permeability soils. • In addition to a pH of 5.5, sulphate and chloride concentrations of 1,000 mg/L and 6,000 mg/L respectively have been adopted to assess potential impacts to concrete piles.
Human Health - Vapour Intrusion	CRC CARE (2011) Groundwater HSLs for vapour intrusion including: • Residential - HSL A/B (sand, depth to groundwater 2.0 – <4.0 m bgl) • Recreation/ Open Space - HSL C (sand, depth to groundwater 2.0 – <4.0 m bgl) • Commercial/ Industrial - HSL D (sand, depth to groundwater 2.0 – <4.0 m bgl) • Intrusive Maintenance Worker- HSL: (sand, depth to groundwater 2.0 – <4.0 m bgl) The British Geological Survey (BSG) (UKRI, 2024) value for assessing risk of methane intrusion from groundwater.	• Groundwater HSLs for vapour intrusion for TRH fractions have been developed based on typical petroleum mixtures and consider the solubility limits of petroleum mixtures. HSLs cannot be applied to non-petroleum sources such as pure solvents or gasworks wastes, where solubility limits are much higher. The HSL (infinite) values presented in Appendix F of CRC CARE, 2011 have been adopted in accordance with CRC CARE guidance. The theoretical solubility of the pure compound in water was used instead to identify vapour limiting HSLs (i.e. chemicals where a vapour inhalation risk was calculated to be only present at concentrations exceeding the theoretical solubility). Whilst it is noted that petroleum products do exist at the Site, given the varying types of hydrocarbon impact (i.e. gasworks, diesel, and petrol) the HSL infinite values have been adopted as a conservative approach. • HSLs associated with depths to groundwater of between 2.0 and <4.0 m bgl in sand lithology were selected to assess groundwater analytical results as the Tier 1 criteria have been conducted as an initial screening only. The Site specific remediation criteria (**Section 4.3**) are considered protective of groundwater at 1 m bgl, based sensitivity analysis (AECOM, 2025a). • The BSG methane criteria assumes all methane in water will outgas to form an explosive atmosphere.

Notes: *NHMRC – National Health and Medical Research Council; PFAS – Per- and Polyfluoroalkyl Substances; NEMP – National Environmental Management Plan; WHO – World Health Organisation; US EPA – United States Environmental Protection Agency; RSL – Regional Screening Level; NZHM – New Zealand Health Ministry; ANZECC – Australian and New Zealand Environment and Conservation Council; STV – Short Term Trigger Value; ANZG – Australian and New Zealand Guidelines; BTAG – Biological Technical Assistance Group; RIVM – Rijksinstituut voor Volksgezondheid en Milieu; TRH – Total Recoverable Hydrocarbons; CRC CARE – Cooperative Research Council for Contamination Assessment and Remediation of the Environment; BSG – British Geological Survey; HSL – Health Screening Level*

4.3 Site Specific Remediation Criteria

Site Specific Remediation Criteria (RC), to inform remediation and management works required at the Site, for the protection of human health were initially derived in 2016 (AECOM, 2016), and reviewed updated in 2025 (AECOM, 2025a). The RC adopted for groundwater are presented in **Appendix C**.

The RC consider the following scenarios and land uses which are considered applicable to the currently proposed future development based on the review of RC (AECOM, 2025d)*:*

- High density residential development (slab-on-grade buildings and buildings with a communal basement car park)
- Recreation / open space
- Multi-storey car park
- Commercial/light industrial (slab-on-grade buildings and working within a basement car park).

It is noted that residential development is now only proposed in Regatta Point. However, high density residential land use is known to occur off-Site and hydraulically down-gradient along Evans Street to the south of the Site, and the potential exists for groundwater migration from the Site to reach this area. As such, the RC protective of residential use should be applied to groundwater data from the Site in assessment of off-Site risks.

Potential risks to ecological receptors were not considered in the RC and were separately assessed (AECOM, 2020), and reviewed in 2025 (AECOM, 2025b) noting that the only potential ecological receptors identified for the Site are off-Site aquatic receptors via groundwater migrations.

The risk-based Site RC are derived based on generic, conservative exposure assumptions protective of on-Site and off-Site human health under the above-mentioned potential future land use conditions at the Site, and incorporated the following key assumptions:

- NAPL impacts at the Site will be remediated to the extent practicable and therefore risks associated with exposure to NAPL, and volatile contaminants derived from NAPL were not considered in the derivation of the RC.
- Intrusive maintenance work at up to 1 m below ground level (bgl) may be undertaken in all land uses.
- An engineered break layer will be present at the ground surface to mitigate the potential for future Site users (with the exception of maintenance workers) to have direct contact with soils.
- A reticulated water supply will be available, based on the urban setting of the Site, and abstraction of groundwater for any purposes other than remediation or monitoring, or temporary extraction during construction, will not be required. Potential exposure to contaminants in groundwater during any construction, remediation, or monitoring will be managed by task specific safety documentation informed by the SEMP.
- Groundwater will be 1 m or more below the final surface of the Site.
- A SEMP will be prepared and put in place to maintain/manage surface cover. It is noted that this GQMP has been prepared as an attachment to the SEMP.
- With regard to basements:
    - Use of any future basements is assumed to be limited to car parking. If basements are constructed for other purposes, a risk assessment specific to the intended use should be conducted.
    - Where basements are associated with future residential or commercial buildings, it is assumed that these will be communal areas for multiple properties, for example, as part of a strata scheme that is managed by a body corporate. Private basements will therefore not be associated with individual residences.
    - Where there is access to a basement car park, it is assumed that any groundwater seepage collects in floor drains and a physical barrier is present, and therefore, groundwater will not be

directly contacted by basement users, with the exception of maintenance workers. It is assumed that individual tenants will not be involved in the maintenance of any associated services, including drainage pumps or sumps.

- For potential future multi-storey car park users, the most sensitive receptor in this scenario would be considered to be a parking attendant present at the Site for a typical eight hour working day. It is considered that RC derived for potential future commercial/light industrial workers (working within a basement) would be protective of all other basement users. This includes multi-storey car park users and residential tenants who access basement car parks and are likely to have lower frequency and duration of exposure, therefore the multi-storey car park users scenario is not evaluated separately in this assessment.
- Adjacent off-Site land uses include open space, commercial/industrial, and residential areas. As these potential land uses have been considered on-Site, the derived RC are considered to also be protective of potential exposures to off-Site receptors (e.g. via groundwater migration beyond the Site boundary), as:
  - Extractive groundwater use is not known to occur within 2 km of the Site, based on review of registered groundwater bores undertaken in 2024, and the urban setting and reticulated water supply indicate that groundwater extraction and use is unlikely to occur.
  - No basements are known to be present in the surrounding off-Site buildings, and are considered unlikely due to the additional costs which would be required for basement construction, based on shallow groundwater elevation, hydraulically downgradient of the Site.
- It is considered that potential exposure to workers undertaking remediation and/or development activities can effectively be mitigated through the implementation of an appropriate Construction Environmental Management Plan (CEMP). The CEMP should be prepared during the planning stage for any future remediation and/or development activities.
- A separate assessment of the potential risks to on-Site visitors was not undertaken as it was considered that the chronic exposure duration assessment of commercial/light industrial workers or residents is sufficiently protective of the shorter exposure duration visitor scenario.

These assumptions, including controls and requirements for future development, are currently documented as requirements of the SEMP (AECOM, 2026), and should be maintained in future SEMPs. Additional assessment of risks to users, and potentially further remediation, would be required in the event of any proposed development or Site use which does not conform to these assumptions.

4.4 Quality Assurance / Quality Control

A QA/QC program has been developed to ensure that data collected is sufficiently accurate, precise and reproducible for the purposes of the assessment program. The objective of the QA/QC program is to provide an assessment of the reliability of the data presented for interpretation. **Table 3** below summarises the QA/QC for investigations conducted as part of implementation of the GQMP.

Table 3 Aspects of the QA/QC Program

Aspect	Description
Use of Experienced Personnel	Field work will be undertaken by trained personnel with previous experience in contaminated site assessment. Field personnel will be familiar with: • Field sampling techniques • Task- and Site-specific health and safety protocols.
Field Methodology	Field activities will be conducted in accordance with the AECOM standard procedures provided in **Appendix D**.
Equipment Calibration	Where applicable, field equipment will be calibrated daily prior to use in the field. Certificates of calibration in accordance with manufacturer requirements will be provided from equipment suppliers as part of hire/procurement.

Aspect	Description
Record Keeping	Date, field personnel details, observations and findings of field activities including (but not limited to) general Site conditions (including weather), groundwater level and water quality measurements, groundwater sampling, and equipment calibration details will be recorded on project-specific data sheets.
Sample Collection	Non-dedicated sampling equipment (e.g. groundwater sampling pump, water level meter and water quality meter) will be decontaminated prior to mobilisation to Site and between sampling locations. Dedicated sampling equipment (e.g. tubing and sample containers) will be used for the collection of groundwater and QA/QC samples.
Duplicates	Field duplicate (inter and intra-laboratory) samples will be collected at a rate of one each for every 20 primary samples, for each sample media, with the exception of field duplicates of PFAS samples, which will be collected at a rate of one every 10 primary samples, in accordance with the PFAS NEMP (HEPA, 2025).
Sample Labelling	A unique sample identification number will be used for each sample to specify the sample origin (monitoring well number and date).
Chain of Custody	Standard Chain of Custody (CoC) procedures will be adopted for sample transfers. CoC documentation includes sample numbers; date of sampling/ collection; analyses required; and release and receipt of parties accepting sample custody.
Sample Storage	Samples will be collected in appropriate sample containers supplied by the analytical laboratory. Where required, sample containers will be prepared with preservation solutions based on the analyte of interest. Samples will be placed in cool storage prior to transfer to the laboratory.
Decontamination	All non-dedicated field equipment used in the sampling process will be subject to appropriate decontamination procedures, generally consisting of a non-phosphate and non-PFAS containing detergent solution wash followed by a deionised, distilled, or clean water rinse. The decontamination procedures will be performed prior to first use onsite and between each sampling location.

The quality of the data collected will be assessed on a range of factors including:

- Documentation and data completeness
- Reference to relevant guidance documents
- Consistency of methodology
- Data quality including comparability, representativeness, and accuracy for data collection and analysis.

4.4.1 Data Quality Indicators

The Data Quality Indicators (DQIs) to be adopted to assess the precision and accuracy of the data include:

- Assessment of the reproducibility of the data by calculation of the Relative Percent Difference (RPD) for laboratory and field duplicate samples. This will provide an indication of the precision of the data. The RPD is calculated from the absolute difference between results of the duplicate pair divided by the mean value of the duplicate pair as presented below:

  RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

  Where: D1 = primary sample analysis

D2 = duplicate sample analysis

- Assessment of the analytical results for laboratory quality control samples. This will provide an indication of the accuracy of the data.
- Collection of rinsate blanks (at a rate of one per day of sampling) to provide an indication of accuracy related to potential for cross contamination of samples during sampling.
- Collection of field blanks (at a rate of one per day of sampling) to assess ambient conditions during sampling. Field blanks will be kept on hold unless rinsate results report detections above the laboratory limit of reporting (LOR).
- Analysis of trip blanks (at a rate of one per esky) to provide an indication of accuracy related to potential for cross contamination of samples during transport.

Assessment criteria for data quality indicators for sampling undertaken during the investigations implemented as part of this GQMP are listed below in **Table 4**.

Table 4 Acceptance Criteria for Data Quality Indicators

Data Quality Indicator	Acceptance Criteria
Rinsate blanks	Less than the laboratory LOR
Intra and inter laboratory field duplicates (1) (3)	Relative percent difference (RPD) less than 30%
Laboratory duplicates (2) (3) (4)	RPDs less than: - 20% for high level laboratory duplicates (i.e., >20 x LOR) - 50% for medium level laboratory duplicates (i.e., 10 to 20 x LOR)
Matrix spikes (5) (6) (7)	Recoveries between 70-130%
Method blanks (7)	Less than the laboratory LOR
Trip blanks	Less than the laboratory LOR
Laboratory control samples (7) (8)	Recoveries between 70-130%.
Surrogate spikes	See Note 6

Notes:

1. *Potential exceptions may occur where the analyte concentrations are close to the LOR. The 30% RPD is obtained from the NEPM, Schedule B3, where it is advised that when an RPD exceeds 30% then a review should be conducted to ascertain the cause.*
2. *If the results are close to the LOR, then higher results will be accepted.*
3. *Assumes that samples are homogeneous and the background analyte level is less than 20% of the spike level (refer to USEPA Method 8000B). Note that there is no requirement for matrix spikes to pass as certain matrices may preclude recovery of spiked compounds. In this case data will be accepted if the laboratory control sample (LCS) data meets the acceptance criteria.*
4. *Laboratory duplicates taken 1 per 10 samples.*
5. *80% of the compounds tested must fall within the control limits. Control limits are dynamic and vary for individual tests as per USEPA Method 8000B.*
6. *Recoveries for surrogates are test dependent and are based on USEPA Method SW846. Control limits are dynamic and vary for individual tests but are within the criteria described in USEPA Method SW846.*
7. *Taken 1 per batch or 1 per 20 samples (whichever is smaller).*
8. *Recoveries for surrogates are test dependent and are based on USEPA Method SW846. Control limits are dynamic and vary for tests but are within the criteria described in USEPA Method SW846.*

4.4.2 Corrective Actions

Analytical data that fail to meet the predetermined DQIs and acceptable limits of accuracy and precision will be managed using one or more of the following corrective actions (where possible) on a case-by-case basis:

- Assess significance of DQI failure to consider whether further actions are necessary
- Reanalyse suspect samples, provided sample or extract is within holding time
- Evaluate and amend sampling and/or analytical procedures
- Resampling and reanalysis
- Accept the data as an estimate with an acknowledged level of bias and imprecision
- Discard the data.

In the event that data of questionable reliability are used, restrictions and limitations associated with the use of such data will be clearly identified. Failure to meet the DQIs will be reported and the significance to the outcome of the sampling and investigation works will be assessed.

5.0 Groundwater Conceptual Site Model

The ASC NEPM states that a CSM is an essential part of all site contamination assessments. A CSM provides a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors, and a framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future.

The development of a CSM is a dynamic and iterative process, where all information and data from each stage of an assessment is integrated to refine the CSM and inform subsequent decisions on whether further investigation or management is necessary.

Sections 5.1 to **5.4** below present the current CSM for groundwater at the Site, based on current Site knowledge of contamination as summarised in Section 3 of the SEMP.

The CSM should be reviewed as part of GME reporting (see **Section 6.8**). Proposed development of the Site, in particular the lowering of the Site and management of shallow groundwater in the north-east section of the proposed Stadium (**Section 6.4.4**) has the potential to alter groundwater flow and may affect NAPL and dissolved phase contaminant mobility, or expose and allow the oxidation of PASS.

5.1 Sources of Contamination

Based on current identified Site contamination and impacts (see Section 3 of the SEMP), the sources of contamination in groundwater listed in **Table 5** below are considered to have the potential to represent potential risks to receptors:

Table 5 Groundwater Potential Sources of Contamination

#	Type	Description
1	Dissolved phase contaminants	Concentrations of the following CoPC have been detected in groundwater above one or more of the adopted Tier 1 criteria for assessment of PEVs (see **Section 4.0**): • TDS • TPH - C_{10}-C_{36} / TRH - C_{10}-C_{40} • Benzene, naphthalene • PAHs – anthracene, benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, dibenzofuran, phenanthrene, fluoranthene, 2.4-dimethylphenol • Metals – aluminium, arsenic, boron, cobalt, copper, iron, lead, manganese, vanadium, zinc • Ammonia (as N), chloride, sodium, phosphorus, sulphate, cyanide • PFAS – PFOS • Methane • E. Coli and pH[1] In particular: • TRH/TPH and other hydrocarbon related contaminants (such as benzene, naphthalene and PAHs) are generally in the vicinity of LNAPL plumes and the former gasworks area in the south-west of the Site, but have been detected in groundwater in other areas. • PFOS above Tier 1 criteria has been detected in the south-east corner of the Site in one well (MW16), although detects above LOR but below criteria have been detected in wells on the north and north-east side of the Site. • Methane in groundwater is widespread, but generally in areas where land reclamation has occurred and buried, saturated natural soils are present, and may represent a risk if volatilised methane accumulates in enclosed spaces or structures.

[1] While E. Coli and pH are not “chemicals” of potential concern, they have been treated as such in assessment.

#	Type	Description
2	NAPL	NAPL has been detected as: • LNAPL in four plumes: - LNAPL Plumes A1, A2 and A3 in the central portion of the Site. - LNAPL Plume B in the south-east corner of the Site, and inferred to be co-sourced and extend off-Site to the east. LNAPL was remediated by Total Fluids Extraction (TFE) between 2015 and 2017. • DNAPL in four plumes in the former gasworks area in the south-east area of the Site. DNAPL was remediated via *in situ* solidification (ISS) in two areas in 2024. NAPL may represent a risk if directly contact with receptors occurs, or if secondary contact occurs via NAPL-derived dissolved phase or vapours. NAPL is not currently considered mobile (see Section 3.4 of the SEMP), but potential mobilisation due to groundwater disturbance should be considered in assessment.
3	PASS	PASS has been detected in natural soils (sands/silts) at the Site, generally in saturated soil below the water table, but also in some pockets of unoxidised material in unsaturated fill. While PASS is not considered a "contaminant" arising from human activities, but is instead a natural condition of soils at the Site, management of PASS is considered to form part of the overall management of the environmental condition of groundwater. If disturbed or dewatered, PASS has the potential to acidify and lower groundwater pH, which may directly impact receptors, or mobilise other contamination, especially metals.

Notes: *CoPC – Chemical of Potential Concern; TDS – Total Dissolved Solids; TPH – Total Petroleum Hydrocarbons; TRH – Total Recoverable Hydrocarbons; PAH – Polycyclic Aromatic Hydrocarbon; PFAS – Per- and Polyfluoroalkyl Substances; PFOS - Perfluorooctane Sulfonic Acid; E. coli - Escherichia Coli; NAPL – Non-Aqueous Phase Liquid; LNAPL – Light NAPL; DNAPL – Dense NAPL; TFE – Total Fluids Extraction; PASS – Potential Acid Sulfate Soil.*

5.2 Potential Receptors

Based on the current and proposed future uses of the Site, the receptors listed in **Table 6** below are considered to have the potential to come into contact with groundwater within or discharging from the Site.

Table 6 Potential Receptors of Groundwater

#	Type	Description
1	Human health – Residents (off-Site only), commercial/industrial workers and visitors at the Site or adjacent properties	• Residents of land to the south or west of the Site, which is zoned to allow a mix of residential and commercial uses. Apartments (first floor and above) are located along Evans Street, south of the Site. • Commercial or industrial workers at the Site or adjacent businesses such as shops and offices to the south and west, or the TasPorts facility to the east. • Visitors to residences, businesses, or open spaces at the Site or adjacent properties It is assumed that potential receptors in this category will not be undertaking intrusive works or activities.
2	Intrusive Maintenance and Construction Workers (On- and Off-Site)	• Workers undertaking intrusive maintenance (such as accessing sub-surface pipes or utility conduits) or construction activities.
3	Recreational users of nearby waterways (Off-Site only)	• Boating, fishing or other recreational uses of Sullivan's Cove or the River Derwent.

#	Type	Description
4	Ecological Receptors (Off-Site only)	• No ecological receptors (terrestrial or aquatic) are present on-Site or proposed as part of future development. Potential plants and vegetation on-Site will be managed as described in Section 4.7 of the SEMP to limit groundwater interaction. • No terrestrial ecosystems have been identified off-Site or are considered likely. • Aquatic ecosystems (assessed as “high disturbed”) are present in Sullivans Cove and the River Derwent.

5.3 Potential Pathways

Table 7 below lists the identified pathways whereby sources of contamination may come into contact with receptors.

Table 7 Potential Receptors of Groundwater

#	Type	Description
1	Direct contact	Ingestion, washing, or other direct contact with groundwater/ NAPL (either on-Site or which has migrated off-Site), or with surface water which Site groundwater has discharged to.
2	Vapour inhalation or accumulation	Inhalation of groundwater derived vapour, or accumulation of non-toxic vapour which represents an explosion risk (methane) in enclosed structures.

Risks associated with groundwater may be present on-Site, or off-Site where groundwater with contamination has migrated beyond the Site boundaries.

As noted in Section 2.5.3 of the SEMP, Site groundwater elevation contours generally followed the pattern of topographic elevation across the Site, indicating a relatively steep up-gradient flow direction to the south-east, prior to flattening out to a very gentle gradient across the central and south-eastern down-gradient areas. Groundwater flow direction followed the steep north-easterly slope towards Regatta Point further around the headland to the far north of the Site.

Groundwater is inferred to have southeast and southerly components of flow in the main area of the Site, with some westerly flow along the eastern boundary with TasPorts land which may be due to a buried seawall in this area, and northeasterly towards Regatta Point. The inferred ultimate discharge points of Site groundwater are the River Derwent and Sullivans Cove.

5.4 Source-Pathway-Receptor Assessment

An exposure pathway describes the course a chemical or physical agent takes from its source to an exposed individual or ecological receptor. In order for a receptor to be exposed to a chemical contaminant from a site, a complete exposure pathway must exist, which generally includes the following elements:

- A source and mechanism of chemical release
- A retention or transport medium (or paths where chemicals are transferred between media)
- A point of potential human or ecological contact with the contaminated medium
- An exposure route (i.e., inhalation, ingestion or dermal contact for the entity) at the point of exposure.

In cases where one or more of the above elements is missing, the exposure pathway is considered to be incomplete. Such circumstances are not considered to pose a risk of harm to receptors. **Table 8** below provides assessment on the status of source-pathway-receptor (SPR) linkages for groundwater at Macquarie Point.

The following assumptions have been made when considering SPR linkages:

- This GQMP and the SEMP will be implemented and maintained at the Site, including the following controls related to groundwater:
  - On-Site Groundwater use will be limited, as required in **Section 1.3**, to:
    - Environmental monitoring, assessment, or remediation;
    - Short-term removal during construction;
    - Groundwater drainage systems for structures.
  - Groundwater drainage and vapour intrusion protection (as required in Sections 4.4 and 4.8 of the SEMP) will be installed and maintained as part of future structures where required.
  - Safety documentation and procedures (such as Construction Environmental Management Plans [CEMPs], Work Health and Safety Plans [WHSPs], and/or task specific Job Safety Analysis [JSAs] or Safe Work Method Statements [SWMSs]) will be prepared and implemented for all intrusive works at the Site, as required in Section 4.3 of the SEMP.
  - Work planning will consider and identify potential disturbance of PASS, and preparation of a suitable Acid Sulfate Soil Management Plan (ASSMP), which may include a Dewatering Management Plan (DWMP), as required in Section 4.12.3 of the SEMP.
  - Potential risks and assumptions about use relating to groundwater will be communicated to adjacent landowners and properties, as required in **Section 6.8**.
- Due to the developed urban nature of the area and available reticulated water supply, groundwater (whether on-Site or in adjacent areas) will not be extracted for drinking, irrigation, recreational, or industrial purposes.

Table 8 Groundwater Source-Pathway-Receptor Linkage Assessment

Exposure Pathway	Residents (off-Site only), commercial/industrial workers and visitors		Intrusive Maintenance or Construction Workers		Recreational Users of Surface Water	Aquatic Ecosystems
	On-Site	Off-Site	On-Site	Off-Site	Off-Site	Off-Site
Incidental ingestion of contaminated groundwater	×(a)	×(a)	✓(d)	✓(d)	✓ (e)	✓(f)
Dermal contact with contaminated groundwater	×(a)	×(a)	✓(d)	✓(d)	✓ (e)	✓(f)
Inhalation of contaminated groundwater-derived vapours in indoor air	×(b)	×(b)	✓ (d)	✓ (d)	N/A	N/A
Accumulation of non-toxic groundwater-derived vapours (methane) to potentially hazardous levels in enclosed spaces.	×(b)	✓(b)	✓(d)	✓(d)	N/A	N/A
Inhalation of contaminated groundwater-derived vapours in outdoor air	✓ (c)	×(c)	✓(d)	× (c)	×(c)	N/A
Ingestion of contaminated groundwater used as potable water supply	×(a)	×(a)	×(a)	×(a)	×(a)	✓ (f)
Inhalation of contaminated groundwater vapours during irrigation/showering	×(a)	×(a)	×(a)	×(a)	×(a)	N/A
Ingestion of vegetables, plants or animals fed by contaminated groundwater	×(a)	×(a)	×(a)	×(a)	✓(f)	✓ (f)

Notes: × : incomplete pathway; ✓: potentially complete pathway; N/A : Not applicable

a) No on-Site or down-gradient off-Site bores used for agricultural / domestic purposes have been identified in previous investigations. The current SEMP restricts the use of Site groundwater to monitoring or remediation purposes or for dewatering (temporary or on-going), and based on the land use off-Site and downgradient, and the reticulated water supply available, use or handling of groundwater off-Site as potable water, or for irrigation, showering, stock watering, or other uses by humans, is considered unlikely.

b) On-Site development includes design and verification of vapour protection systems to prevent hazardous vapour intrusion, including consideration of potential vapour management for long-term drainage systems. No concentrations of CoPC which are considered to represent a potentially hazardous concentration of groundwater-derived vapours in indoor spaces have been detected in groundwater emanating from the Site, with the exception of methane, which is considered co-sourced from off-Site conditions (buried sea- and river-bed) and not sourced from the Site in off-Site areas.

c) No concentrations of CoPC which are considered to represent a potentially hazardous concentration of groundwater-derived vapours in outdoor spaces have been detected in groundwater within or emanating from the Site.

d) Risks to on-Site intrusive maintenance or construction workers will be managed by safety and environmental management documents as required by the SEMP. As part of implementation of the GQMP, off-Site landowners/controllers will be informed of potential risks to inform their own safety planning and management.

e) Potential surface water which may be subject to recreational use (the River Derwent and Sullivans Cove) are between 130 to 270 m from the Site boundary, and it is assessed that attenuation is likely to reduce CoPC concentrations below adopted criteria across these distances.

f) No potential impacts to off-Site ecological receptors are considered likely (see **Section 6.4.5**), which would include animals (i.e., fish) potentially consumed by off-Site recreational users of surface water.

6.0 Groundwater Monitoring Events

6.1 Scope Development and Schedule

In order to monitor the groundwater at and adjacent to the Site, and meet the purpose and objectives of the GQMP, as described in **Section 1.2**, Site-wide GMEs should be conducted at a minimum initial frequency of annually. The first GME is scheduled to occur in June 2026, noting that scheduling may be affected by Site development activities.

Each GME should be conducted with consideration of the following information:

- The environmental investigations which informed Site Suitability Statements / Contaminated Land Audit Reports, the SEMP, and the overall state of knowledge related to Site groundwater contamination.
- The key potential risk areas described in **Section 6.4** below.
- Any changes in Site condition or use, such as development, land use, and activities on neighbouring sites.
- Results and recommendations of previous GMEs.
- Any other recommendations, requirements, or data gaps relating to groundwater conditions which have been identified as part of other investigations or Site activities.

Sections 6.2 to **6.8** provide an initial scope and methodology for GMEs, with proposed groundwater wells to be gauged and selected analytical suites provided on **Table T2**. Groundwater well locations and proposed monitoring actions are shown on **Figure F5**.

Any modification of this scope for future GMEs must be justified as described in **Section 7.0**.

6.2 Well Maintenance and Repair

Groundwater wells at the Site are to be maintained in a functional condition. The following inspections will be made as part of the each GME:

- Inspect condition of concrete pad for signs of damage
- Inspect gatic cover or metal stickup cover for signs of damage
- Inspect well cap to assess if it is appropriately sealed.

Should any of the inspections identify damage to a well which could allow surface water ingress, cross-contamination of groundwater and/or to inhibit future use, work to repair the well will be undertaken.

Gatic covers are to be maintained to prevent the ingress of surface water and gatic bolts are to be replaced when showing signs of wear or damage.

The integrity of the groundwater wells should be maintained so far as reasonably practicable during normal operations or any Site development work. If wells cannot be located during sampling or gauging events, appropriate measures, such as use of a metal detector or engagement of a licensed surveyor to locate the recorded co-ordinates of a well, should be undertaken.

If a lost well cannot be relocated, a damaged well cannot be repaired and used for ongoing monitoring, or removal of groundwater well is required for the purpose of Site development:

- The groundwater well network should be assessed to determine if a replacement is required and is practicable, noting that as Site development progresses direct replacement may not be possible, or if remaining wells can be used to provide suitable information for monitoring groundwater condition.

  Replacement should be conducted as part of any other larger scale maintenance activities as discussed below.
- If the groundwater well location is known and a groundwater well is to be removed from the monitoring network (due to damage or no longer being required), the groundwater well must be

decommissioned in accordance with National Uniform Drillers Licensing Committee (NUDLC) Minimum Construction Requirements for Water Bores in Australia, Fourth Edition (2020) decommissioning requirements.

Minor maintenance requirements (such as replacing missing bolts) will be undertaken immediately during GMEs. Larger scale maintenance requirements (such as gatic replacement, redevelopment if excess siltation has occurred, or well replacement if required) will be scheduled for completion prior to, or during, the following GME.

Any new groundwater well, or groundwater well which has had the maintenance or repair activities undertaken that affects the well casing elevation, a licensed surveyor will be engaged to re-survey the top of casing location with reference to Map Grid of Australia (MGA) Zone 55) and elevation with reference to the Australian Height Datum (AHD).

A summary of groundwater well maintenance requirements completed or identified during each GME must be documented in the report described in **Section 6.8**.

6.3 Groundwater Gauging and Sampling Methodology

AECOM SOPs for development, low-flow sampling, and gauging of groundwater wells are attached as **Appendix D**. GME activities should be conducted with reference to and in accordance with these documents, or with suitable procedures which have been developed in accordance with the following documents:

- *AS NZS 5667.1.1998 – Water Quality Sampling – Part 1 Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*
- *AS NZS 5667.11,1998 – Water quality - Sampling guidance on sampling of groundwaters*
- *EPA Victoria Publication 669.1: Groundwater sampling guidelines* (EPA Victoria, 2022)
- *The Per- and Polyfluoroalkyl Substances National Environmental Management* Plan (the PFAS NEMP) (HEPA, 2025)
- The ASC NEPM

If the above documents are updated or superseded in the future, any groundwater sampling methodologies should be formulated or updated with reference to the most recent relevant guidelines.

During GMEs:

- A gauging round should be conducted prior to sampling. The gauging round should be completed in as short a time as practicable (ideally within one day).

  During gauging, the concentration of Volatile Organic Compounds (VOCs) and potential flammable compounds in each wellhead should be recorded using an appropriately calibrated photo-ionisation detector (PID) and Lower Explosive Limit (LEL) detector.

  The time at which each well is gauged should be recorded and potential tidal influence considered when assessing data.

- Sampling of each groundwater should be conducted once the gauging round is complete for all wells. Groundwater sampling should:
  - Include collection of field groundwater parameters with an appropriately calibrated water quality meter. Parameters which should be recorded include:
    - Physical appearance and characteristics of groundwater, such as colour, turbidity, and odour.
    - Field pH
    - Electrical Conductivity (EC)
    - Temperature
    - Oxygen Reduction Potential (ORP)

  - Dissolved Oxygen (DO)
- Be undertaken using low-flow methodologies for consistency with previous GMEs and historical data, unless justification for an alternative methodology, including assessment of potential differences which may arise in groundwater results, is provided.

6.4 Potential Elevated Risk Areas

Groundwater at the Site has impacts from a number of historic industrial land uses on- and off-Site, as discussed in the SEMP. The following areas have been identified in previous investigations as having detected contamination, Site characteristics, or proposed development which may introduce elevated groundwater risks.

6.4.1 Non-Aqueous Phase Liquid Areas

NAPL has been detected at the Site as both Light Non-Aqueous Phase Liquid (LNAPL) and Dense NAPL (DNAPL), as described in Section 3.4 of the SEMP.

Where practicable, GMEs should include gauging and sampling of wells within and hydraulically up-, down- and cross-gradient of NAPL areas. **Table 9** below presents existing groundwater wells which are within or immediately adjacent to inferred NAPL areas, with groundwater well locations shown on **Figure F3**.

For the purpose of the initial GME scope presented on **Table T2**, all groundwater wells on **Table 9** are included in the gauging scope, and collection and analysis of groundwater is included for all wells which are screened across the shallow aquifer.

However, collection and analysis of groundwater samples is not considered required from MW123B, MW126B, MW128B, MW129, MW131_GHD, MW136_GHD. Each of these wells are screened below the water table for assessment of the deeper aquifer, and are either in a nested bore, or <5 m, from a groundwater wells screened in the shallower aquifer which is included in the sampling scope for the GME. As the Site has a single continuous aquifer, and any contamination to the deeper portions of the aquifer would have to pass through shallower groundwater in order to reach receptors, collection and analysis of groundwater from the shallower screened wells is considered suitable for assessment and monitoring of groundwater condition.

Table 9 NAPL Monitoring Wells

NAPL Area	Groundwater Well Location			
	Within inferred plume extent	Up-gradient	Down-gradient	Cross-gradient
LNAPL Plume A1	MW183	MW103A	MW182, MW191	MW177, MW187, MW184
LNAPL Plume A2	MW185	MW191, MW184,	MW187, MW146, RN4, MW176, MW175	MW186, MW36
LNAPL Plume A3	MW187	MW182, MW177, MW183	MW155, MW146, RN4,	MW185
LNAPL Plume B	MW3, PW02, S8, PC13[1]	MW164, MW6[2], MW188	MW5[2], MW135_GHD[1], MW136_GHD[1,3], MW16, MW126A, MW126B[3], MW154[2], MW60, MW193, MW134_GHD[1]	-

NAPL Area	Groundwater Well Location			
	Within inferred plume extent	Up-gradient	Down-gradient	Cross-gradient
Tar Plume A	-	MW128A, MW128B	MW196, MW123A, MW123B[3], MW130_GHD, MW131_GHD[3], MW132_GHD	-
Tar Plume B	-	MW196, MW198	MW100, MW129[3] MW197, MW133_GHD, RS6	MW132_GHD
Tar Plume C	-	MW101	MW128A, MW128B[3], MW196	MW102
Tar Plume D	-	-	MW101, MW102, MW198	MW121

Notes: *1. Off-Site well on third party land with limited access granted; 2. LNAPL has been historically detected in this well; 3. Groundwater wells screened below the water table to assess the deeper portion of the aquifer.*

6.4.2 Per- and Polyfluoroalkyl Substances (PFAS)

While no direct record of PFAS usage or storage on the Site exists, PFAS has been identified as a CoPC arising from bulk fuel storage.

PFAS analysis has been conducted on samples collected from 33 groundwater wells across the Site between 2015 and 2025.

PFAS has not been reported above the laboratory LOR in the following 21 groundwater wells when included in laboratory analysis: MW101, MW123A, MW123B, MW124A, MW124B, MW25A, MW125B, MW126B, MW127A, MW127B, MW128A, MW128B, MW129, NR2*, R2*, R3*, RN2, RS6, S4*, S9*, TW03. Wells marked with a * have been lost or destroyed.

PFAS has been detected above LOR in 14 wells, as summarised on **Table 10** below. It is noted that other PFAS congeners have also been detected in the wells listed on **Table 10**, but do not have adopted criteria. 6:2 Fluorotelomer sulfonic acid (FTS) has only been included as no other PFAS has been detected in RN4.

Table 10 Detectable PFAS in Groundwater

Well	Date	Detectable PFAS (µg/L)				Comment(s)
		PFHxS	PFOS	PFOA	6:2 FTS	
Ecosystem Protection		NC	0.13	220	NC	
Drinking Water		0.07	0.07	0.2	NC	
MW16	19 Jul 2016	<0.02	0.09	0.02	<0.05	MW16 in the south-east corner of the Site, cross/down-hydraulic gradient of LNAPL Plume B. Hydraulic contours and groundwater elevations in surrounding wells indicate that groundwater at this well may be coming from the north and west (on-Site) and from the east (off-Site), and is likely to be discharging in a southerly direction.
	18 Jul 2017	0.04	0.38	0.06	<0.05	
	23 Jun 2025	0.01	0.30	0.02	<0.05	

Well	Date	Detectable PFAS (µg/L)				Comment(s)
		PFHxS	PFOS	PFOA	6:2 FTS	
Ecosystem Protection		NC	0.13	220	NC	
Drinking Water		0.07	0.07	0.2	NC	
BG1	21Jul 2016	0.04	<0.01	0.01	<0.05	BG1 is upgradient / background and detection in this well may indicate an off-Site source.
	18 Jul 2017	<0.02	<0.01	<0.01	<0.05	
	17 Jun 2025	0.007	0.014	0.013	<0.005	
MW6	19 Jul 2016	<0.02	<0.01	<0.01	<0.05	MW6 is located in the south-east corner of the Site, on the eastern boundary with adjacent TasPorts property and up- to cross-gradient of LNAPL Plume B.
	18 Jul 2019	<0.02	<0.01	<0.01	<0.05	
	23 Jun 2025	0.003	0.012	0.005	<0.005	
MW60	19 Jul 2016	<0.02	<0.01	0.01	<0.05	MW126A is located in the south-east corner of the Site, near the inferred discharge point of groundwater from the Site and down-gradient of LNAPL Plume B.
	18 Jul 2017	<0.02	<0.01	0.02	<0.05	
	24 Jun 2025	0.005	0.006	0.015	<0.005	
MW120	18 Aug 2015	-	<0.02	<0.02	<0.1	MW120 was located in the north-west corner of the Site, and is an upgradient / background well and detection in this well may indicate an off-Site source. This well was lost/destroyed and has been replaced by MW120A.
	02 Feb 2016	-	<0.01	<0.01	<0.1	
	21 Jul 2016	<0.02	0.02	<0.01	<0.05	
MW120A	25 Jun 2025	0.004	0.024	0.006	<0.005	This well was installed to replace MW120 in 2025.
MW121	19 Aug 2015	-	<0.02	<0.02	<0.1	MW121 is located in the north-west portion of the Site, and is an upgradient / background location and detection in this well may indicate an off-Site source.
	21 Jul 2016	<0.02	0.02	0.03	<0.05	
	18 Jul 2017	<0.02	0.03	<0.01	<0.05	
	18 Jun 2025	0.001	0.019	0.004	<0.005	

Well	Date	Detectable PFAS (µg/L)				Comment(s)
		PFHxS	PFOS	PFOA	6:2 FTS	
Ecosystem Protection		NC	0.13	220	NC	
Drinking Water		0.07	0.07	0.2	NC	
MW126A	02 Feb 2016	-	<0.01	<0.01	<0.1	MW126A is located in the south-east corner of the Site, near the inferred discharge point of groundwater from the Site.
	19 Jul 2016	<0.02	<0.01	<0.01	<0.05	
	18 Jul 2017	<0.02	<0.01	<0.01	<0.05	
	24 Jun 2025	0.005	0.004	0.007	<0.005	
MW188	24 Jun 2025	0.001	<0.001	0.002	<0.005	MW188 was installed in 2025 in a roadway east of the Red Shed in the south-east corner of the Site.
MW193	24 Jun 2025	<0.001	0.002	0.003	<0.005	MW188 was installed in 2025 in a roadway east of the Red Shed on the southern boundary in the south-east corner of the Site.
MW194	17 Jun 2025	0.004	0.017	0.015	<0.005	MW194 was installed in 2025 adjacent to BG1 on the northern Site boundary Site, and is considered to represent groundwater entering the Site.
RN2	19 Jul 2016	<0.02	<0.01	<0.01	0.13	RN2 is on the Site boundary, and hydraulic contours indicate that water at this location is likely to represent groundwater entering the Site from the east.
	19 Jul 2017	<0.02	<0.01	<0.01	<0.05	

Notes: *NC - No criteria; PFHxS - Perfluorohexane sulfonic acid; PFOS - Perfluorooctane sulfonic acid; PFOA - Perfluorooctanoic acid; FTS - Fluorotelomer sulfonic acid.*

Exceedances of adopted the criteria for drinking water and protection of marine ecosystems (95% species protection level) have been detected in one well, MW16 in the south-east corner of the Site. **Table 11** below lists wells in the vicinity of MW16.

Table 11 Wells in the vicinity of MW16

Groundwater Well ID	Inferred Hydraulic Direction[1]	PFAS Detected above LOR in Well Previously?
MW154	Up-gradient	Not analysed
S8	Up-gradient	Not analysed (LNAPL in well)
MW60	Cross- to down-gradient	Yes
MW126A	Cross- to down-gradient	Yes
MW134_GHD	Down-gradient	Not analysed. Off-Site well with limited access granted by third party landowner
MW135_GHD	Cross- to up-gradient	Not analysed. Off-Site well with limited access granted by third party landowner

Groundwater Well ID	Inferred Hydraulic Direction[1]	PFAS Detected above LOR in Well Previously?
MW136_GHD	Cross- to up-gradient	Not analysed. Off-Site well with limited access granted by third party landowner
PC12	Cross- to down-gradient	Not analysed. Off-Site well with limited access granted by third party landowner
MW193	Cross-gradient	Yes
MW151	Down-gradient	Not analysed

Notes: 1. Inferring groundwater flow direction is complex in the vicinity of MW16, as groundwater elevation is relatively flat and a seawall has been identified

For the purpose of the initial GME scope presented on **Table T2**, all groundwater wells on **Table 10** and **Table 11** have been included in the gauging scope, and selected for PFAS analysis.

6.4.3 Potential Acid Sulfate Soil (PASS)

If disturbed by excavation or dewatering, PASS located beneath the Site has the potential to oxidise and acidify. Any such disturbance requires an Acid Sulfate Soil Management Plan (ASSMP) as described in the SEMP, which may include requirements for ongoing monitoring of groundwater.

However, any such requirements will be specific to the area and extent of disturbance, and should be documented in the ASSMP or DWMP and implemented outside of the SEMP and GQMP.

6.4.4 Groundwater Elevation Relative to Buildings and Structures

As described in **Section 4.3**, the Site Specific RC include an assumption that groundwater will be greater than 1 m below building slabs.

As part of the proposed design, lowering of the Site surface elevation and construction of buildings is proposed and an area (shown on **Figure F4**) has been identified where groundwater may be present within 1 m of the base of the proposed structures (and above the base in some areas). Design and construction in this area must include protection against groundwater or groundwater-derived vapour entering buildings, as required by Section 4.4 of the SEMP, and it is understood that this is currently proposed to be achieved by a combination of a drainage layer and vapour barrier.

Any future changes in design shown on **Figure F4**, which may affect the distance between groundwater and the base of building slabs, should be considered for implications to the GQMP.

The timeframe for when construction of this layer will occur is not yet specified, but is anticipated to occur in 2027/2028, with initial excavation occurring in 2026. Groundwater monitoring during and after construction must assess if groundwater is being lowered and is not a risk of reaching the surface.

For the purpose of the initial GME scope presented on **Table T2**, gauging of all groundwater wells has been included.

6.4.5 Potential Impacts to Off-Site Ecological Receptors

A Site-wide assessment of potential off-Site impacts to ecological receptors, namely the River Derwent and Sullivans Cove was conducted in 2019/2020 and is reported in the *Assessment of Potential Off-Site Ecological Impacts* (AECOM, 2020). *Assessment of Potential Off-Site Ecological Impacts – 2025 Addendum* (AECOM, 2025b) was prepared in 2025 in order to incorporate additional data collected since initial issue of this assessment on the Site's environmental condition.

The objective of the *Assessment of Potential Off-Site Ecological Impacts* was to assess the potential risk posed to off-Site aquatic receptors with respect to the nature and extent of contaminant discharge *via* groundwater from contaminant sources at the Site.

Based on the outcomes of the weight-of evidence assessment conducted in this assessment, and the review and addendum prepared in 2025, it is unlikely that the Chemicals of Potential Ecological Concern (CoPEC) concentrations in groundwater beneath the Site are presenting a potentially

unacceptable risk to off-Site aquatic ecological receptors (if present) at the inferred points of discharge on the basis that:

- The assessed adjacent aquatic habitats are artificial, of low ecological value and considered to be 'highly disturbed' environments. A sensitivity analysis demonstrated that the overall risk conclusions would not materially change if the condition of the off-Site receiving environment was improved over time to become consistent with a 'slightly-moderately disturbed' habitat, for which a higher level of species protection would be desirable.
- The following chemicals have been identified as CoPEC at the Site, based on reported concentrations in one or more groundwater samples exceeding the adopted Tier 1 criteria:
  - Metals (aluminium, cadmium, copper, lead, manganese, vanadium, zinc)
  - Ammonia (as N), free cyanide, total phosphorus, and pH[2]
  - TRH >C10-C40 fraction (sum)
  - Monoaromatic hydrocarbons (benzene, ethylbenzene, o-xylene, m&p-xylene, 1,2,4-trimethylbenzene)
  - Polycyclic aromatic hydrocarbons (naphthalene, anthracene, phenanthrene, fluoranthene, benzo(a)pyrene)
  - 2,4-dimethylphenol
  - PFOS

  It is noted that cadmium and PFOS were not identified as CoPEC in the initial assessment (AECOM, 2020), but were identified and considered in the 2025 update (AECOM, 2025b).
- Concentrations of CoPEC were reported below adopted screening levels near Sullivans Cove and the River Derwent, were likely to attenuate further prior to discharge into these areas, or were associated with background conditions. Concentrations of CoPEC did not increase significantly (>20%) compared between 2020 and 2025, and no new exceedances of adopted ecological criteria were detected, with the exception of:
  - Elevated concentrations of cadmium, copper, lead, and zinc were observed in groundwater collected from MW180, a new groundwater well installed at Regatta Point in 2024 and screened across historical fill.

    Concentrations in excess of adopted criteria were inconsistent across the two sampling events conducted to date.
  - 2,4-Dimethylphenol: Elevated concentrations were observed at
    - MW132_GHD, located on Evans Street to the south of the Site in December 2022.

      Remediation of gasworks impacts in the Gateway was conducted in 2025 and, combined with natural attenuation processes, concentrations are expected to decline over time. During the most recent GME (June 2025) concentrations of 2,4-dimethylphenol were below the laboratory LOR in MW132_GHD.
    - MW120A, located in the north-west corner of the Site in June 2025.

      MW120A is one of the most hydraulically up-gradient wells on the Site and is located close to where groundwater is inferred to enter the Site. Concentrations in this groundwater wells are unlikely to be representative of groundwater discharging from the Site.
- Hydrocarbon fingerprinting of an LNAPL sample collected from within Plume B suggests that the LNAPL is dominantly composed of weathered diesel and lube oil. No new sources of LNAPL were identified. The plume is considered stable and no significant TRH-signature is evident downgradient near the receiving environment at Sullivans Cove.

[2] While pH is not a chemical, it has been treated as one for the purpose of assessment of ecological risks.

- Disturbance of PASS in Site soil without appropriate management could lead to acidification and increased mobilisation of metals, and increase the potential risk to off-Site aquatic ecological receptors. However, implementation of an ASSMP in accordance with the SEMP is expected to mitigate this risk.
- A mixing zone indicating estuarine/saline water interaction noted near Sullivans Cove is likely to result in the reduction of groundwater concentrations of key CoPEC prior to the point of discharge into the receiving environments.
- The Hobart Rivulet (which passes north of the Escarpment, through Audit Area 4 East, and south of Regatta Point) has concrete walls are understood to be below the groundwater level beneath the Site and may act as a barrier to groundwater flow in the direction of the point of discharge to River Derwent.
- Groundwater is inferred to predominately discharge through cracks and protrusions in the seawalls. No obvious groundwater seepage through the concrete seawall was noted near Sullivans Cove or the River Derwent during low tide inspections as part of the initial 2020 assessment, and no development or modification of seawalls is known to have occurred since then.

In summary, the *Assessment of Potential Off-Site Ecological Impacts* considered multiple lines of evidence to assess the potential risk posed to off-Site aquatic ecological receptors (i.e. marine ecosystems within the River Derwent and Sullivans Cove) with respect to the nature and extent of contaminant discharge via groundwater from contaminant sources at the Site.

Based on the outcomes of AECOM (2020), including the review conducted as part of AECOM (2025b), it is considered that groundwater emanating from the Site boundary is unlikely to pose an unacceptable risk to off-Site aquatic ecological receptors at Sullivans Cove and the River Derwent.

GMEs must include:

- Gauging and groundwater sampling at groundwater wells located (at a minimum) on the Site boundary where groundwater may be discharging from the Site towards aquatic ecological receptors (Sullivans Cove and the River Derwent).
- Analysis of the following to improve understanding of ecological risks:
  - Cadmium, copper, lead, and zinc in MW180
  - 2,4-dimethylphenol in MW120A and MW132_GHD.

6.5 Sample Analytical Suites

6.5.1 General Suite

Previous groundwater investigations have generally assessed samples for the following analytical suites, which is considered suitable to refresh Site groundwater data and allow assessment of potential risks to receptors:

- Total Petroleum Hydrocarbons (TPH) C6-C40
- Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene (BTEXN)
- Phenols
- Metals (aluminium, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, manganese and zinc)
- Cations/Anions (calcium, magnesium, sodium, chloride, sulfate, alkalinity and ionic balance)
- Acidity
- Cyanide (total, free and weak acid dissolvable [WAD])
- Ammonia
- Methane

- Total dissolved solids

The general suite should be undertaken for all groundwater samples collected as part of the GME, unless otherwise justified as part of review of groundwater data following the GME.

6.5.2 Per- and Poly-Fluoroalkyl Substances (PFAS)

PFAS analysis should be conducted on groundwater collected from wells which have previously had detectable concentrations of PFAS, and satellite wells in the vicinity of MW16, which has reported concentrations of PFOS in excess of adopted criteria, as described in **Section 6.5.2**.

6.5.3 Laboratory Limits of Reporting

Laboratory analytical suites must be selected with suitable LORs to allow assessment against the adopted criteria. Current criteria are presented in **Appendix C**, but LORs must consider any changes in criteria which arise as a result of future investigations and assessments, reference sources, or other actions which lead to changes in adopted criteria.

6.6 Waste Management

All wastewater, such as extracted groundwater and equipment wash water, is to be collected within temporary storage containers such as jerry cans or waste drums.

All solid waste products derived during each sampling event (for example filters, tubing, bladders and gloves) are to be disposed of in prescribed waste bins.

Wastewater and solid wastes are to be disposed of as potentially contaminated waste at the conclusion of each GME.

6.7 Triggers and Contingencies

Table 12, **Table 13** and **Table 14** below summarise the trigger levels and applicable contingency actions for NAPL and dissolved phase concentrations in groundwater, and for groundwater gauging.

The results of any groundwater monitoring should be assessed against these trigger levels and the contingency actions undertaken if triggers have been identified.

Table 12 NAPL Triggers and Contingency Actions

Trigger	Contingency Action
New occurrence of NAPL in a well	• Further gauging to confirm the presence of NAPL. • Assess the potential source and if there is any potential for a new release to have occurred. • Assess for potential changes to the CSM and assess whether there is a potential change in risk profile. • Develop a scope to further assess and implement appropriate NAPL management activities, if required. Actions may include, but are not limited to, sampling and fingerprinting of NAPL, testing of NAPL mobility and transmissivity, and/or removal/remediation of NAPL from groundwater.

Trigger	Contingency Action
Increase in NAPL thickness that cannot be attributed to groundwater level fluctuation (i.e., not within historical NAPL thickness or groundwater elevation).	• Review historical groundwater data. • Evaluate NAPL thickness in adjacent wells and changes in NAPL gradients. • Assess for potential changes to the CSM and assess whether there is a potential change in risk profile. • Develop a scope to further assess and implement appropriate NAPL management activities, if required. Actions may include, but are not limited to, sampling and fingerprinting of NAPL, testing of NAPL mobility and transmissivity, and/or removal/remediation of NAPL from groundwater.
First time identification of dissolved phase petroleum hydrocarbon compound concentrations exceeding solubility limits in groundwater from a well downgradient from a NAPL containing well.	• Review historical groundwater data. • Evaluate NAPL thickness in adjacent wells and changes in NAPL gradients. • Assess for potential changes to the CSM and assess whether there is a potential change in risk profile. • Develop and implement appropriate management and assessment activities, if required.

Table 13 Dissolved Phase Triggers and Contingency Actions

Trigger	Contingency Action
CoPC result(s) exceed criteria, where previously there was no exceedance.	• Assess whether the quality of the data is acceptable. • Assess the significance of criteria exceedance to consider whether further actions are necessary • Assess if any on- or off-Site activities can be identified which may have introduced the trigger result. • Assess whether the CSM is still valid. • If the CSM has potentially changed, assess whether there is a potential change in risk profile, and if so, develop a scope to confirm results, and further assess and implement mitigation measures, if required. • Develop and implement appropriate management, assessment activities and/or remediation, if required.
Increase in CoPC concentrations by an order of magnitude, compared to the most recent previous GME at this location.	
CoPC results show an increasing trend based on application of the Mann-Kendall statistical technique.	

Table 14 Groundwater Elevation and Flow Direction Triggers and Contingency Actions

Trigger	Contingency Action
Groundwater elevation is detected or inferred to be less than 1 m below the bottom of a building slab.	• Determine if the building or structure has mitigations, as required by Section 4.4 of the SEMP, and confirm that they have been maintained and are operational. • If the building or structure does not have suitable mitigations, develop and implement an assessment of risks to building users from shallow groundwater, which may include but is not limited to further groundwater sampling and assessment, soil vapour or indoor air sampling. • Prepare and implement appropriate management measures to mitigate any risks identified.
Groundwater elevations have significantly decreased	• Assess the area of elevation decrease and assess if PASS may have been exposed. • If PASS may have been exposed, develop and implement appropriate management, assessment, and/or remediation activities, if required.
Groundwater flow direction and inferred discharge points have significantly altered	• Assess if change in flow direction alters CSM and if any risks to potential sensitive receptors (i.e., aquatic ecosystems in the River Derwent or Sullivans Cove) are elevated. • Prepare and implement appropriate assessment, management and/or remediation measures to mitigate any risks identified.

6.8 Reporting

A GME report should be prepared following each GME by the organisation who conducted the groundwater sampling. The GME report should include at a minimum (where applicable):

- Background information on the Site and setting, including any changes at the Site (such as development, construction, or land use) which have occurred since the previous GME.
- Confirmation that the scope prepared for the sampling event has been fulfilled or otherwise provide the rationale for any variations.
- Sample collection and analysis data, including:
  - Field records of groundwater level, field parameters, groundwater well condition and/or repair, calibration of any instrumentation used, decontamination, and any other activities conducted in the field.
  - Laboratory analysis documentation, including Chain of Custody, Certificates of Analysis, and any laboratory conducted QA/QC checks.
  - Any other field records relevant to the groundwater investigation conducted.
- Tabulation of groundwater depths and field parameters, and of analytical results against criteria.
- Site maps or figures showing monitoring points, inferred groundwater contours, and criteria exceedances.
- Assessment on the status of groundwater impacts, assessment of potential changes to the impact areas or extents, concentration and stability, and potential changes to the risk profile.
- Review of the data against triggers levels and contingency actions and recommendations for any action that may be required.

- Review of the frequency of sampling and if any modification to the scope for the next GME are warranted, such as increase or decrease in number of wells to be gauged and sampled, or changes in proposed analytical suites.

  Analytical suites or overall monitoring frequency may be modified and decreased, if it is assessed and can be demonstrated that:

  - There is sufficient data to establish risk status.
  - Groundwater concentrations trends are established.
  - No works or development of the Site or surrounding areas which may disturb groundwater or which represent an ongoing risk of groundwater contamination are occurring or anticipated.
  - Possible changes to groundwater condition and potential risks to receptors can be adequately monitored by other data collection.

  Updates to the scope of GMEs are not considered to trigger a requirement to update or issue new versions of the GQMP or SEMP. Any changes should be captured in the review of these documents, which occurs at a minimum of every three years (see **Section 7.0**)
- Review of whether the Site CSM is still accurate or requires update, or if any update of this GQMP is required (i.e., a new or significantly altered environmental risk in groundwater has been identified).
- Scope recommended activities to be undertaken during or prior to the next GME, including any well maintenance, repair or replacement required.

If not previously conducted, any risks to potential off-Site users from groundwater identified based on the results of the GME, or assumptions on groundwater use by occupiers of off-Site land which form part of the assessment of groundwater data, should be communicated to the owners/controllers of those areas.

7.0 Review and Update Process

The approach to monitoring the quality of groundwater as outlined in this GQMP must be reviewed with the SEMP as described in Section 5.4 of the SEMP, namely:

- Every three years, based on the range of 1 to 5 years provided in *Environmental Management Plan Guidelines* (DCCEEW, 2024).
- If significant changes in Site use or environmental condition (i.e., a chemical release) occur.
- If significant changes to environmental legislation occur.

In addition, as part of reporting on the annual GME (**Section 6.8**), groundwater data should be considered and assessed to considered if a GQMP update is required if a new or significantly altered environmental risk in groundwater has been identified, if the groundwater CSM requires significant changes, or if other information has been uncovered which .

As part of this review, the condition and usage of the Site and surrounding land, and the CSM, should be considered and the risk profile and adopted criteria for groundwater reassessed and updated if required. Any changes in legislative or regulatory requirements or recommended practices should be incorporated into the GQMP for ongoing monitoring or management of groundwater.

If as part of future revisions, the GQMP is separated from the SEMP or the Site is sub-divided and separate GQMPs are developed for sub-areas, the information on roles and responsibilities, Site background, and any ongoing environmental management requirements relating to groundwater must be incorporated into the new or updated GQMP.

Ongoing monitoring should only cease if it can be demonstrated that:

- There is sufficient data to characterise the groundwater at the Site.
- Groundwater elevations and inferred flow are stable and unlikely to have meaningful change.
- Any contamination of groundwater remaining, including dissolved chemicals or NAPL in groundwater, is stable and not migrating, and does not represent any unacceptable risk to human health or ecological receptors on- or off-Site.
- No works or development of the Site or surrounding areas which may disturb groundwater or which represent an ongoing risk of groundwater contamination are occurring or anticipated.

Cessation of ongoing groundwater monitoring must only occur if the above has been documented and verified by an Environmental Auditor.

References

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

Appendix A

Figures

Appendix A Figures

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Figure F4 Potential Shallow Groundwater Interaction Area

Figure F5 Groundwater Monitoring Event – Scope of Work

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0 100 200 400
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LEGEND
Site Boundary

SITE LOCATION

Macquarie Point Development Corporation
Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure
F1

Map Document: (L:\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2024\01\Well_Maintenance_Targetted_GME\F1_A3P_Site_Location.mxd)

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REGATTA POINT

STATE GROWTH AREA

AUDIT AREA 4 EAST

THE ESCARPMENT (AUDIT AREA 4 WEST)

NORTHERN VEHICULAR ACCESS

THE ROYAL ENGINEERS BUILDING AND LAND

THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)

THE PRECINCT NORTH (LOT B)

THE GATEWAY

THE GOODS SHED AND YARD (AUDIT AREA 1)

GOODS SHED

THE PRECINCT SOUTH

RED SHED

SEAROAD SHED SLAB

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N

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0 25 50 100

metres

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Legend

- Regatta Point Boundary
- Proposed Future Building Footprint
- Proposed Basement Carpark
- Assessment Area
- Site Boundary

Proposed Landuse

- Aboriginal Culturally Informed Zone
- Residential Development and Public Foreshore Zone
- Paved area and extension to the Aboriginal Culturally Informed Zone
- Multipurpose Stadium and Associated Concourse Zone
- Complementary Integrated Mixed Use Zone
- Royal Engineers Building and Land
- Antarctic Facilities Zone
- Transport Corridor
- Vegetated Area

SITE LAYOUT AND PROPOSED DEVELOPMENT PLAN

Macquarie Point Development Corporation

Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure F2

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\10\Audit_Area_4_East\F2_Proposed_Development_Plan_AA4_East.mxd)

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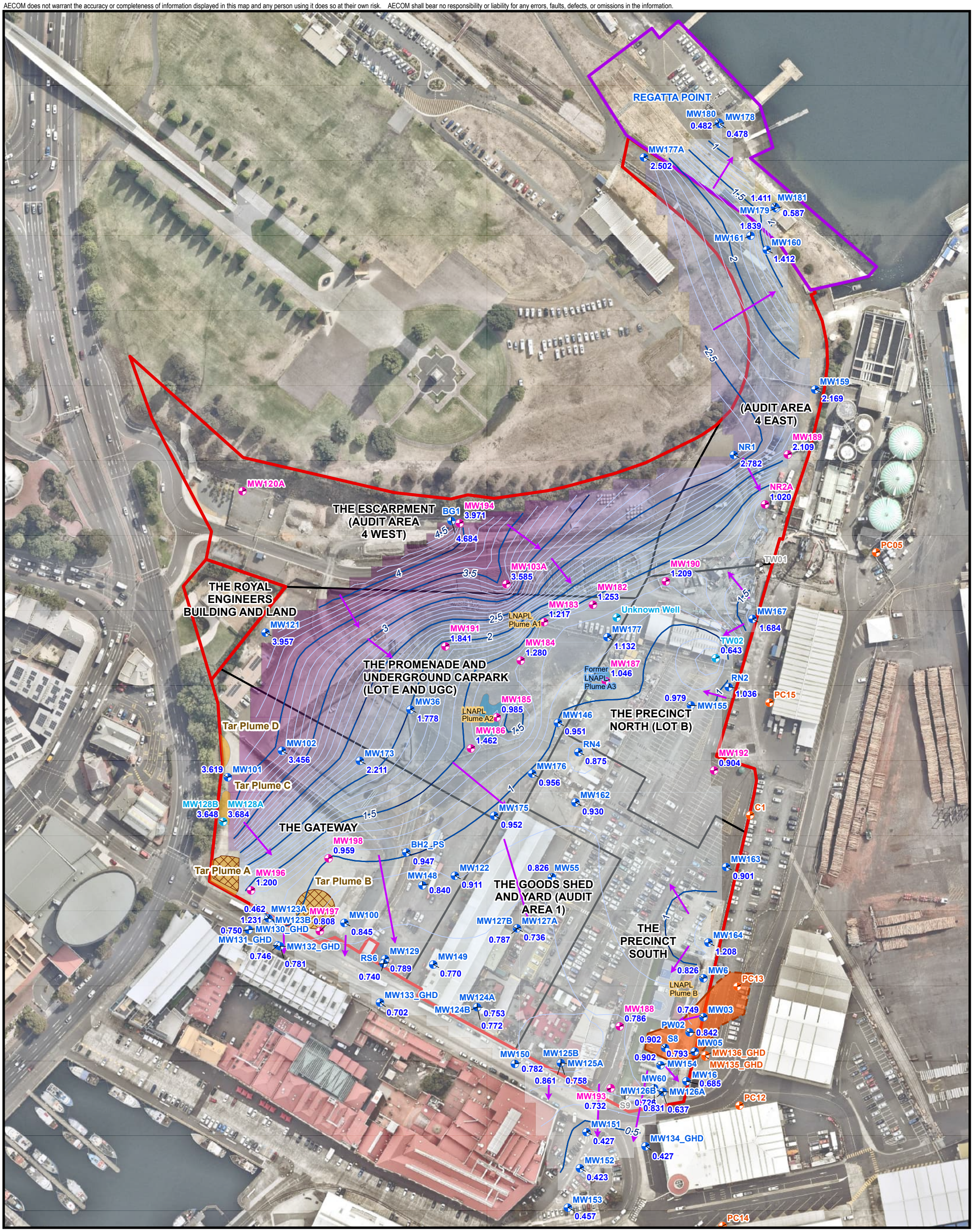

PROJECT ID 60321835 CREATED BY PK LAST MODIFIED PK 20 Jan 2026 AECOM www.aecom.com	Legend New Groundwater Well Existing Groundwater Well Lost/Destroyed Well Reinstated and Resurveyed Existing Well TasPorts Well ISS Treated Material Inferred Tar Extent Inferred Groundwater Contour (Major) Inferred Groundwater Contour (Minor) Inferred Extent of LNAPL Plume Historical Inferred Extent of LNAPL Plume Assessment Area Boundary Regatta Point Boundary Site Boundary Groundwater Contour Elevation (mAHD) 4.59782 0.423804	**INFERRED SHALLOW GROUNDWATER CONTOURS - SITE-WIDE - JUNE 2025**
N DATUM GDA 1994, PROJECTION MGA ZONE 55 0 25 50 100 metres 1:1,900 (when printed at A3)		**Macquarie Point Development Corporation** *Groundwater Quality Management Plan* Macquarie Point, Hobart, TAS **Figure** **F3**

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\07\Geotech\Soil_GW_SV_2025\Soil_GW_SV_2025.aprx)

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REGATTA POINT
MW180 0.482
MW178 0.478
MW177A 2.502
MW181 1.411
MW179 0.587
MW161 1.839
MW160 1.412
MW159 2.169
(AUDIT AREA 4 EAST)
MW189 2.109
NR1 2.782
NR3A 1.020
PC05
TW01
MW190 1.209
Final level - 1.7 mAHD
MW182 1.253
MW183 1.217
Unknown Well
MW167 1.684
MW177 1.132
TW02 0.643
RN2 1.036
PC15
0.979
MW155
THE PRECINCT NORTH (LOT B)
MW192 0.904
C1
MW163 0.901
MW164 1.208
THE PRECINCT SOUTH
0.826 MW6
PC13
LNAPL Plume B
MW188 0.786
0.749 MW03
PW02 0.842
0.902 S8 0.793
MW136_GHD
0.902 MW05 MW135_GHD
MW154 0.685
MW60 MW16
MW126B MW126A
PC12
MW193 0.732
S9 0.726 0.637
MW151 0.427
MW134_GHD 0.427
MW152 0.423
MW153 0.457
PC14
THE GOODS SHED AND YARD (AUDIT AREA 1)
MW127B 0.787
MW127A 0.736
0.826 MW55
MW122 0.911
MW148 0.840
MW198 0.959
BH2_PS 0.947
Tar Plume A
MW196 1.200
Tar Plume B
Final level - 3.3 mAHD
0.462 MW123A
MW197
1.231 MW123B 0.808
MW100 0.845
0.750 MW130_GHD
MW131_GHD
MW132_GHD 0.746 0.781
MW129 0.789
RS6 0.740
MW149 0.770
MW133_GHD 0.702
MW124A
MW124B 0.753 0.772
MW150 0.782
MW125B
MW125A 0.861 0.758
THE GATEWAY
MW128B 3.648
MW128A 3.684
MW120A
MW102 3.456
MW101 3.619
Tar Plume C
Tar Plume D
THE ROYAL ENGINEERS BUILDING AND LAND
MW121 3.957
THE ESCARPMENT (AUDIT AREA 4 WEST)
BG1 4.684
MW194 3.971
MW103A 3.585
Final level - 4.8 mAHD
MW191 1.841
MW184 1.280
MW173 2.211
THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)
MW36 1.778
MW185 0.985
LNAPL Plume A2
MW186 1.462
Final level - 3.0 mAHD
Former LNAPL Plume A3
MW187 1.046
MW146 0.951
RN4 0.875
MW176 0.956
MW162 0.930
MW175 0.952
1 2 2.5 3 3.5 4 4.5 1.5

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DATUM GDA 1994, PROJECTION MGA ZONE 55
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Legend
- New Groundwater Well
- Existing Groundwater Well
- Lost/Destroyed Well
- Reinstated and Resurveyed Existing Well
- TasPorts Well
- ISS Treated Material
- Inferred Tar Extent
- Groundwater Elevation Contours
- Inferred Extent of LNAPL Plume
- Historical Inferred Extent of LNAPL Plume
- Groundwater inferred to be ≤ 1 m below building slab following development
- Assessment Area Boundary
- Regatta Point Boundary
- Site Boundary

Final Surface Level
- Final level - 1.7 mAHD
- Final level - 2.9 mAHD
- Final level - 3.0 mAHD
- Final level - 3.3 mAHD
- Final level - 4.8 mAHD

POTENTIAL SHALLOW GROUNDWATER INTERACTION AREA

Macquarie Point Development Corporation

Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure F4

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REGATTA POINT
MW180 0.482
MW178 0.478
MW177A 2.502
MW181 0.587
MW179 1.411
MW161 1.839
MW160 1.412
MW159 2.169
(AUDIT AREA 4 EAST)
MW189 2.109
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TW01
MW190 1.209
MW167 1.684
TW02 0.643
RN2 1.036
PC15
MW155 0.979
THE PRECINCT NORTH (LOT B)
MW192 0.904
C1
MW163 0.901
MW164 1.208
MW6 0.826
PC13
MW03 0.749
PW02 0.842
MW05 0.902
S8 0.793
MW136_GHD
MW135_GHD
MW154 0.902
MW16 0.685
MW126A
PC12
MW151 0.427
MW134_GHD 0.427
MW152 0.423
MW153 0.457
PC14
THE PRECINCT SOUTH
LNAPL Plume B
MW188 0.786
MW187 1.046
Former LNAPL Plume A3
MW177 1.132
MW183 1.217
MW182 1.253
MW190 1.209
MW103A 3.585
THE ESCARPMENT (AUDIT AREA 4 WEST)
BG1
MW194 3.971
4.684
MW120A
THE ROYAL ENGINEERS BUILDING AND LAND
MW121 3.957
THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)
LNAPL Plume A1
MW191 1.841
MW184 1.280
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Tar Plume D
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MW173 2.211
3.619 MW101
Tar Plume C
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MW128A 3.684
THE GATEWAY
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BH2_PS 0.947
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MW196 1.200
Tar Plume B
MW148 0.840
MW122 0.911
0.826 MW55
THE GOODS SHED AND YARD (AUDIT AREA 1)
0.462 MW123A
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MW100 0.845
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MW131_GHD
MW132_GHD
0.746
0.781
RS6
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MW149 0.770
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MW133_GHD 0.702
MW124A
MW124B 0.753
0.772
MW127B 0.787
MW127A 0.736
MW150 0.782
MW125B
MW125A 0.758
0.861
MW193 0.732
MW126B
0.726
0.831
0.637
S9

Legend
- Gauge Only
- Sample (General Suite)
- Sample (General and PFAS Suites)
- Lost/Destroyed Well
- ISS Treated Material
- Inferred Tar Extent
- Inferred Groundwater Contour (Major)
- Inferred Groundwater Contour (Minor)
- Inferred Extent of LNAPL Plume
- Historical Inferred Extent of LNAPL Plume
- Assessment Area Boundary
- Regatta Point Boundary
- Site Boundary

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GROUNDWATER MONITORING EVENT SCOPE OF WORK

Macquarie Point Development Corporation

Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure
F5

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Appendix B

Tables

Appendix B Tables

List of Attached Tables

Table T1 Site Monitoring Well Network

Table T2 Groundwater Well Gauging and Sampling Scope

Table T1 - Groundwater Well Network

								Most Recent Gauging Data						
Area	Well ID	Easting (MGA94)	Northing (MGA94)	Top of Casing (m AHD)	Approximate Well Depth (m bgl)	Screened Interval (m bgl)	Screened Lithology	Date Gauged / Access Attempted	Depth to LNAPL (m bTOC)	Depth to Groundwater (m bTOC)	LNAPL Thickness (m)	SWL (m AHD)[2]	LNAPL-Corrected GW Elevation (mAHD)	Comments
1. The Goods Shed Yard	MW124A	527507.730	5252350.790	3.767	5.00	2.0-5.0	Fill	13-Jun-25	-	2.995	-	0.772	0.772	GC, NO, Over LEL
1. The Goods Shed Yard	MW124B	527507.670	5252350.790	3.738	11.30	9.4-11.4	Alluvial/ Marine Deposits	13-Jun-25	-	2.985	-	0.753	0.753	GC, NO
1. The Goods Shed Yard	MW127A	527529.640	5252393.950	3.896	4.70	1.8-4.8	Fill	13-Jun-25	-	3.109	-	0.787	0.787	GC, NO, Over LEL
1. The Goods Shed Yard	MW127B	527529.680	5252393.990	3.866	16.80	15.6-16.6	Slope Deposits	13-Jun-25	-	3.130	-	0.736	0.736	GC, Organic odour, 77% LEL
1. The Goods Shed Yard	MW149	527483.676	5252374.243	4.024	4.70	2.0-5.0	Fill	13-Jun-25	-	3.254	-	0.770	0.770	GC, NO
1. The Goods Shed Yard	MW55	527548.733	5252422.331	3.789	5.00	3.0-6.0	Fill	13-Jun-25	-	2.963	-	0.826	0.826	GC, NO, Over LEL
2. The Escarpment	BG1	527493.615	5252617.707	7.492	3.44	0.5-3.5	Fill / Dolerite	16-Jun-25	-	2.808	-	4.684	4.684	Data Logger
2. The Escarpment	MW103A	527523.755	5252582.928	6.299	5.00	2.0-5.0	Dolerite bedrock	16-Jun-25	-	2.714	-	3.585	3.585	GC, NO
2. The Escarpment	MW120A	527378.983	5252633.983	7.942	8.51	2.0-9.0	Dolerite bedrock	25-Jun-25	-	7.988	-	-0.046	-0.046	GC, NO, well dry for two weeks following installation (5 June), very slowly recharging
2. The Escarpment	MW194	527498.158	5252616.538	7.465	5.96	1.5-6.0	Dolerite bedrock	16-Jun-25	-	3.494	-	3.971	3.971	GC, NO
3. Audit Area 4 East	MW159	527693.238	5252689.962	5.757	7.58	3.5-8.0	Bedrock	16-Jun-25	-	3.588	-	2.169	2.169	GC, NO
3. Audit Area 4 East	MW160	527666.699	5252766.390	7.306	9.48	3.5-8.0	Bedrock	16-Jun-25	-	5.894	-	1.412	1.412	GC, NO
3. Audit Area 4 East	MW161	527657.800	5252774.319	7.634	6.45	3.5-6.5	Bedrock	16-Jun-25	-	5.795	-	1.839	1.839	GC, NO
3. Audit Area 4 East	MW177A	527598.808	5252815.946	9.497	7.15	4.3-7.3	Bedrock	16-Jun-25	-	6.995	-	2.502	2.502	GC, NO
3. Audit Area 4 East	MW189	527678.261	5252654.104	5.233	6.55	2.7-6.5	Bedrock	16-Jun-25	-	3.124	-	2.109	2.109	GC, NO
3. Audit Area 4 East	NR1	527648.559	5252654.045	8.295	8.00	3.5-8.0	Bedrock	16-Jun-25	-	5.513	-	2.782	2.782	GC, NO, 6% LEL
3. Audit Area 4 East	NR2A	527665.785	5252626.689	5.073	5.92	1.5-6.0	Fill / Sand	16-Jun-25	-	4.053	-	1.020	1.020	GC, NO
4. The Promenade and Underground Carpark	MW121	527391.610	5252556.420	6.957	5.00	2.0-5.0	Weathered Dolerite	13-Jun-25	-	3.000	-	3.957	3.957	No gatic lid, dirt in gatic, NO
4. The Promenade and Underground Carpark	MW146	527552.111	5252507.052	4.186	5.49	2.5-5.5	Fill	16-Jun-25	-	3.235	-	0.951	0.951	GC, 24% LEL
4. The Promenade and Underground Carpark	MW175	527517.100	5252456.440	3.904	4.00	1.5-4.5	Fill	13-Jun-25	-	2.952	-	0.952	0.952	GC, NO, 100mm PVC
4. The Promenade and Underground Carpark	MW176	527537.900	5252479.310	4.036	4.58	1.5-4.5	Fill	16-Jun-25	-	3.080	-	0.956	0.956	GC, NO, NS
4. The Promenade and Underground Carpark	MW177	527579.184	5252554.472	4.529	4.50	1.5-4.5	Fill	16-Jun-25	-	3.397	-	1.132	1.132	100mm well casing
4. The Promenade and Underground Carpark	MW182	527571.272	5252571.919	4.858	5.62	2.0-6.0	Fill	16-Jun-25	-	3.605	-	1.253	1.253	GC, NO
4. The Promenade and Underground Carpark	MW183	527544.466	5252562.171	5.052	5.82	1.5-6.0	Fill	16-Jun-25	-	3.835	-	1.217	1.217	GC, 53% LEL
4. The Promenade and Underground Carpark	MW184	527531.675	5252541.194	4.864	5.85	1.5-6.0	Fill	16-Jun-25	-	3.584	-	1.280	1.280	GC, NO, NS
4. The Promenade and Underground Carpark	MW185	527518.554	5252510.048	4.638	5.80	2.0-6.0	Fill	16-Jun-25	-	3.653	-	0.985	0.985	GC, HC sheen, Over LEL
4. The Promenade and Underground Carpark	MW186	527504.381	5252492.922	4.832	5.91	2.0-6.0	Fill	16-Jun-25	-	3.370	-	1.462	1.462	GC, HC odour, NS, 18% LEL
4. The Promenade and Underground Carpark	MW191	527490.356	5252549.038	5.659	4.58	1.5-6.0	Dolerite (weathered to fresh)	13-Jun-25	-	3.818	-	1.841	1.841	GC, NO, 8% LEL
4. The Promenade and Underground Carpark	MW36	527525.300	5252509.000	5.647	6.57	4.0-7.0	Fill/Bedrock	16-Jun-25	-	3.869	-	1.778	1.778	Gatic Missing
5. The Precinct North	MW155	527625.037	5252516.399	3.929	4.51	1.5-4.5	Fill	16-Jun-25	-	2.950	-	0.979	0.979	GC, NO, NS, 44% LEL
5. The Precinct North	MW167	527658.873	5252563.922	4.164	4.83	2.0-5.0	Fill	16-Jun-25	-	2.480	-	1.684	1.684	GC, NO
5. The Precinct North	MW187	527578.434	5252529.858	4.258	9.35	2.0-6.5	Fill	16-Jun-25	-	3.212	-	1.046	1.046	GC, NO, HC Sheen
5. The Precinct North	MW190	527611.266	5252584.652	4.703	4.93	1.5-5.0	Fill	16-Jun-25	-	3.494	-	1.209	1.209	GC, NO
5. The Precinct North	MW192	527637.744	5252480.774	3.601	5.89	1.5-6.0	Fill	16-Jun-25	-	2.697	-	0.904	0.904	GC, NO, NS
5. The Precinct North	RN2	527645.786	5252526.638	4.182	5.36	1.0-5.0	Fill	16-Jun-25	-	3.146	-	1.036	1.036	GC, NO, NS, Over LEL
5. The Precinct North	TW02	527638.679	5252542.362	4.086	5.76	2.4-5.5	Fill	16-Jun-25	-	3.443	-	0.643	0.643	NO, New TOC, screen measures at 2.88 to 5.76 mBTOC
6. The Precinct South	MW03	527629.967	5252344.531	2.596	8.63	2-7.5	Fill	16-Jun-25	1.830	1.900	0.070	0.696	0.749	Over LEL, Brown NAPL on probe, HC odour
6. The Precinct South	MW05	527625.558	5252326.180	2.663	4.33	1.4-4.4	Fill	16-Jun-25	-	1.870	-	0.793	0.793	HC odour, GC
6. The Precinct South	MW125A	527553.730	5252320.260	3.306	5.99	2.0-5.0	Fill	16-Jun-25	-	2.445	-	0.861	0.861	GC, NO
6. The Precinct South	MW125B	527553.730	5252320.260	3.309	15.28	13.8-15.3	Marine Deposits	16-Jun-25	-	2.551	-	0.758	0.758	GC, NO
6. The Precinct South	MW126A	527609.600	5252304.450	2.857	5.13	2.1-5.1	Fill	16-Jun-25	-	2.131	-	0.726	0.726	GC, NO
6. The Precinct South	MW126B	527609.600	5252304.450	2.831	18.88	15.9.0-18.9	Slope Deposits	16-Jun-25	-	2.194	-	0.637	0.637	GC, NO
6. The Precinct South	MW154	527608.419	5252318.975	2.827	3.80	1.0-4.0	Fill	16-Jun-25	-	1.925	-	0.902	0.902	H2O above TOC, 45% LEL
6. The Precinct South	MW16	527622.576	5252310.246	2.630	4.91	3.0-6.0	Fill	16-Jun-25	-	1.945	-	0.685	0.685	85% LEL
6. The Precinct South	MW162	527561.725	5252463.136	4.079	4.73	2.0-5.0	Fill	16-Jun-25	-	3.149	-	0.930	0.930	GC, 6% LEL
6. The Precinct South	MW163	527644.415	5252427.853	2.837	3.82	0.95-3.95	Fill	16-Jun-25	-	1.936	-	0.901	0.901	H2O above TOC, Over LEL
6. The Precinct South	MW164	527634.673	5252386.218	2.685	3.86	0.5-4.0	Fill	16-Jun-25	-	1.477	-	1.208	1.208	GC, NO, NS, 28% LEL
6. The Precinct South	MW188	527586.042	5252340.345	3.080	4.95	1.0-5.0	Fill	16-Jun-25	-	2.294	-	0.786	0.786	GC, NO, Over LEL
6. The Precinct South	MW193	527581.087	5252306.338	2.924	5.48	1.0-5.0	Fill	16-Jun-25	-	2.192	-	0.732	0.732	GC, NO, Over LEL
6. The Precinct South	MW6	527631.882	5252366.709	2.896	4.89	2.0-5.0	Fill	16-Jun-25	-	2.070	-	0.826	0.826	Over LEL, Level logger
6. The Precinct South	MW60	527604.842	5252306.320	2.864	6.00	3.0-6.0	Fill	16-Jun-25	-	2.033	-	0.831	0.831	GC, NO
6. The Precinct South	PW02	527624.264	5252337.008	2.723	6.00	1.5-6.0	Fill	16-Jun-25	1.871	1.913	0.042	0.810	0.842	15% LEL, Brown NAPL on probe, HC odour
6. The Precinct South	RN4	527563.308	5252490.930	4.045	5.17	1.5-6.0	Fill/Marine Deposits	16-Jun-25	-	3.170	-	0.875	0.875	GC, NO, NS, 32% LEL
6. The Precinct South	S8	527610.904	5252328.497	2.830	5.20	1.2-5.2	Fill	16-Jun-25	1.909	1.990	0.810	0.840	0.902	Over LEL. Brown NAPL on probe, HC odour
6. The Precinct South	S9	527588.943	5252302.383	2.910	4.00	1.0-4.0	Fill	16-Jun-25	-	-	-	-	-	Lost under garden bed
7. The Gateway	BH2_PS	527483.786	5252435.896	5.286	7.03	Unknown	Fill/Marine Deposits	16-Jun-25	-	4.339	-	0.947	0.947	GC, NO
7. The Gateway	MW100	527434.926	5252397.121	4.006	11.50	3.0-9.0	Fill	13-Jun-25	-	3.161	-	0.845	0.845	GC, NO
7. The Gateway	MW101	527370.927	5252477.012	5.317	3.60	1.6-4.6	Fill	13-Jun-25	-	1.698	-	3.619	3.619	GC, NO
7. The Gateway	MW102	527400.582	5252491.493	5.778	4.49	1.6-4.6	Fill/Weathered Dolerite/Slope Deposits	13-Jun-25	-	2.322	-	3.456	3.456	No gatic lid, dirt in gatic, NO
7. The Gateway	MW122	527495.560	5252422.980	3.933	4.00	2.0-4.0	Fill	13-Jun-25	-	3.022	-	0.911	0.911	GC, NO
7. The Gateway	MW128A	527368.319	5252452.571	5.207	2.98	1.8-4.8	Slope Deposits/Bedrock	13-Jun-25	-	1.523	-	3.684	3.684	GC, NO
7. The Gateway	MW128B	527368.350	5252452.570	5.229	3.50	10.0-13.0	Bedrock	13-Jun-25	-	1.581	-	3.648	3.648	GC, NO
7. The Gateway	MW129	527457.190	5252377.340	3.800	16.00	14.0-16.0	Slope Deposits	13-Jun-25	-	3.060	-	0.740	0.740	GC, NO
7. The Gateway	MW148	527477.706	5252417.844	3.786	4.90	2.0-5.0	Fill	13-Jun-25	-	2.946	-	0.840	0.840	GC, NO
7. The Gateway	MW173	527443.426	5252486.041	5.928	4.92	2.0-5.0	Fill/Marine Deposits	16-Jun-25	-	3.717	-	2.211	2.211	GC
7. The Gateway	MW196	527383.693	5252415.008	3.299	6.03	1.5-6.0	Fill	25-Jun-25	-	2.099	-	1.200	1.200	
7. The Gateway	MW197	527421.438	5252392.726	3.290	5.90	3.7-6	Marine Deposits	25-Jun-25	-	2.482	-	0.808	0.808	
7. The Gateway	MW198	527426.182	5252432.536	3.201	5.21	2.0-6.0	Fill	16-Jun-25	-	2.242	-	0.959	0.959	GC, NO
7. The Gateway	RS6	527456.344	5252374.791	3.792	5.50	1.5-6.0	Fill	13-Jun-25	-	3.003	-	0.789	0.789	GC, NO
8. Regatta Point	MW178	527640.962	5252835.628	1.282	4.85	2.7-5.0	Bedrock	16-Jun-25	-	0.804	-	0.478	0.478	GC, NO
8. Regatta Point	MW179	527671.789	5252789.467	2.273	5.39	1.5-5.5	Bedrock	16-Jun-25	-	1.686	-	0.587	0.587	GC, NO
8. Regatta Point	MW180	527640.331	5252836.358	1.243	1.89	0.7-2.2	Fill	16-Jun-25	-	0.761	-	0.482	0.482	GC, NO
8. Regatta Point	MW181	527671.149	5252790.232	2.261	0.85	0.4-0.95	Fill	16-Jun-25	-	-	-	-	-	GC, NO, dry
9. Offsite	C1	527657.503	5252456.170	3.142	4.50	1.0-4.5	Fill	27-Feb-25	-	2.281		0.861	0.861	
9. Offsite	MW123A	527393.270	5252399.740	3.223	3.65	1.8-3.8	Fill	13-Jun-25	-	1.992	-	1.231	1.231	GC, NO, 2 x bolts missing
9. Offsite	MW123B	527393.230	5252399.730	3.278	17.45	14.6-17.6	Fill	13-Jun-25	-	2.816	-	0.462	0.462	GC, NO, 2 x bolts missing
9. Offsite	MW130_GHD	527382.450	5252393.370	2.728	4.71	2.0-5.0	Marine Deposits	12-Jun-25	-	1.978	-	0.750	0.750	Grass in gatic, new gatic lid installed
9. Offsite	MW131_GHD	527398.420	5252384.860	2.611	9.66	6.7-9.7	Marine Deposits	12-Jun-25	-	1.865	-	0.746	0.746	GC, NO, Datalogger
9. Offsite	MW132_GHD	527399.600	5252384.260	2.631	3.89	2.5-4.5	Fill/Marine Deposits	12-Jun-25	-	1.850	-	0.781	0.781	GC, NO, 2 x bolts missing
9. Offsite	MW133_GHD	527454.400	5252353.360	3.127	4.45	2.0-3.0	Fill	12-Jun-25	-	2.425	-	0.702	0.702	GC, NO, Datalogger
9. Offsite	MW134_GHD	527600.190	5252274.580	3.057	5.99	4.0-7.0	Fill	16-Jun-25	-	2.630	-	0.427	0.427	LEL Over
9. Offsite	MW135_GHD	527632.940	5252353.790	2.597	5.00	2.0-5.0	Fill	27-Feb-25	-	1.939	-	0.658	0.658	Access not granted to gauge
9. Offsite	MW136_GHD	527633.060	5252324.500	2.549	13.50	10.2-13.50	Fill	4-Feb-16	-	2.050	-	0.499	0.499	
9. Offsite	MW150	527528.454	5252319.791	3.265	4.39	1.0-5.0	Fill / Marine Deposits	13-Jun-25	-	2.483	-	0.782	0.782	GC, NO, H2O in gatic above TOC, 2 x bolts missing
9. Offsite	MW151	527567.708	5252282.430	2.553	4.87	1.0-5.5	Fill / Marine Deposits	12-Jun-25	-	2.126	-	0.427	0.427	GC, NO
9. Offsite	MW152	527564.181	5252262.443	2.563	4.98	1.0-5.5	Fill/Marine Deposits	12-Jun-25	-	2.140	-	0.423	0.423	GC, NO, 1% LEL
9. Offsite	MW153	527557.540	5252240.934	2.449	4.42	1.0-4.6	Fill/Marine Deposits	12-Jun-25	-	1.992	-	0.457	0.457	GC, NO
9. Offsite	PC05	527726.727	5252600.326	Unknown	3.28	No data	Fill	27-Feb-25	ND	2.313	-	-	-	Good condition, no sheen, no odour, orange organic material on probe
9. Offsite	PC08	527746.787	5252222.601	Unknown	2.10	No data	Fill	-	-	-	-	-	-	No access attempted by field staff.
9. Offsite	PC10	527817.921	5252666.445	Unknown	4.42	No data	Fill	27-Feb-25	-	-	-	-	-	Bolts sheared unable to open - need driller
9. Offsite	PC11	527779.795	5252522.473	Unknown	4.56	No data	Fill	27-Feb-25	-	-	-	-	-	Bolts sheared unable to open - need driller
9. Offsite	PC12	527651.691	5252296.989	Unknown	4.98	No data	Fill	27-Feb-25	ND	2.525	-	-	-	LEL 17, organic material on probe, good condition
9. Offsite	PC13	527650.528	5252362.247	2.636	4.33	No data	Fill	27-Feb-25	1.3	1.310	0.01	1.326	1.334	Good condition, 1 cm of LNAPL
9. Offsite	PC14	527642.432	5252230.789	Unknown	2.20	No data	Fill	-	-	-	-	-	-	No access attempted by field staff. A mark which may be this well is visible on aerial photographs.
9. Offsite	PC15	527668.146	5252518.054	3.489	4.38	No data	Fill	27-Feb-25	-	-	-	-	-	Under large shipping container unable to locate

Notes:

m bgl - metres below ground level
TOC - top of casing
AHD - Australian Height Datum
SWL - Standing Water Level
GC - Good condition
NO - No odour
HC - Hydrocarbon
LEL - Lower explosive limit
H20 - Water
NS - no sheen
NAPL - non-aqueous phase liquid

[1] *The Easting and Northing coordinates presented are the MGA94 Coordinates*
[2] *SWL values in wells containing LNAPL have been corrected for the depression of the LNAPL/water interface in the well by multiplying the apparent LNAPL thickness in the well an LNAPL specific gravity of 0.76*

Table T2 - GME Scope

AECOM

Area	Well ID	Easting (MGA94)	Northing (MGA94)	Top of Casing (m AHD)	Approximate Well Depth (m bgl)	Screened Interval (m bgl)	Screened Lithology	GME Activities			Purpose and Area	Potential LNAPL Well?
								Gauge?	Sample			
									General Suite	PFAS Suite		
1. The Goods Shed Yard	MW124A	527507.730	5252350.790	3.767	5.00	2.0-5.0	Fill	Yes			Groundwater on southern boundary of the Site.	
1. The Goods Shed Yard	MW124B	527507.670	5252350.790	3.738	11.30	9.4-11.4	Alluvial/ Marine Deposits	Yes			Deep (>10 m bgl) groundwater on southern boundary of the Site. Aquifer is interconnected. Shallow well MW123A used for assessment of groundwater in this area	
1. The Goods Shed Yard	MW127A	527529.640	5252393.950	3.896	4.70	1.8-4.8	Fill	Yes	Yes		Groundwater adjacent to the Goods Shed and downgradient of fuel storage and the former Goods Shed Annexe mechanics workshop	
1. The Goods Shed Yard	MW127B	527529.680	5252393.990	3.866	16.80	15.6-16.6	Slope Deposits	Yes			Deep (>10 m bgl) groundwater adjacent to the Goods Shed and downgradient of fuel storage and the former Goods Shed Annexe mechanics workshop Aquifer is interconnected. Shallow well MW127A used for assessment of groundwater in this area	
1. The Goods Shed Yard	MW149	527483.676	5252374.243	4.024	4.70	2.0-5.0	Fill	Yes			Located in the southern portion of the Site on the western site of the Goods Shed. Well installed to assess groundwater quality down-inferred hydraulic gradient of the Sewer (Main Hobart Pipeline) and former UST locations.	
1. The Goods Shed Yard	MW55	527548.733	5252422.331	3.789	5.00	3.0-6.0	Fill	Yes	Yes		Located in the southern portion of the Site on the western site of the Goods Shed. Well installed to assess groundwater quality down-inferred hydraulic gradient of the Sewer (Main Hobart Pipeline) and the Goods Shed Annexe (former mechanics workshop	
2. The Escarpment	BG1	527493.615	5252617.707	7.492	3.44	0.5-3.5	Fill / Dolerite	Yes	Yes	Yes	Located on northern boundary, upgradient of Site land. Installed to assess groundwater entering the Site. Screened across fill and dolerite	
2. The Escarpment	MW103A	527523.755	5252582.928	6.299	5.00	2.0-5.0	Dolerite bedrock	Yes			Located in the central eastern portion of the Site, up-gradient of LNAPL plumes A1, A2 and former LNAPL Plume A3 and down-gradient of previous soil impacts in the Escarpment, to assess shallow groundwater quality.	
2. The Escarpment	MW120A	527378.983	5252633.983	7.942	8.51	2.0-9.0	Dolerite bedrock	Yes	Yes	Yes	Replacement well for MW120 to assess groundwater entering the north-west corner of the Site.	
2. The Escarpment	MW194	527498.158	5252616.538	7.465	5.96	1.5-6.0	Dolerite bedrock	Yes	Yes	Yes	New well adjacent to BG1 to assess groundwater in dolerite entering the Site.	
3. Audit Area 4 East	MW159	527693.238	5252689.962	5.757	7.58	3.5-8.0	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the vicinity of the WWTP	
3. Audit Area 4 East	MW160	527666.699	5252766.390	7.306	9.48	3.5-8.0	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the upgradient of Regatta Point	
3. Audit Area 4 East	MW161	527657.800	5252774.319	7.634	6.45	3.5-6.5	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the upgradient of Regatta Point	
3. Audit Area 4 East	MW177A	527598.808	5252815.946	9.497	7.15	4.3-7.3	Bedrock	Yes	Yes		Located at the northern portion of the Site. Assess groundwater entering Regatta Point	
3. Audit Area 4 East	MW189	527678.261	5252654.104	5.233	6.55	2.7-6.5	Bedrock	Yes			New well on the eastern boundary of the Site to replace NR4 and assess groundwater entering the Site from the WWTP	
3. Audit Area 4 East	NR1	527648.559	5252654.045	8.295	8.00	3.5-8.0	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the vicinity of the former Northern Refuelling Area.	
3. Audit Area 4 East	NR2A	527665.785	5252626.689	5.073	5.92	1.5-6.0	Fill / Sand	Yes	Yes		Located in the eastern boundary of the Site. Assess shallow groundwater quality at the Site boundary adjacent to WWTP and the former Oil and Diesel Pipelines. Replacement for TW01 and NR2	
4. The Promenade and Underground Carpark	MW121	527391.610	5252556.420	6.957	5.00	2.0-5.0	Weathered Dolerite	Yes	Yes	Yes	Located on the western boundary of the Site. Assess shallow groundwater entering the Site.	
4. The Promenade and Underground Carpark	MW146	527552.111	5252507.052	4.186	5.49	2.5-5.5	Fill	Yes			Located in the central portion of the Site. Delineate and assess groundwater quality down-gradient of LNAPL Plumes A1 and A2.	
4. The Promenade and Underground Carpark	MW175	527517.100	5252456.440	3.904	4.00	1.5-4.5	Fill	Yes			Central portion of the Site, downgradient of bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3, and in vicinity of Hobart Sewer.	
4. The Promenade and Underground Carpark	MW176	527537.900	5252479.310	4.036	4.58	1.5-4.5	Fill	Yes			Central portion of the Site, downgradient of bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3, and in vicinity of Hobart Sewer.	
4. The Promenade and Underground Carpark	MW177	527579.184	5252554.472	4.529	4.50	1.5-4.5	Fill	Yes			Central portion of the Site, cross- to downgradient of bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3, and in vicinity of Hobart Sewer.	
4. The Promenade and Underground Carpark	MW182	527571.272	5252571.919	4.858	5.62	2.0-6.0	Fill	Yes	Yes		Groundwater well to delineate LNAPL Plume A1 to the north-east	
4. The Promenade and Underground Carpark	MW183	527544.466	5252562.171	5.052	5.82	1.5-6.0	Fill	Yes	Yes[1]		Groundwater well to intersect LNAPL Plume A1	Yes
4. The Promenade and Underground Carpark	MW184	527531.675	5252541.194	4.864	5.85	1.5-6.0	Fill	Yes	Yes		Groundwater well to delineate LNAPL Plume A1 to the south-west and LNAPL Plume A2 to the north-east	
4. The Promenade and Underground Carpark	MW185	527518.554	5252510.048	4.638	5.80	2.0-6.0	Fill	Yes	Yes[1]		Groundwater well to intersect LNAPL Plume A2	Yes
4. The Promenade and Underground Carpark	MW186	527504.381	5252492.922	4.832	5.91	2.0-6.0	Fill	Yes	Yes		Groundwater well to delineate LNAPL Plume A2 to the south	
4. The Promenade and Underground Carpark	MW191	527490.356	5252549.038	5.659	4.58	1.5-6.0	Dolerite (weathered to fresh)	Yes	Yes		Groundwater well to delineate LNAPL Plume A1 and A2 to the west.	
4. The Promenade and Underground Carpark	MW36	527525.300	5252509.000	5.647	6.57	4.0-7.0	Fill/Bedrock	Yes	Yes		Located in the central portion of the Site. Delineate and assess groundwater quality cross- and up-gradient of LNAPL Plume A2.	
5. The Precinct North	MW155	527625.037	5252516.399	3.929	4.51	1.5-4.5	Fill	Yes	Yes		Located in the central eastern portion of the Site. Assess shallow groundwater quality at the boundary of the Site in the vicinity of the former oil pipeline.	
5. The Precinct North	MW167	527658.873	5252563.922	4.164	4.83	2.0-5.0	Fill	Yes	Yes		Located on the central eastern Site boundary to assess groundwater quality and potential vapour risks associated with previously identified TRH impacts in soil at BH126/MW156 near the water table.	
5. The Precinct North	MW187	527578.434	5252529.858	4.258	9.35	2.0-6.5	Fill	Yes	Yes[1]		Groundwater well to intersect former LNAPL Plume A3 (if present)	Yes
5. The Precinct North	MW190	527611.266	5252584.652	4.703	4.93	1.5-5.0	Fill	Yes	Yes		Groundwater well to assess general groundwater condition in the north-east portion of the Site	
5. The Precinct North	MW192	527637.744	5252480.774	3.601	5.89	1.5-6.0	Fill	Yes	Yes		Groundwater well on the eastern boundary to replace TW03 and assess groundwater entering the Site from the WWTP / TasPorts	
5. The Precinct North	RN2	527645.786	5252526.638	4.182	5.36	1.0-5.0	Fill	Yes	Yes		Located on the eastern boundary of the Site. Assess shallow groundwater quality at the boundary of the Site in the vicinity of the former oil pipeline.	
5. The Precinct North	TW02	527638.679	5252542.362	4.086	5.76	2.4-5.5	Fill	Yes	Yes		Located on the eastern boundary of the Site. Assess shallow groundwater quality at the boundary of the Site in the vicinity of the former oil pipeline.	
6. The Precinct South	MW03	527629.967	5252344.531	2.596	8.63	2-7.5	Fill	Yes			Located on the eastern boundary of the Precinct South to assess shallow groundwater quality. LNAPL previously detected in this well	Yes
6. The Precinct South	MW05	527625.558	5252326.180	2.663	4.33	1.4-4.4	Fill	Yes			Located on the eastern boundary of the Precinct South to assess shallow groundwater quality. LNAPL previously detected in this well	Yes
6. The Precinct South	MW125A	527553.730	5252320.260	3.306	5.99	2.0-5.0	Fill	Yes	Yes		Southern boundary of the Precinct South. South western boundary of the Red Shed. Assess shallow (<10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B.	
6. The Precinct South	MW125B	527553.730	5252320.260	3.309	15.28	13.8-15.3	Marine Deposits	Yes			Southern boundary of the Precinct South. South western boundary of the Red Shed. Assess deep (>10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B. Aquifer is interconnected. Shallow well MW125A used for assessment of groundwater in this area	
6. The Precinct South	MW126A	527609.600	5252304.450	2.857	5.13	2.1-5.1	Fill	Yes	Yes	Yes	South east boundary of the Precinct South. Assess shallow <>10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B.	
6. The Precinct South	MW126B	527609.600	5252304.450	2.831	18.88	15.9.0-18.9	Slope Deposits	Yes			South east boundary of the Precinct South. Assess deep (>10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B. Aquifer is interconnected. Shallow well MW126A used for assessment of groundwater in this area	
6. The Precinct South	MW154	527608.419	5252318.975	2.827	3.80	1.0-4.0	Fill	Yes	Yes[1]	Yes[1]	Located in the south eastern portion of the Precinct South. To further delineate LNAPL plume B and/or assess ground water quality impacts.	Yes
6. The Precinct South	MW16	527622.576	5252310.246	2.630	4.91	3.0-6.0	Fill	Yes	Yes	Yes	Located on the eastern boundary of the Precinct South to assess shallow groundwater quality and flow conditions, in proximity to the sea walls and former bulk fuel storage areas.	
6. The Precinct South	MW162	527561.725	5252463.136	4.079	4.73	2.0-5.0	Fill	Yes			Located in the Precinct South down-hydraulic gradient of the former Goods Shed Annexe area (former mechanics area).	
6. The Precinct South	MW163	527644.415	5252427.853	2.837	3.82	0.95-3.95	Fill	Yes			Eastern boundary of the Site to assess groundwater flow and quality at Site boundary	
6. The Precinct South	MW164	527634.673	5252386.218	2.685	3.86	0.5-4.0	Fill	Yes	Yes		Eastern boundary of the Site to assess groundwater flow and quality at Site boundary	
6. The Precinct South	MW188	527586.042	5252340.345	3.080	4.95	1.0-5.0	Fill	Yes	Yes	Yes	Groundwater well to delineate LNAPL Plume B to the west	
6. The Precinct South	MW193	527581.087	5252306.338	2.924	5.48	1.0-5.0	Fill	Yes	Yes	Yes	Groundwater well to delineate LNAPL Plume B to the west	
6. The Precinct South	MW6	527631.882	5252366.709	2.896	4.89	2.0-5.0	Fill	Yes	Yes	Yes	Located on the eastern boundary of the Precinct South. Assess shallow groundwater quality and flow conditions at the Site boundary and in proximity to the sea walls and former bulk fuel storage.	
6. The Precinct South	MW60	527604.842	5252306.320	2.864	6.00	3.0-6.0	Fill	Yes	Yes	Yes	Located in the south eastern portion of the Precinct South. Assess shallow groundwater quality and gain further insight into LNAPL impacts at the southern Site boundary.	
6. The Precinct South	PW02	527624.264	5252337.008	2.723	6.00	1.5-6.0	Fill	Yes			Located on the eastern boundary of the Precinct South. Assess shallow groundwater quality and flow conditions at the Site boundary and in proximity to the sea walls. Gain insight into LNAPL impacts at the Site boundary	Yes
6. The Precinct South	RN4	527563.308	5252490.930	4.045	5.17	1.5-6.0	Fill/Marine Deposits	Yes	Yes		Central portion of the Site, upgradient of Goods Shed Annexe and downgradient of former bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3.	
6. The Precinct South	S8	527610.904	5252328.497	2.830	5.20	1.2-5.2	Fill	Yes			Located in the eastern portion of the Precinct South within SeaRoad Shed Slab. Assessing shallow groundwater quality and assess LNAPL.	Yes
6. The Precinct South	S9	527588.943	5252302.383	2.910	4.00	1.0-4.0	Fill	Yes			Located on the south-eastern boundary of the Site. Assessing shallow groundwater quality downgradient of LNAPL Plume B.	
7. The Gateway	BH2_PS	527483.786	5252435.896	5.286	7.03	Unknown	Fill/Marine Deposits	Yes	Yes		Located in the south-western portion of the Site, cross-gradient to LNAPL Plume A2 and former gasworks areas.	
7. The Gateway	MW100	527434.926	5252397.121	4.006	11.50	3.0-9.0	Fill	Yes			Located in the southern portion of the Site, down-gradient of gasworks area and cross-gradient to DNAPL Plume B	
7. The Gateway	MW101	527370.927	5252477.012	5.317	3.60	1.6-4.6	Fill	Yes	Yes		Located on the south-western boundary of the Site, between DNAPL Plumes C and D. Assess groundwater entering the Site.	
7. The Gateway	MW102	527400.582	5252491.493	5.778	4.49	1.6-4.6	Fill/Weathered Dolerite/Slope Deposits	Yes	Yes		In the central western portion of the Site. Assess groundwater in the vicinity of the former Roundhouse and cross-gradient of gasworks.	
7. The Gateway	MW122	527495.560	5252422.980	3.933	4.00	2.0-4.0	Fill	Yes	Yes		Located in the central southern portion of the Site. Provides indication of potential impact from sewer infrastructure and LNAPL Plume A2 (i.e. located down/cross inferred hydraulic gradient).	
7. The Gateway	MW128A	527368.319	5252452.571	5.207	2.98	1.8-4.8	Slope Deposits/Bedrock	Yes	Yes		Located on the western boundary of the Site. Assess shallow groundwater entering the Site in the former gasworks area.	
7. The Gateway	MW128B	527368.350	5252452.570	5.229	3.50	10.0-13.0	Bedrock	Yes			Located on the western boundary of the Site. Assess deep (>10 m bgl) groundwater entering the Site in the former gasworks area. Aquifer is interconnected. Shallow well MW128A used for assessment of groundwater in this area	
7. The Gateway	MW129	527457.190	5252377.340	3.800	16.00	14.0-16.0	Slope Deposits	Yes			Located adjacent to the central southern boundary of the Site. Assess deep groundwater quality at the Site boundary in proximity to sewer infrastructure and former UST location.	
7. The Gateway	MW148	527477.706	5252417.844	3.786	4.90	2.0-5.0	Fill	Yes	Yes		Located in the south-west portion the Site, to assess potential impact sourced from former UST locations.	
7. The Gateway	MW173	527443.426	5252486.041	5.928	4.92	2.0-5.0	Fill/Marine Deposits	Yes	Yes		In the central western portion of the Site. Assess groundwater in the vicinity of the former Roundhouse and cross-gradient of gasworks.	
7. The Gateway	MW196	527383.693	5252415.008	3.299	6.03	1.5-6.0	Fill	Yes	Yes		Groundwater well to assess groundwater condition at Brick Pit12, downgradient of Tar Plume A	
7. The Gateway	MW197	527421.438	5252392.726	3.290	5.90	3.7-6	Marine Deposits	Yes	Yes		Groundwater well to assess groundwater condition downgradient of Tar Plume B	
7. The Gateway	MW198	527426.182	5252432.536	3.201	5.21	2.0-6.0	Fill	Yes	Yes		Groundwater well to assess groundwater condition at Brick Pit12, downgradient of Tar Plume B	
7. The Gateway	RS6	527456.344	5252374.791	3.792	5.50	1.5-6.0	Fill	Yes			Located adjacent to the central southern boundary of the Site, to assess groundwater quality at the Site boundary in proximity to sewer infrastructure and the UST location. MW129 is a newer well at the same location.	
8. Regatta Point	MW178	527640.962	5252835.628	1.282	4.85	2.7-5.0	Bedrock	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in dolerite	
8. Regatta Point	MW179	527671.789	5252789.467	2.273	5.39	1.5-5.5	Bedrock	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in dolerite	
8. Regatta Point	MW180	527640.331	5252836.358	1.243	1.89	0.7-2.2	Fill	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in fill (if present)	
8. Regatta Point	MW181	527671.149	5252790.232	2.261	0.85	0.4-0.95	Fill	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in fill (if present)	

Table T2 - GME Scope

Area	Well ID	Easting (MGA94)	Northing (MGA94)	Top of Casing (m AHD)	Approximate Well Depth (m bgl)	Screened Interval (m bgl)	Screened Lithology	GME Activities			Purpose and Area	Potential LNAPL Well?
								Gauge?	Sample			
									General Suite	PFAS Suite		
9. Offsite	C1	527657.503	5252456.170	3.142	4.50	1.0-4.5	Fill	Yes[2]			Located east of the Precinct South in TasPorts land. Limited access has been historically provided to assess groundwater flow and monitoring.	
9. Offsite	MW123A	527393.270	5252399.740	3.223	3.65	1.8-3.8	Fill	Yes	Yes		Located along Evans Street, south of the former gasworks area.	
9. Offsite	MW123B	527393.230	5252399.730	3.278	17.45	14.6-17.6	Fill	Yes			Located along Evans Street, south of the former gasworks area. Screened to assess deep (>10 m bgl) groundwater	
9. Offsite	MW130_GHD	527382.450	5252393.370	2.728	4.71	2.0-5.0	Marine Deposits	Yes[3]	Yes[3]		Located along Evans Street. Assess groundwater quality off-Site and downgradient of gasworks	
9. Offsite	MW131_GHD	527398.420	5252384.860	2.611	9.66	6.7-9.7	Marine Deposits	Yes[3]	Yes[3]		Located along Evans Street. Assess deep groundwater quality off-Site and downgradient of gasworks Aquifer is interconnected. Shallow well MW123A used for assessment of groundwater in this area	
9. Offsite	MW132_GHD	527399.600	5252384.260	2.631	3.89	2.5-4.5	Fill/Marine Deposits	Yes[3]			Located along Evans Street. Assess groundwater quality off-Site and downgradient of gasworks	
9. Offsite	MW133_GHD	527454.400	5252353.360	3.127	4.45	2.0-3.0	Fill	Yes[3]	Yes[3]		Located on western end of Evans St to the south of Site. Assess shallow groundwater quality within Evans St (former Hobart Rivulet) and down-hydraulic gradient of Site.	
9. Offsite	MW134_GHD	527600.190	5252274.580	3.057	5.99	4.0-7.0	Fill	Yes[2]	Yes[2]	Yes[2]	Located along Evans Street. Assess groundwater quality off-Site and downgradient of LNAPL Plume B	
9. Offsite	MW135_GHD	527632.940	5252353.790	2.597	5.00	2.0-5.0	Fill	Yes[2]	Yes[2]	Yes[2]	Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	MW136_GHD	527633.060	5252324.500	2.549	13.50	10.2-13.50	Fill	Yes[2]			Located on TasPorts land to the east. Assess adjacent deep (>10 m bgl)groundwater quality Aquifer is interconnected. Shallow well MW135_GHD used for assessment of groundwater in this area	
9. Offsite	MW150	527528.454	5252319.791	3.265	4.39	1.0-5.0	Fill / Marine Deposits	Yes[3]	Yes[3]		Located on eastern end of Evans St to the south of Site. Assess shallow groundwater quality within Evans St (former Hobart Rivulet) and down-hydraulic gradient of Site.	
9. Offsite	MW151	527567.708	5252282.430	2.553	4.87	1.0-5.5	Fill / Marine Deposits	Yes	Yes	Yes	Located on eastern end of Evans St to the south of Site. Assess shallow groundwater quality within Evans St (former Hobart Rivulet) and down-hydraulic gradient of Site.	
9. Offsite	MW152	527564.181	5252262.443	2.563	4.98	1.0-5.5	Fill/Marine Deposits	Yes	Yes		Located in UniTas carpark to the south and east of Site. Assess shallow groundwater quality down hydraulic gradient of Site towards Sullivans Cove.	
9. Offsite	MW153	527557.540	5252240.934	2.449	4.42	1.0-4.6	Fill/Marine Deposits	Yes	Yes		Located in UniTas carpark to the south and east of Site. Assess shallow groundwater quality down hydraulic gradient of Site towards Sullivans Cove.	
9. Offsite	PC05	527726.727	5252600.326	Unknown	3.28	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC08	527746.787	5252222.601	Unknown	2.10	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC10	527817.921	5252666.445	Unknown	4.42	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC11	527779.795	5252522.473	Unknown	4.56	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC12	527651.691	5252296.989	Unknown	4.98	No data	Fill	Yes[2]	Yes[2]	Yes[2]	Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC13	527650.528	5252362.247	2.636	4.33	No data	Fill	Yes[2]	Yes[1,2]	Yes[1,2]	Located on TasPorts land to the east. Assess adjacent groundwater quality	Yes
9. Offsite	PC14	527642.432	5252230.789	Unknown	2.20	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC15	527668.146	5252518.054	3.489	4.38	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
							Total	**95**	**69**	**16**		

Notes
1. Sample if LNAPL is not present
2. Access approval from third party (TasPorts) required
3. Traffic management generally required

Appendix C

Adopted Groundwater Criteria

Table C1 - Tier 1 Groundwater Criteria - Drinking Water (Health)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
630-20-6	1,1,1,2-Tetrachloroethane	Water	0.57 µg/L	US EPARSL NOV 2024 - Tap Water Quality
71-55-6	1,1,1-Trichloroethane	Water	8000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
79-34-5	1,1,2,2-Tetrachloroethane	Water	0.076 µg/L	US EPARSL NOV 2024 - Tap Water Quality
79-00-5	1,1,2-Trichloroethane	Water	0.28 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-34-3	1,1-Dichloroethane	Water	2.8 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-35-4	1,1-Dichloroethene	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health
87-61-6	1,2,3-Trichlorobenzene	Water	7 µg/L	US EPARSL NOV 2024 - Tap Water Quality
96-18-4	1,2,3-Trichloropropane	Water	0.00075 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-94-3	1,2,4,5-Tetrachlorobenzene	Water	1.7 µg/L	US EPARSL NOV 2024 - Tap Water Quality
120-82-1	1,2,4-Trichlorobenzene	Water	1.2 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-63-6	1,2,4-trimethylbenzene	Water	56 µg/L	US EPARSL NOV 2024 - Tap Water Quality
96-12-8	1,2-Dibromo-3-chloropropane	Water	0.00033 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-93-4	1,2-Dibromoethane (EDB)	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
95-50-1	1,2-Dichlorobenzene	Water	1.5 mg/L	NHMRC ADWG (amended 2025) Human Health
107-06-2	1,2-Dichloroethane	Water	3 µg/L	NHMRC ADWG (amended 2025) Human Health
78-87-5	1,2-Dichloropropane	Water	0.85 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-67-8	1,3,5-trimethylbenzene	Water	60 µg/L	US EPARSL NOV 2024 - Tap Water Quality
99-35-4	1,3,5-Trinitrobenzene	Water	590 µg/L	US EPARSL NOV 2024 - Tap Water Quality
142-28-9	1,3-Dichloropropane	Water	370 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-46-7	1,4-Dichlorobenzene	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health
90-12-0	1-Methylnaphthalene	Water	1.1 µg/L	US EPARSL NOV 2024 - Tap Water Quality
58-90-2	2,3,4,6-Tetrachlorophenol	Water	240 µg/L	US EPARSL NOV 2024 - Tap Water Quality
93-76-5	2,4,5-Trichlorophenoxy acetic acid	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health
88-06-2	2,4,6-Trichlorophenol	Water	0.02 mg/L	NHMRC ADWG (amended 2025) Human Health
120-83-2	2,4-Dichlorophenol	Water	0.2 mg/L	NHMRC ADWG (amended 2025) Human Health
105-67-9	2,4-Dimethylphenol	Water	360 µg/L	US EPARSL NOV 2024 - Tap Water Quality
51-28-5	2,4-Dinitrophenol	Water	39 µg/L	US EPARSL NOV 2024 - Tap Water Quality
121-14-2	2,4-Dinitrotoluene	Water	0.24 µg/L	US EPARSL NOV 2024 - Tap Water Quality
606-20-2	2,6-Dinitrotoluene	Water	0.049 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-58-7	2-Chloronaphthalene	Water	750 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-57-8	2-Chlorophenol	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health
95-49-8	2-Chlorotoluene	Water	240 µg/L	US EPARSL NOV 2024 - Tap Water Quality
131-89-5	2-Cyclohexyl-4,6-dinitrophenol	Water	23 µg/L	US EPARSL NOV 2024 - Tap Water Quality
591-78-6	2-hexanone (MBK)	Water	38 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-57-6	2-Methylnaphthalene	Water	36 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-48-7	2-Methylphenol (o-Cresol)	Water	930 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-59-8	2-Naphthylamine	Water	0.039 µg/L	US EPARSL NOV 2024 - Tap Water Quality
88-74-4	2-Nitroaniline	Water	190 µg/L	US EPARSL NOV 2024 - Tap Water Quality
67-64-1	2-Propanone (Acetone)	Water	18000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-94-1	3,3-Dichlorobenzidine	Water	0.13 µg/L	US EPARSL NOV 2024 - Tap Water Quality
56-49-5	3-Methylcholanthrene	Water	0.0011 µg/L	US EPARSL NOV 2024 - Tap Water Quality
534-52-1	4,6-Dinitro-2-methylphenol	Water	1.5 µg/L	US EPARSL NOV 2024 - Tap Water Quality
92-67-1	4-Aminobiphenyl	Water	0.003 µg/L	US EPARSL NOV 2024 - Tap Water Quality
59-50-7	4-Chloro-3-methylphenol	Water	1400 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-47-8	4-Chloroaniline	Water	0.37 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-43-4	4-Chlorotoluene	Water	250 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-10-1	4-Methyl-2-pentanone (MIBK)	Water	6300 µg/L	US EPARSL NOV 2024 - Tap Water Quality
100-01-6	4-Nitroaniline	Water	3.8 µg/L	US EPARSL NOV 2024 - Tap Water Quality
99-55-8	5-Nitro-o-toluidine	Water	8.2 µg/L	US EPARSL NOV 2024 - Tap Water Quality
57-97-6	7,12-Dimethylbenz(a)anthracene	Water	0.0001 µg/L	US EPARSL NOV 2024 - Tap Water Quality
319-84-6	a-BHC	Water	0.0072 µg/L	US EPARSL NOV 2024 - Tap Water Quality
83-32-9	Acenaphthene	Water	530 µg/L	US EPARSL NOV 2024 - Tap Water Quality
98-86-2	Acetophenone	Water	1900 µg/L	US EPARSL NOV 2024 - Tap Water Quality
309-00-2	Aldrin	Water	0.00092 µg/L	US EPARSL NOV 2024 - Tap Water Quality
309-00-2 + 60-57-1	Aldrin + Dieldrin	Water	0.0003 mg/L	NHMRC ADWG (amended 2025) Human Health
107-05-1	Allyl chloride	Water	0.73 µg/L	US EPARSL NOV 2024 - Tap Water Quality
62-53-3	Aniline	Water	13 µg/L	US EPARSL NOV 2024 - Tap Water Quality
120-12-7	Anthracene	Water	1800 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-36-0	Antimony	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health
12674-11-2	Arochlor 1016	Water	0.22 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11104-28-2	Arochlor 1221	Water	0.0047 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11141-16-5	Arochlor 1232	Water	0.0047 µg/L	US EPARSL NOV 2024 - Tap Water Quality
53469-21-9	Arochlor 1242	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
12672-29-6	Arochlor 1248	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11097-69-1	Arochlor 1254	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11096-82-5	Arochlor 1260	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-38-2	Arsenic	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
103-33-3	Azobenzene	Water	0.12 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-39-3	Barium	Water	2 mg/L	NHMRC ADWG (amended 2025) Human Health
319-85-7	b-BHC	Water	0.025 µg/L	US EPARSL NOV 2024 - Tap Water Quality
56-55-3	Benz(a)anthracene	Water	0.03 µg/L	US EPARSL NOV 2024 - Tap Water Quality
71-43-2	Benzene	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
92-87-5	Benzidine	Water	0.00011 µg/L	US EPARSL NOV 2024 - Tap Water Quality
50-32-8	Benzo(a)pyrene	Water	0.01 µg/L	NHMRC ADWG (amended 2025) Human Health

Table C1 - Tier 1 Groundwater Criteria - Drinking Water (Health)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
207-08-9	Benzo(k)fluoranthene	Water	2.5 µg/L	US EPARSL NOV 2024 - Tap Water Quality
98-07-7	Benzotrichloride	Water	0.003 µg/L	US EPARSL NOV 2024 - Tap Water Quality
100-44-7	Benzyl chloride	Water	0.089 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-41-7	Beryllium	Water	0.06 mg/L	NHMRC ADWG (amended 2025) Human Health
111-91-1	Bis(2-chloroethoxy) methane	Water	59 µg/L	US EPARSL NOV 2024 - Tap Water Quality
111-44-4	Bis(2-chloroethyl) ether	Water	0.014 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-60-1	Bis(2-chloroisopropyl)ether	Water	710 µg/L	US EPARSL NOV 2024 - Tap Water Quality
117-81-7	Bis(2-ethylhexyl)phthalate	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
7440-42-8	Boron	Water	4 mg/L	NHMRC ADWG (amended 2025) Human Health
108-86-1	Bromobenzene	Water	62 µg/L	US EPARSL NOV 2024 - Tap Water Quality
74-97-5	Bromochloromethane	Water	83 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-27-4	Bromodichloromethane	Water	0.06 mg/L	WHO (2011) Drinking Water Guidelines
74-83-9	Bromomethane	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
85-68-7	Butyl benzyl phthalate	Water	16 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-43-9	Cadmium	Water	0.002 mg/L	NHMRC ADWG (amended 2025) Human Health
75-15-0	Carbon disulfide	Water	810 µg/L	US EPARSL NOV 2024 - Tap Water Quality
56-23-5	Carbon Tetrachloride	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health
470-90-6	Chlorfenvinphos	Water	11 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-90-7	Chlorobenzene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health
510-15-6	Chlorobenzilate	Water	0.31 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-00-3	Chloroethane	Water	21000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
74-87-3	Chloromethane	Water	190 µg/L	US EPARSL NOV 2024 - Tap Water Quality
2921-88-2	Chlorpyrifos	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
5598-13-0	Chlorpyrifos-methyl	Water	120 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-47-3	Chromium	Water	0.05 mg/L	WHO (2011) Drinking Water Guidelines
16065-83-1	Chromium (trivalent)	Water	22000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
218-01-9	Chrysene	Water	25 µg/L	US EPARSL NOV 2024 - Tap Water Quality
156-59-2	cis-1,2-Dichloroethene	Water	36 µg/L	US EPARSL NOV 2024 - Tap Water Quality
1476-11-5	cis-1,4-Dichloro-2-butene	Water	0.0013 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-48-4	Cobalt	Water	6 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-50-8	Copper	Water	2 mg/L	NHMRC ADWG (amended 2025) Human Health
57-12-5	Cyanide Total	Water	0.08 mg/L	NHMRC ADWG (amended 2025) Human Health
72-54-8	DDD	Water	0.032 µg/L	US EPARSL NOV 2024 - Tap Water Quality
72-55-9	DDE	Water	0.046 µg/L	US EPARSL NOV 2024 - Tap Water Quality
50-29-3	DDT	Water	0.009 mg/L	NHMRC ADWG (amended 2025) Human Health
DDT+DDE+DDD	DDT+DDE+DDD	Water	0.001 mg/L	NZ Drinking Water 2008
333-41-5	Diazinon	Water	0.004 mg/L	NHMRC ADWG (amended 2025) Human Health
53-70-3	Dibenz(a,h)anthracene	Water	0.025 µg/L	US EPARSL NOV 2024 - Tap Water Quality
132-64-9	Dibenzofuran	Water	7.9 µg/L	US EPARSL NOV 2024 - Tap Water Quality
124-48-1	Dibromochloromethane	Water	0.1 mg/L	WHO (2011) Drinking Water Guidelines
74-95-3	Dibromomethane	Water	8.3 µg/L	US EPARSL NOV 2024 - Tap Water Quality
84-74-2	Dibutyl Phthalate	Water	900 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-71-8	Dichlorodifluoromethane (Freon 12)	Water	200 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-09-2	Dichloromethane	Water	0.004 mg/L	NHMRC ADWG (amended 2025) Human Health
62-73-7	Dichlorvos	Water	0.005 mg/L	NHMRC ADWG (amended 2025) Human Health
60-57-1	Dieldrin	Water	0.0018 µg/L	US EPARSL NOV 2024 - Tap Water Quality
84-66-2	Diethyl phthalate	Water	15000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
60-51-5	Dimethoate	Water	0.007 mg/L	NHMRC ADWG (amended 2025) Human Health
60-11-7	Dimethylaminoazobenzene	Water	0.005 µg/L	US EPARSL NOV 2024 - Tap Water Quality
117-84-0	Di-n-octyl phthalate	Water	200 µg/L	US EPARSL NOV 2024 - Tap Water Quality
88-85-7	Dinoseb	Water	15 µg/L	US EPARSL NOV 2024 - Tap Water Quality
122-39-4	Diphenylamine	Water	1300 µg/L	US EPARSL NOV 2024 - Tap Water Quality
68583-22-2	E. Coli	Water	1 CFU/100mL	NZ Drinking Water 2008
72-20-8	Endrin	Water	0.0006 mg/L	WHO (2011) Drinking Water Guidelines
563-12-2	Ethion	Water	0.004 mg/L	NHMRC ADWG (amended 2025) Human Health
100-41-4	Ethylbenzene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health
55-38-9	Fenthion	Water	0.007 mg/L	NHMRC ADWG (amended 2025) Human Health
206-44-0	Fluoranthene	Water	800 µg/L	US EPARSL NOV 2024 - Tap Water Quality
86-73-7	Fluorene	Water	290 µg/L	US EPARSL NOV 2024 - Tap Water Quality
16984-48-8	Fluoride	Water	1.5 mg/L	NHMRC ADWG (amended 2025) Human Health
58-89-9	g-BHC (Lindane)	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
76-44-8	Heptachlor	Water	0.0003 mg/L	NHMRC ADWG (amended 2025) Human Health
1024-57-3	Heptachlor epoxide	Water	0.0014 µg/L	US EPARSL NOV 2024 - Tap Water Quality
118-74-1	Hexachlorobenzene (HCB)	Water	0.0098 µg/L	US EPARSL NOV 2024 - Tap Water Quality
87-68-3	Hexachlorobutadiene	Water	0.0007 mg/L	NHMRC ADWG (amended 2025) Human Health
77-47-4	Hexachlorocyclopentadiene	Water	0.41 µg/L	US EPARSL NOV 2024 - Tap Water Quality
67-72-1	Hexachloroethane	Water	0.33 µg/L	US EPARSL NOV 2024 - Tap Water Quality
193-39-5	Indeno(1,2,3-cd)pyrene	Water	0.25 µg/L	US EPARSL NOV 2024 - Tap Water Quality
78-59-1	Isophorone	Water	78 µg/L	US EPARSL NOV 2024 - Tap Water Quality
98-82-8	Isopropylbenzene (Cumene)	Water	450 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7439-92-1	Lead	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
121-75-5	Malathion	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health
7439-96-5	Manganese	Water	0.5 mg/L	NHMRC ADWG (amended 2025) Human Health
7439-97-6	Mercury	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
72-43-5	Methoxychlor	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health

Table C1 - Tier 1 Groundwater Criteria - Drinking Water (Health)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
7439-98-7	Molybdenum	Water	0.05 mg/L	NHMRC ADWG (amended 2025) Human Health
53-96-3	N-2-Fluorenyl Acetamide	Water	0.016 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
91-20-3	Naphthalene	Water	0.12 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
104-51-8	n-butylbenzene	Water	1000 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
7440-02-0	Nickel	Water	0.39 mg/L	US EPA RSL NOV 2024 - Tap Water Quality
14797-55-8(as N)	Nitrate (as N)	Water	11.2 mg/L	US EPA RSL NOV 2024 - Tap Water Quality
14797-55-8	Nitrate (as NO3-)	Water	50 mg/L	NHMRC ADWG (amended 2025) Human Health
14797-65-0(as N)	Nitrite (as N)	Water	11.2 mg/l	NHMRC ADWG (amended 2025) Human Health
98-95-3	Nitrobenzene	Water	0.14 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
924-16-3	N-Nitrosodibutylamine	Water	0.0027 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
55-18-5	N-Nitrosodiethylamine	Water	0.00017 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
621-64-7	N-Nitrosodipropylamine	Water	0.011 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
10595-95-6	N-Nitrosomethylethylamine	Water	0.00071 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
59-89-2	N-Nitrosomorpholine	Water	0.012 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
100-75-4	N-Nitrosopiperidine	Water	0.0082 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
930-55-2	N-Nitrosopyrrolidine	Water	0.037 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
103-65-1	n-propylbenzene	Water	660 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
95-47-6	o-Xylene	Water	190 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
608-93-5	Pentachlorobenzene	Water	3.2 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
76-01-7	Pentachloroethane	Water	0.65 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
82-68-8	Pentachloronitrobenzene	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health
87-86-5	Pentachlorophenol	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
375-73-5	Perfluorobutane sulfonic acid (PFBS)	Water	1 µg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4	Perfluorohexane sulfonic acid (PFHxS)	Water	0.03 µg/L	NHMRC ADWG (amended 2025) Human Health
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	Water	0.008 µg/L	NHMRC ADWG (amended 2025) Human Health
335-67-1	Perfluorooctanoic acid (PFOA)	Water	0.2 µg/L	NHMRC ADWG (amended 2025) Human Health
62-44-2	Phenacetin	Water	34 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
108-95-2	Phenol	Water	5800 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
23505-41-1	Pirimphos-ethyl	Water	0.0005 mg/L	NHMRC ADWG (amended 2025) Human Health
1336-36-3	Polychlorinated Biphenyls	Water	0.044 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
23950-58-5	Pronamide	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health
129-00-0	Pyrene	Water	120 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
135-98-8	sec-butylbenzene	Water	2000 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
7782-49-2	Selenium	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
7440-22-4	Silver	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health
100-42-5	Styrene	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health
14808-79-8	Sulfate as SO4	Water	500 mg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4/1763-23-1	Sum PFHxS and PFOS	Water	0.07 µg/L	PFAS NEMP 3.0 2025
98-06-6	tert-butylbenzene	Water	690 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
127-18-4	Tetrachloroethene (PCE)	Water	0.05 mg/L	NHMRC ADWG (amended 2025) Human Health
463-56-9	Thiocyanate	Water	4 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
7440-31-5	Tin	Water	12000 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
108-88-3	Toluene	Water	0.8 mg/L	NHMRC ADWG (amended 2025) Human Health
1319-77-3	Total Cresols	Water	1500 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
1330-20-7	Total Xylenes	Water	0.6 mg/L	NHMRC ADWG (amended 2025) Human Health
8001-35-2	Toxaphene	Water	0.071 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
156-60-5	trans-1,2-Dichloroethene	Water	360 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
110-57-6	trans-1,4-Dichloro-2-butene	Water	0.0013 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
75-25-2	Tribromomethane (Bromoform)	Water	0.1 mg/L	WHO (2011) Drinking Water Guidelines
79-01-6	Trichloroethene	Water	0.02 mg/L	WHO (2011) Drinking Water Guidelines
75-69-4	Trichlorofluoromethane (Freon 11)	Water	5200 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
67-66-3	Trichloromethane (Chloroform)	Water	0.3 mg/L	WHO (2011) Drinking Water Guidelines
1582-09-8	Trifluralin	Water	0.09 mg/L	NHMRC ADWG (amended 2025) Human Health
7440-62-2	Vanadium	Water	86 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
108-05-4	Vinyl acetate	Water	410 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
75-01-4	Vinyl chloride	Water	0.0003 mg/L	NHMRC ADWG (amended 2025) Human Health

Table C2 - Tier 1 Groundwater Criteria - Drinking Water (Aesthetics)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
95-50-1	1,2-Dichlorobenzene	Water	0.001 mg/L	NHMRC ADWG (amended 2013) Aesthetic
541-73-1	1,3-Dichlorobenzene	Water	0.02 mg/L	NHMRC ADWG (amended 2013) Aesthetic
106-46-7	1,4-Dichlorobenzene	Water	0.0003 mg/L	NHMRC ADWG (amended 2013) Aesthetic
88-06-2	2,4,6-Trichlorophenol	Water	0.002 mg/L	NHMRC ADWG (amended 2013) Aesthetic
120-83-2	2,4-Dichlorophenol	Water	0.0003 mg/L	NHMRC ADWG (amended 2013) Aesthetic
95-57-8	2-Chlorophenol	Water	0.0001 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7429-90-5	Aluminium	Water	0.2 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7664-41-7	Ammonia (as NH3)	Water	0.5 mg/L	NHMRC ADWG (amended 2013) Aesthetic
16887-00-6	Chloride	Water	250 mg/L	NHMRC ADWG (amended 2013) Aesthetic
108-90-7	Chlorobenzene	Water	0.01 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7440-50-8	Copper	Water	1 mg/L	NHMRC ADWG (amended 2013) Aesthetic
100-41-4	Ethylbenzene	Water	0.003 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7439-89-6	Iron	Water	0.3 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7439-96-5	Manganese	Water	0.1 mg/L	NHMRC ADWG (amended 2013) Aesthetic
14797-55-8(as N)	Nitrate (as N)	Water	10000 ug/L	NHMRC ADWG (amended 2013) Aesthetic
pH_Lab	pH (Lab)	Water	6.5 - 8.5 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7440-23-5	Sodium	Water	180 mg/L	NHMRC ADWG (amended 2013) Aesthetic
100-42-5	Styrene	Water	0.004 mg/L	NHMRC ADWG (amended 2013) Aesthetic
14808-79-8	Sulfate as SO4	Water	250 mg/L	NHMRC ADWG (amended 2013) Aesthetic
108-88-3	Toluene	Water	0.025 mg/L	NHMRC ADWG (amended 2013) Aesthetic
TDS	Total Dissolved Solids	Water	600 mg/L	NHMRC ADWG (amended 2013) Aesthetic
1330-20-7	Total Xylenes	Water	0.02 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7440-66-6	Zinc	Water	3 mg/L	NHMRC ADWG (amended 2013) Aesthetic

Table C3 - Tier 1 Groundwater Criteria - Drinking Water (Primary / Secondary Contact)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
630-20-6	1,1,1,2-Tetrachloroethane	Water	5.7 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
71-55-6	1,1,1-Trichloroethane	Water	80000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
79-34-5	1,1,2,2-Tetrachloroethane	Water	0.76 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
79-00-5	1,1,2-Trichloroethane	Water	2.8 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-34-3	1,1-Dichloroethane	Water	28 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-35-4	1,1-Dichloroethene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
87-61-6	1,2,3-Trichlorobenzene	Water	70 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
96-18-4	1,2,3-Trichloropropane	Water	0.0075 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-94-3	1,2,4,5-Tetrachlorobenzene	Water	17 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
120-82-1	1,2,4-Trichlorobenzene	Water	12 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-63-6	1,2,4-trimethylbenzene	Water	560 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
96-12-8	1,2-Dibromo-3-chloropropane	Water	0.0033 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-93-4	1,2-Dibromoethane (EDB)	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
95-50-1	1,2-Dichlorobenzene	Water	15 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
107-06-2	1,2-Dichloroethane	Water	30 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
78-87-5	1,2-Dichloropropane	Water	8.5 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-67-8	1,3,5-trimethylbenzene	Water	600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
99-35-4	1,3,5-Trinitrobenzene	Water	5900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
142-28-9	1,3-Dichloropropane	Water	3700 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-46-7	1,4-Dichlorobenzene	Water	0.4 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
90-12-0	1-Methylnaphthalene	Water	0.063 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
58-90-2	2,3,4,6-Tetrachlorophenol	Water	2400 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
93-76-5	2,4,5-Trichlorophenoxy acetic acid	Water	1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
88-06-2	2,4,6-Trichlorophenol	Water	0.2 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
120-83-2	2,4-Dichlorophenol	Water	2 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
105-67-9	2,4-Dimethylphenol	Water	3600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
51-28-5	2,4-Dinitrophenol	Water	390 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
121-14-2	2,4-Dinitrotoluene	Water	2.4 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
606-20-2	2,6-Dinitrotoluene	Water	0.49 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-58-7	2-Chloronaphthalene	Water	7500 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-57-8	2-Chlorophenol	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
95-49-8	2-Chlorotoluene	Water	2400 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
131-89-5	2-Cyclohexyl-4,6-dinitrophenol	Water	230 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
591-78-6	2-hexanone (MBK)	Water	380 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-57-6	2-Methylnaphthalene	Water	360 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-48-7	2-Methylphenol (o-Cresol)	Water	9300 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-59-8	2-Naphthylamine	Water	0.39 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
88-74-4	2-Nitroaniline	Water	1900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
67-64-1	2-Propanone (Acetone)	Water	180000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-94-1	3,3-Dichlorobenzidine	Water	1.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
56-49-5	3-Methylcholanthrene	Water	0.011 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
534-52-1	4,6-Dinitro-2-methylphenol	Water	15 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
92-67-1	4-Aminobiphenyl	Water	0.03 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
59-50-7	4-Chloro-3-methylphenol	Water	14000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-47-8	4-Chloroaniline	Water	3.7 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-43-4	4-Chlorotoluene	Water	2500 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-10-1	4-Methyl-2-pentanone (MIBK)	Water	63000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
100-01-6	4-Nitroaniline	Water	38 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
99-55-8	5-Nitro-o-toluidine	Water	82 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
57-97-6	7,12-Dimethylbenz(a)anthracene	Water	0.001 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
319-84-6	a-BHC	Water	0.072 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
83-32-9	Acenaphthene	Water	5300 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
98-86-2	Acetophenone	Water	19000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
309-00-2	Aldrin	Water	0.0092 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
309-00-2 + 60-57-1	Aldrin + Dieldrin	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
107-05-1	Allyl chloride	Water	7.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
62-53-3	Aniline	Water	130 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
120-12-7	Anthracene	Water	18000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-36-0	Antimony	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
12674-11-2	Arochlor 1016	Water	2.2 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11104-28-2	Arochlor 1221	Water	0.047 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11141-16-5	Arochlor 1232	Water	0.047 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
53469-21-9	Arochlor 1242	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
12672-29-6	Arochlor 1248	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11097-69-1	Arochlor 1254	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11096-82-5	Arochlor 1260	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-38-2	Arsenic	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
103-33-3	Azobenzene	Water	1.2 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-39-3	Barium	Water	20 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
319-85-7	b-BHC	Water	0.25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
56-55-3	Benz(a)anthracene	Water	0.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
71-43-2	Benzene	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
92-87-5	Benzidine	Water	0.0011 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
50-32-8	Benzo(a)pyrene	Water	0.1 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
207-08-9	Benzo(k)fluoranthene	Water	25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
98-07-7	Benzotrichloride	Water	0.03 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
100-44-7	Benzyl chloride	Water	0.89 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-41-7	Beryllium	Water	0.6 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
111-91-1	Bis(2-chloroethoxy) methane	Water	590 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
111-44-4	Bis(2-chloroethyl) ether	Water	0.14 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
108-60-1	Bis(2-chloroisopropyl)ether	Water	7100 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
117-81-7	Bis(2-ethylhexyl)phthalate	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7440-42-8	Boron	Water	40 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
108-86-1	Bromobenzene	Water	620 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
74-97-5	Bromochloromethane	Water	830 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-27-4	Bromodichloromethane	Water	0.6 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
74-83-9	Bromomethane	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
85-68-7	Butyl benzyl phthalate	Water	160 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-43-9	Cadmium	Water	0.02 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
75-15-0	Carbon disulfide	Water	8100 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
56-23-5	Carbon Tetrachloride	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
470-90-6	Chlorfenvinphos	Water	110 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-90-7	Chlorobenzene	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
510-15-6	Chlorobenzilate	Water	3.1 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-00-3	Chloroethane	Water	83000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
74-87-3	Chloromethane	Water	1900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
2921-88-2	Chlorpyrifos	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
5598-13-0	Chlorpyrifos-methyl	Water	1200 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-47-3	Chromium	Water	0.5 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
16065-83-1	Chromium (trivalent)	Water	220000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
218-01-9	Chrysene	Water	250 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
156-59-2	cis-1,2-Dichloroethene	Water	360 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
1476-11-5	cis-1,4-Dichloro-2-butene	Water	0.013 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-48-4	Cobalt	Water	60 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-50-8	Copper	Water	20 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
57-12-5	Cyanide Total	Water	0.8 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
72-54-8	DDD	Water	0.32 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
72-55-9	DDE	Water	0.46 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
50-29-3	DDT	Water	0.09 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
DDT+DDE+DDD	DDT+DDE+DDD	Water	0.01 mg/L	NZ Drinking Water 2008 (AF x 10)
333-41-5	Diazinon	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
53-70-3	Dibenz(a,h)anthracene	Water	0.25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
132-64-9	Dibenzofuran	Water	79 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
124-48-1	Dibromochloromethane	Water	1 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
74-95-3	Dibromomethane	Water	83 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
84-74-2	Dibutyl Phthalate	Water	9000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-71-8	Dichlorodifluoromethane (Freon 12)	Water	2000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-09-2	Dichloromethane	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
62-73-7	Dichlorvos	Water	0.05 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
60-57-1	Dieldrin	Water	0.018 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
84-66-2	Diethyl phthalate	Water	150000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
60-51-5	Dimethoate	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
60-11-7	Dimethylaminoazobenzene	Water	0.05 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
117-84-0	Di-n-octyl phthalate	Water	2000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
88-85-7	Dinoseb	Water	150 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
122-39-4	Diphenylamine	Water	13000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
68583-22-2	E. Coli	Water	10 CFU/100mL	NZ Drinking Water 2008 (AF x 10)
72-20-8	Endrin	Water	0.006 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
563-12-2	Ethion	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
100-41-4	Ethylbenzene	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
55-38-9	Fenthion	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
206-44-0	Fluoranthene	Water	8000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
86-73-7	Fluorene	Water	2900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
16984-48-8	Fluoride	Water	15 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
12789-03-6	gamma-Chlordane	Water	0.02 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
58-89-9	g-BHC (Lindane)	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
608-73-1	HCH-technical	Water	0.25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
76-44-8	Heptachlor	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1024-57-3	Heptachlor epoxide	Water	0.014 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
118-74-1	Hexachlorobenzene (HCB)	Water	0.098 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
87-68-3	Hexachlorobutadiene	Water	0.007 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
77-47-4	Hexachlorocyclopentadiene	Water	4.1 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
67-72-1	Hexachloroethane	Water	3.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
193-39-5	Indeno(1,2,3-cd)pyrene	Water	2.5 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
78-59-1	Isophorone	Water	780 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
98-82-8	Isopropylbenzene (Cumene)	Water	4500 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7439-92-1	Lead	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
121-75-5	Malathion	Water	0.7 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7439-96-5	Manganese	Water	5 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7439-97-6	Mercury	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
72-43-5	Methoxychlor	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7439-98-7	Molybdenum	Water	0.5 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
53-96-3	N-2-Fluorenyl Acetamide	Water	0.16 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-20-3	Naphthalene	Water	1.2 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
104-51-8	n-butylbenzene	Water	10000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-02-0	Nickel	Water	3.9 mg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
14797-55-8(as N)	Nitrate (as N)	Water	112 mg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
14797-55-8	Nitrate (as NO3-)	Water	500 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
14797-65-0(as N)	Nitrite (as N)	Water	10 mg/l	Guidelines for Canadian Drinking Water (2014) MAC (AF x 10)

Table C3 - Tier 1 Groundwater Criteria - Drinking Water (Primary / Secondary Contact)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
98-95-3	Nitrobenzene	Water	1.4 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
924-16-3	N-Nitrosodibutylamine	Water	0.027 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
55-18-5	N-Nitrosodiethylamine	Water	0.0017 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
621-64-7	N-Nitrosodipropylamine	Water	0.11 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
10595-95-6	N-Nitrosomethylethylamine	Water	0.0071 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
59-89-2	N-Nitrosomorpholine	Water	0.12 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
100-75-4	N-Nitrosopiperidine	Water	0.082 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
930-55-2	N-Nitrosopyrrolidine	Water	0.37 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
103-65-1	n-propylbenzene	Water	6600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-47-6	o-Xylene	Water	1900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
608-93-5	Pentachlorobenzene	Water	32 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
76-01-7	Pentachloroethane	Water	6.5 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
82-68-8	Pentachloronitrobenzene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
87-86-5	Pentachlorophenol	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
375-73-5	Perfluorobutane sulfonic acid (PFBS)	Water	10 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
355-46-4	Perfluorohexane sulfonic acid (PFHxS)	Water	0.3 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	Water	0.08 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
335-67-1	Perfluorooctanoic acid (PFOA)	Water	2 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
62-44-2	Phenacetin	Water	340 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-95-2	Phenol	Water	58000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
23505-41-1	Pirimphos-ethyl	Water	0.005 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1336-36-3	Polychlorinated Biphenyls	Water	0.44 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
23950-58-5	Pronamide	Water	0.7 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
129-00-0	Pyrene	Water	1200 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
135-98-8	sec-butylbenzene	Water	20000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7782-49-2	Selenium	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7440-22-4	Silver	Water	1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
100-42-5	Styrene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
14808-79-8	Sulfate as SO4	Water	5000 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
355-46-4/1763-23-1	Sum PFHxS and PFOS	Water	2 µg/L	PFAS NEMP 3.0 2025
98-06-6	tert-butylbenzene	Water	6900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
127-18-4	Tetrachloroethene (PCE)	Water	0.5 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
463-56-9	Thiocyanate	Water	40 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-31-5	Tin	Water	12000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-88-3	Toluene	Water	8 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1319-77-3	Total Cresols	Water	15000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
1330-20-7	Total Xylenes	Water	6 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
8001-35-2	Toxaphene	Water	0.71 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
156-60-5	trans-1,2-Dichloroethene	Water	3600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
110-57-6	trans-1,4-Dichloro-2-butene	Water	0.013 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-25-2	Tribromomethane (Bromoform)	Water	1 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
79-01-6	Trichloroethene	Water	0.2 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
75-69-4	Trichlorofluoromethane (Freon 11)	Water	52000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
67-66-3	Trichloromethane (Chloroform)	Water	3 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
1582-09-8	Trifluralin	Water	0.9 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7440-62-2	Vanadium	Water	860 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-05-4	Vinyl acetate	Water	4100 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-01-4	Vinyl chloride	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 HSL D - Sand 2 to <4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Xylenes	Water	No Limit	
71-43-2	Benzene	Water	4.9 mg/L	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	4.83 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	242 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	6.03 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	452 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	132 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	4.02 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	189 mg/l	
F1-BTEX	C6-C10 less BTEX	Water	4.1 mg/L	
F2-NAPHTHALENE	>C10-C16 minus naphthalene (F2)	Water	4.8 mg/L	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview*, United Kingdom Research and Innovation, 2024

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 IMW - Sand - 2-<4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Total Xylenes	Water	No Limit	
71-43-2	Benzene	Water	No Limit	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	1390 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	69600 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	1740 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	129000 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	37900 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	1160 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	54300 mg/l	
F1-BTEX	TPH C6 - C10 Fraction	Water	No Limit	
F2-NAPHTHALENE	TPH >C10 - C16 Fraction	Water	No Limit	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview*, United Kingdom Research and Innovation, 2024

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 HSL C - Sand 2 to <4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Xylenes	Water	No Limit	
71-43-2	Benzene	Water	No Limit	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	656 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	33000 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	820 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	61900 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	17900 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	547 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	25700 mg/l	
F1-BTEX	C6-C10 less BTEX	Water	No Limit	
F2-NAPHTHALENE	>C10-C16 minus naphthalene (F2)	Water	No Limit	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview* , United Kingdom Research and Innovation, 2024

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 HSL A&B - Sand 2 to <4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Xylenes	Water	No Limit	
71-43-2	Benzene	Water	0.8 mg/L	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	0.763 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	38.4 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	0.953 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	71.9 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	20.8 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	0.636 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	29.9 mg/l	
F1-BTEX	C6-C10 less BTEX	Water	0.64 mg/L	
F2-NAPHTHALENE	>C10-C16 minus naphthalene (F2)	Water	0.76 mg/L	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview* , United Kingdom Research and Innovation, 2024

ChemCode	ChemName	Matrix Type	Adopted Criteria	Source
C10-C40	>C10-C40 fraction (sum)	Water	600 ug/L	RIVM (2001) Dutch Intervention Value
71-55-6	1,1,1-Trichloroethane	Water	400 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
79-34-5	1,1,2,2-Tetrachloroethane	Water	500 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
79-00-5	1,1,2-Trichloroethane	Water	5800 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very Low reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
75-34-3	1,1-Dichloroethane	Water	250 µg/L	R3 BTAG Marine Benchmarks
75-35-4	1,1-Dichloroethene	Water	900 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
634-66-2	1,2,3,4-Tetrachlorobenzene	Water	6 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
634-90-2	1,2,3,5-Tetrachlorobenzene	Water	7 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
87-61-6	1,2,3-Trichlorobenzene	Water	16 µg/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
95-94-3	1,2,4,5-Tetrachlorobenzene	Water	7 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
120-82-1	1,2,4-Trichlorobenzene	Water	140 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
95-63-6	1,2,4-trimethylbenzene	Water	19 ug/L	R3 BTAG Marine Benchmarks
95-50-1	1,2-Dichlorobenzene	Water	200 ug/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
107-06-2	1,2-Dichloroethane	Water	2600 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
540-59-0	1,2-Dichloroethene	Water	680 ug/L	R3 BTAG Marine Benchmarks
78-87-5	1,2-Dichloropropane	Water	1200 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
108-70-3	1,3,5-Trichlorobenzene	Water	20 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
99-35-4	1,3,5-Trinitrobenzene	Water	4 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
541-73-1	1,3-Dichlorobenzene	Water	260 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
142-28-9	1,3-Dichloropropane	Water	1400 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
106-46-7	1,4-Dichlorobenzene	Water	60 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Very Low reliability.
90-13-1	1-Chloronaphthalene	Water	0.7 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
58-90-2	2,3,4,6-Tetrachlorophenol	Water	20 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
15950-66-0	2,3,4-Trichlorophenol	Water	4 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
935-95-5	2,3,5,6-Tetrachlorophenol	Water	1.4 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
933-78-8	2,3,5-Trichlorophenol	Water	2 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
933-75-5	2,3,6-Trichlorophenol	Water	2 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
576-24-9	2,3-Dichlorophenol	Water	31 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
95-95-4	2,4,5-Trichlorophenol	Water	4 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
88-06-2	2,4,6-Trichlorophenol	Water	20 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
120-83-2	2,4-Dichlorophenol	Water	160 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
105-67-9	2,4-Dimethylphenol	Water	2 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
51-28-5	2,4-Dinitrophenol	Water	45 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
121-14-2	2,4-Dinitrotoluene	Water	65 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
87-65-0	2,6-Dichlorophenol	Water	34 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
606-20-2	2,6-Dinitrotoluene	Water	0.3 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
95-57-8	2-Chlorophenol	Water	490 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
95-48-7	2-Methylphenol (o-Cresol)	Water	1020 ug/L	R3 BTAG Marine Benchmarks
88-75-5	2-Nitrophenol	Water	2 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
91-94-1	3,3-Dichlorobenzidine	Water	0.5 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
95-77-2	3,4-Dichlorophenol	Water	2 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
591-35-5	3,5-Dichlorophenol	Water	4 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
108-10-1	4-Methyl-2-pentanone (MIBK)	Water	123000 ug/L	R3 BTAG Marine Benchmarks
0100-02-07	4-Nitrophenol	Water	58 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
319-84-6	a-BHC	Water	25 ug/L	R3 BTAG Marine Benchmarks
309-00-2	Aldrin	Water	0.003 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
107-05-1	Allyl chloride	Water	3 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
7429-90-5	Aluminium	Water	72 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability
7664-41-7 (as N)	Ammonia (as N)	Water	1200 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
62-53-3	Aniline	Water	250 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
120-12-7	Anthracene	Water	0.4 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability. Higher SPV adopted for bioaccumulation potential
12674-11-2	Arochlor 1016	Water	4 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
11104-28-2	Arochlor 1221	Water	0.009 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
11141-16-5	Arochlor 1232	Water	1 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
53469-21-9	Arochlor 1242	Water	0.3 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
12672-29-6	Arochlor 1248	Water	0.3 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
11097-69-1	Arochlor 1254	Water	0.1 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
7440-36-0	Antimony	Water	9 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
7440-38-2	Arsenic	Water	42 ug/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
22569-72-8	Arsenic III	Water	94 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
71-43-2	Benzene	Water	900 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
92-87-5	Benzidine	Water	2.5 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
50-32-8	Benzo(a)pyrene	Water	0.2 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7440-41-7	Beryllium	Water	0.13 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
117-81-7	Bis(2-ethylhexyl)phthalate	Water	1 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
7440-42-8	Boron	Water	1500 µg/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025)
C10-C36	C10-C36 fraction (sum)	Water	600 ug/L	RIVM (2001) Dutch Intervention Value
7440-43-9	Cadmium	Water	14 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
75-15-0	Carbon disulfide	Water	20 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
56-23-5	Carbon Tetrachloride	Water	320 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
108-90-7	Chlorobenzene	Water	100 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
2921-88-2	Chlorpyrifos	Water	0.04 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability. DGV may not protect key test species from acute (and chronic) toxicity. Check toxicant DGV technical brief for spread of data and its significance. This DGV is greater than the value for acute toxicity (Warne et al., 2018).
7440-47-3	Chromium	Water	20 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Guideline value for Cr(VI)
18540-29-9	Chromium (hexavalent)	Water	20 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
16065-83-1	Chromium (trivalent)	Water	49 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
7440-48-4	Cobalt	Water	14 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability
7440-50-8	Copper	Water	3 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability.
57-12-5	Cyanide Total	Water	7 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very Low reliability. Cyanide as un-ionised HCN, measured as [CN].
72-55-9	DDE	Water	0.0005 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
50-29-3	DDT	Water	0.0004 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
333-41-5	Diazinon	Water	0.01 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
84-74-2	Dibutyl Phthalate	Water	26 ug/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
75-09-2	Dichloromethane	Water	5000 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
60-57-1	Dieldrin	Water	0.01 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
84-66-2	Diethyl phthalate	Water	1000 ug/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
60-51-5	Dimethoate	Water	0.15 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
115-29-7	Endosulfan	Water	0.02 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
115-29-7	Endosulfan	Water	0.02 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
72-20-8	Endrin	Water	0.01 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
100-41-4	Ethylbenzene	Water	110 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
206-44-0	Fluoranthene	Water	1.4 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability. Higher SPV adopted for bioaccumulation potential
58-89-9	g-BHC (Lindane)	Water	0.007 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
76-44-8	Heptachlor	Water	0.0004 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
1024-57-3	Heptachlor epoxide	Water	0.0036 ug/L	USEPA (2013) Water Quality Criteria - Aquatic Life (Chronic, Marine)
118-74-1	Hexachlorobenzene (HCB)	Water	0.2 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability

ChemCode	ChemName	Matrix Type	Adopted Criteria	Source
87-68-3	Hexachlorobutadiene	Water	0.03 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
77-47-4	Hexachlorocyclopentadiene	Water	0.05 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
67-72-1	Hexachloroethane	Water	360 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
78-59-1	Isophorone	Water	130 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
98-82-8	Isopropylbenzene (Cumene)	Water	30 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7439-92-1	Lead	Water	6.6 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability.
121-75-5	Malathion	Water	0.2 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7439-96-5	Manganese	Water	2500 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7439-97-6	Mercury	Water	0.4 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Very High reliability.
72-43-5	Methoxychlor	Water	0.004 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
7439-98-7	Molybdenum	Water	34 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
108-38-3	m-Xylene	Water	100 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
91-20-3	Naphthalene	Water	90 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
7440-02-0	Nickel	Water	200 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability
14797-55-8	Nitrate (as NO3-)	Water	700 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
98-95-3	Nitrobenzene	Water	550 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
95-47-6	o-Xylene	Water	470 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
608-93-5	Pentachlorobenzene	Water	2.5 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
76-01-7	Pentachloroethane	Water	120 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
87-86-5	Pentachlorophenol	Water	33 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) -
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	Water	0.13 ug/l	PFAS National Environmental Management Plan
335-67-1	Perfluorooctanoic acid (PFOA)	Water	220 ug/l	PFAS National Environmental Management Plan
pH_Lab	pH (Lab)	Water	6.5 - 9 pH Units	USEPA (2013) Water Quality Criteria - Aquatic Life (Chronic, Marine)
85-01-8	Phenanthrene	Water	2 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
108-95-2	Phenol	Water	520 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
1336-36-3	Polychlorinated Biphenyls	Water	0.03 ug/L	USEPA (2013) Water Quality Criteria - Aquatic Life (Chronic, Marine)
7782-49-2	Selenium	Water	18 µg/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7440-22-4	Silver	Water	1.8 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
100-42-5	Styrene	Water	910 ug/L	R3 BTAG Marine Benchmarks
127-18-4	Tetrachloroethene (PCE)	Water	70 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7440-31-5	Tin	Water	10 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
108-88-3	Toluene	Water	180 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7723-14-0	Total Phosphorus	Water	0.1 ug/L	R3 BTAG Marine Benchmarks
1330-20-7	Total Xylenes	Water	100 ug/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
8001-35-2	Toxaphene	Water	0.006 µg/L	ANZG (2018) Marine Waters Unknown LOSP Toxicant DGVs (June 2025)
75-25-2	Tribromomethane (Bromoform)	Water	640 ug/L	R3 BTAG Marine Benchmarks
79-01-6	Trichloroethene	Water	400 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
67-66-3	Trichloromethane (Chloroform)	Water	1100 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability. DGV may not protect key test species from chronic toxicity. Check toxicant DGV technical brief and Read the detail, below, for spread of data and its significance.
1582-09-8	Trifluralin	Water	4.4 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7440-62-2	Vanadium	Water	160 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability
75-01-4	Vinyl chloride	Water	140 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7440-66-6	Zinc	Water	12 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability
0131-11-3	Dimethyl phthalate	Water	3700 ug/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability

ChemCode	ChemName	MatrixType	Adopted Criteria	Comments
107-02-8	Acrolein	Water	0.1 mg/L	ANZECC (2000) Agriculture, Parks & Gardens - STV
16984-48-8	Fluoride	Water	2 mg/L	
330-54-1	diuron	Water	0.002 mg/L	
61-82-5	Amitrol	Water	0.002 mg/L	
7429-90-5	Aluminium	Water	20 mg/L	
7439-89-6	Iron	Water	10 mg/L	
7439-92-1	Lead	Water	5 mg/L	
7439-93-2	Lithium	Water	2.5 mg/L	
7439-96-5	Manganese	Water	10 mg/L	
7439-97-6	Mercury	Water	0.002 mg/L	
7439-98-7	Molybdenum	Water	0.05 mg/L	
7440-02-0	Nickel	Water	2 mg/L	
7440-38-2	Arsenic	Water	2 mg/L	
7440-41-7	Beryllium	Water	0.5 mg/L	
7440-42-8	Boron	Water	0.5 mg/L	
7440-43-9	Cadmium	Water	0.05 mg/L	
7440-47-3	Chromium	Water	1 mg/L	
7440-48-4	Cobalt	Water	0.1 mg/L	
7440-50-8	Copper	Water	5 mg/L	
7440-61-1	Uranium	Water	0.1 mg/L	
7440-62-2	Vanadium	Water	0.5 mg/L	
7440-66-6	Zinc	Water	5 mg/L	
75-99-0	2,2-DPA (Dalapon)	Water	0.004 mg/L	
7723-14-0	Phosphorous	Water	0.8 mg/L	
7727-37-9	Nitrogen	Water	25 mg/L	
7782-49-2	Selenium	Water	0.05 mg/L	

ChemCode	ChemName	MatrixType	Adopted Criteria	Comments
14797-55-8	Nitrate	Water	400 mg/L	ANZECC (2000) Stock Watering
14797-65-0	Nitrite	Water	30 mg/L	ANZECC (2000) Stock Watering
14808-79-8	Sulphate	Water	2000 mg/L	ANZECC (2000) Stock Watering
16984-48-8	Fluoride	Water	2 mg/L	ANZECC (2000) Stock Watering
375-73-5	Perfluorobutanesulfonic acid (PFBS)	Water	1 µg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4	PFHxS	Water	0.03 µg/L	NHMRC ADWG (amended 2025) Human Health
335-67-1	PFOA	Water	0.2 µg/L	NHMRC ADWG (amended 2025) Human Health
1763-23-1	PFOS	Water	0.008 µg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4/1763-23-1	Sum of PFOS and PFHxS	Water	2 µg/L	PFAS NEMP 3.0 2025
7429-90-5	Aluminium	Water	5 mg/L	ANZECC (2000) Stock Watering
7439-92-1	Lead	Water	0.1 mg/L	ANZECC (2000) Stock Watering
7439-97-6	Mercury	Water	0.002 mg/L	ANZECC (2000) Stock Watering
7439-98-7	Molybdenum	Water	0.15 mg/L	ANZECC (2000) Stock Watering
7440-02-0	Nickel	Water	1 mg/L	ANZECC (2000) Stock Watering
7440-38-2	Arsenic	Water	0.5 mg/L	ANZECC (2000) Stock Watering
7440-42-8	Boron	Water	5 mg/L	ANZECC (2000) Stock Watering
7440-43-9	Cadmium	Water	0.01 mg/L	ANZECC (2000) Stock Watering
7440-47-3	Chromium	Water	1 mg/L	ANZECC (2000) Stock Watering
7440-48-4	Cobalt	Water	1 mg/L	ANZECC (2000) Stock Watering
7440-50-8	Copper	Water	0.4 mg/L	ANZECC (2000) Stock Watering
7440-61-1	Uranium	Water	0.2 mg/L	ANZECC (2000) Stock Watering
7440-61-1	Uranium	Water	0.2 Bq/L	ANZECC (2000) Stock Watering
7440-66-6	Zinc	Water	20 mg/L	ANZECC (2000) Stock Watering
7440-70-2	Calcium	Water	1000 mg/L	ANZECC (2000) Stock Watering
7782-49-2	Selenium	Water	0.02 mg/L	ANZECC (2000) Stock Watering
Radium-226	Radium 226	Water	5 Bq/L	ANZECC (2000) Stock Watering
Radium-228	Radium 228	Water	2 Bq/L	ANZECC (2000) Stock Watering

Table C11 - Tier 1 Groundwater Criteria - Buildings and Structures
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
14808-79-8 Turb	Sulfate (as SO4)	Water	1000 mg/L	AS2159-2009 - Buildings and Structures
16887-00-6	Chloride	Water	6000 mg/L	

Table C12 - Groundwater Criteria - Remediation Criteria
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria (mg/L)								Source
			Potential Future Residents (slab-on-grade with unknown construction or multi-storey building)	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) *	Potential Future Commercial/Light Industrial Workers (low-rise slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers	
50-32-8	Benzo(a)pyrene	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	0.05	Not Volatile	Not Volatile	*Review of Site Specific Remediation Criteria 2025, Macquarie Point,* AECOM Australia Pty Ltd, 10 October 2025
91-20-3	Naphthalene	Water	2	3	7	12	28	6	Not Limiting	Not Limiting	
71-43-2	Benzene	Water	0.8	0.8	6	5	9	5	Not Limiting	Not Limiting	
108-88-3	Toluene	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	5500	Not Limiting	Not Limiting	
100-41-4	Ethylbenzene	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	1600	Not Limiting	Not Limiting	
1330-20-7	Xylenes (total)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	2800	Not Limiting	Not Limiting	
C6-C8-Aliph	TPH C6-C8 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	16,000	Not Limiting	Not Limiting	
C8-C10-Aliph	TPH >C8-C10 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	79	Not Limiting	Not Limiting	
C8-C10-Arom	TPH >C8-C10 (Aromatic)	Water	30	30	Not Limiting	Not Limiting	Not Limiting	360	Not Limiting	Not Limiting	
C10-C12-Aliph	TPH >C10-C12 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	40	Not Limiting	Not Limiting	
C10-C12-Arom	TPH >C10-C12 (Aromatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	190	Not Limiting	Not Limiting	
C12-C16-Aliph	TPH >C12-C16 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	67	Not Limiting	Not Limiting	
C12-C16-Arom	TPH >C12-C16 (Aromatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Volatile	Not Volatile	160	Not Limiting	Not Limiting	
Aliphatic>C16-C21	TPH >C16-C21 (Aliphatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	3,300	Not Limiting	Not Limiting	
CWG-ARE3	TPH >C16-C21 (Aromatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	94	Not Limiting	Not Limiting	
C21-C34-Aliph	TPH >C21-C34 (Aliphatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	3,300	Not Limiting	Not Limiting	
C21-C34-Arom	TPH >C21-C34 (Aromatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Limiting	Not Limiting	
C34-C40-Aliph	TPH >C34-C40 (Aliphatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	3,300	Not Limiting	Not Limiting	
C34-C40-Arom	TPH >C34-C40 (Aromatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Limiting	Not Limiting	
105-67-9	Dimethylphenol, 2,4-	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	1,300	Not Volatile	Not Volatile	
95-48-7	Methylphenol-2 (cresol, o-)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	4,300	Not Volatile	Not Volatile	
108-39-4	Methylphenol-3 (cresol, m-)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	4,200	Not Volatile	Not Volatile	
106-44-5	Methylphenol-4 (cresol, p-)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	4,300	Not Volatile	Not Volatile	
62-53-3	Aniline	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	890	Not Volatile	Not Volatile	
132-64-9	Dibenzofuran	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	8	Not Volatile	Not Volatile	
100-42-5	Styrene	Water	96	99	Not Limiting	Not Limiting	Not Limiting	160	Not Limiting	Not Limiting	
F1-BTEX	C6-C10 fraction (minus BTEX)(F1)	Water	30	30	Not Limiting	Not Limiting	Not Limiting	79	Not Limiting	Not Limiting	The minimum criteria for aliphatic/aromatic fractions have been adopted for broader TRH fractions
F2-NAPHTHALENE	>C10-C16 (minus Naphthalene)(F2)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	40	Not Limiting	Not Limiting	
C16-C34	>C16-C34 fraction	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Volatile	Not Limiting	
C34-C40	>C34-C40 fraction	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Volatile	Not Limiting	

Not Volatile - No Remediation Criteria has been adopted as the exposure pathway under this scenario is inhalation only
Not Limiting - The calculated Remediation Criteria exceeds the theoretical soil saturation limit and therefore unacceptable risks via vapour inhalation will not occur.

Appendix D

AECOM Standard Operating Procedures

Appendix D AECOM Standard Operating Procedures

Attached Standard Operating Procedures

Q4AN-EV-402 – Groundwater Well Development

Q4AN-EV-407 – Groundwater Sampling – Low Flow Pump

Q4AN-EV-414 – NAPL and Groundwater Gauging

FQM - Groundwater Well Development

Q4AN(EV)-402-PR1

1.0 Purpose and Scope

To develop groundwater monitoring wells appropriately to ensure a representative sample of the groundwater quality can be obtained, accurate aquifer parameters can be determined and/or to maximise well efficiency.

This Fieldwork Instruction (FI) describes the broad methodology for groundwater well development. The aim is to remove from the annulus, between the screen and hole wall, clays or compacted material resulting from the drilling operations, as well as the fine material from the water-bearing formation itself[1]. Well development is necessary to remove the finer grained material from the well screens and gravel pack that may otherwise interfere with water quality analyses, and to improve the hydraulic efficiency and characteristics of the gravel pack or hydrologic unit adjacent to the well screens. The methods of development may vary according to the physical characteristics of the hydrological units in which the monitoring well is screened and with the drilling method used. Well development may be undertaken by a variety of techniques, including the following:

- Bailing (see FQM Groundwater Sampling – Bailer – ANZ - ENV)
- Power Pack or Waterra Footvalve pumps (e.g. Waterra) with surge block (see FQM - Groundwater Sampling – Hydrasleeve – ANZ - ENV – in preparation)
- Suction pumps
- Airlifting (not to be used for groundwater monitoring wells)

The choice of well development method will depend upon factors such as the well design (diameter and depth), drilling technique and well purpose (production or monitoring).

2.0 References

a. ANZECC and National Health and Medical Research Council (NH&MRC) (January, 1992) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites

b. AS4482.1-2005 *Guide to the sampling and investigation of potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds*

c. AS4482.1-2005 *Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances*

d. EPA Publication 441 (*A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes).*

e. EPA Publication 669 *(Groundwater Sampling Guidelines)*, April 2000.

f. EPA Victoria, SEPP, Prevention and Management of Contamination of Land, State Government of Victoria, June 2002

g. National Environment Protection Council (NEPC) (December, 1999) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) Guideline on the Investigation Levels for Soil and Groundwater

h. NEPC, 2009. National Environmental Protection (Assessment of site contamination) Measure. Schedule B (2): Guideline on data collection, sample design and reporting. National Environment Protection Council, Canberra.

i. National Uniform Drillers Licensing Committee (NUDLC), Minimum Construction Requirements for Water Bores in Australia 2011 (3rd Edition February 2012).

j. FQM Photo-Ionisation Detector (PID) – ANZ - ENV Q4AN(EV)-003-PR1.

k. FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV Q4AN(EV)-004-PR1

l. FQM Groundwater Sampling Methodologies – ANZ - ENV Q4AN(EV)-405-PR1

[1] National Uniform Drillers Licensing Committee (NUDLC), Minimum Construction Requirements for Water Bores in Australia 2011 (3rd Edition February 2012).

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m. FQM Groundwater Sampling – Bailer – ANZ - ENV Q4AN(EV)-406-PR1.

n. FQM Groundwater Sampling – Low Flow Pump – ANZ - ENV Q4AN(EV)-407-PR1

o. FQM Groundwater Sampling – Peristaltic Pump – ANZ – ENV Q4AN(EV)-408-PR1

p. FQM Groundwater Sampling - Hydrasleeve – ANZ – ENV Q4AN(EV)-409-PR1 (in preparation)

q. FQM Groundwater Quality Measurements – ANZ – ENV Q4AN(EV)-410-PR1 (in preparation)

3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methods detailed in this Fieldwork Instruction. To ensure equipment is in good working order prior to use, is maintained according to supplier's advice and is appropriately calibrated or verified. Any faults shall be reported to the Project Manager or the equipment supplier as soon as they are identified.
Project Manager	The Project Manager (PM) is responsible for ensuring equipment used are fit for purpose and developing work scope and services to be delivered to a client within the designated timeline.
Regional SH&E Manager	The Regional Safety, Health and Environment (SH&E) Manager is an assigned person in each office and is responsible for reviewing and approving the project specific risk assessment (Project Safety Plan/Safe Work Method Statement), monitoring the implementation of SH&E Plans, interface with PMs in matters of health and safety, investigating reports of incidents or accidents and approving drilling contractors to undertake the proposed works.

4.0 Equipment and Materials

4.1 Equipment

All well development techniques require:

- Oil water interface probe or water level meter;
- Water Quality Meter (WQM); and
- Imhoff cone or white dish.

The specific equipment required for bailing and foot valve/surge block methods are outlined in the individual FIs for these techniques. The equipment required for airlifting includes:

- Compressor; and
- Airlines/tubing or drill rods.

Optional or supplemental equipment required to complete this task may include:

- Photo Ionisation Detector (PID);
- Lower Explosive Limit (LEL) Detector; and
- T-piece or diversion head.

4.1.1 Electronic Dip Meter

An electronic dip meter is suitable for the measurement of groundwater levels only. Where NAPL is expected or suspected to be present in groundwater wells an oil/water interface meter should be used. A short beeping sound is made when the electronic dip meter intersects the standing water level.

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4.1.2 Oil/Water Interface Meter

The oil/water interface probe should be used where LNAPL or DNAPL are expected or suspected to be present in the wells. The probe emits two different sounds for distinguishing the depth to NAPL (continuous tone) and the standing water level (short beeping). In the case of LNAPL, the continuous tone will occur typically before the beeping tone; with DNAPL, the continuous tone would occur towards the base of the well, after the beeping tone.

Additional equipment required for groundwater well development depends on the technique adopted. A discussion of the equipment required for bailing and Waterra pumping is provided in the individual work Instructions for these techniques. The following discussion refers to equipment required for well development using airlifting only.

4.1.3 Water Quality Meter

A water quality meter will typically comprise instrument probes to measure electrical conductivity (EC), pH, temperature, oxidation reduction potential (ORP) and dissolved oxygen (DO). When renting a water quality meter, the rental company should supply a calibration certificate indicating that the equipment has been cleaned, calibrated and is ready for use. The calibration sheet should be kept with the project notes, scanned and filed at the end of the field program. If calibration has not been undertaken, or there is no evidence of calibration, this will need to be completed prior to commencing fieldworks. Calibration of the water quality meter should also be undertaken weekly and should be recorded on calibration sheets (FQM Water Quality Meter Calibration Record – ANZ – ENV). Calibration solutions should be available onsite at all times to allow probe readings to be confirmed. This is particularly important if the readings appear to be erroneous compared to historical results, typical aquifer water quality or are unrealistic. Additional information on using and calibrating a water quality meter is found in FQM Groundwater Quality Measurements – ANZ - ENV.

4.1.4 Compressor

A compressor is typically supplied by the drilling contractor but may also be hired as a trailer mounted or portable system. When developing, a filter should be used to prevent volatile hydrocarbon gases produced by compressor operation from contaminating the compressed air which is injected into the well.

4.1.5 Drill rods

Air can be introduced to the groundwater bore by forcing it inside drilling rods. This is only possible where the drill rig is present on site. Drill rods are often used for development of deep bores to mitigate manual handling issues. Where hydrocarbon compounds are contaminants of interest associated with the groundwater, consideration should be made to the types of lubricants used on these rods i.e. silicon based rod grease or “chicken fat” should be used to lubricate rod threads, canola oil or similar should be used to lubricate rotary hammer bits.

4.1.6 Airlines / Tubing

Airlines usually take the form of poly pipe or HDPE. These need to be long enough to reach the bottom of the well, with extra length at the surface. The diameter of the pipe used will depend on availability of materials, depth to water, depth of bore and bore diameter. The poly pipe needs to be able to with stand high pressures caused by use of compressed air and have appropriate fittings to connect to the compressor. Before installation, the airlines should be checked for any blockages. Airlines are usually supplied by the drilling contractor.

4.1.7 Photo Ionisation Detector (PID)

Refer to FQM Photo-Ionisation Detector (PID) – ANZ - ENV, for applicability, operation and calibration of a PID.

4.1.8 Lower Explosive Limit (LEL) Detector

Refer to FQM Lower Explosive Limit (LEL) Detector – ANZ - ENV, for applicability, operation and calibration of a LEL.

4.1.9 T-piece or Diversion Head

A t-piece is usually made out of PVC and forms an “L” shape which forces groundwater to flow away from the bore. A diversion head is similar but often involves use of an end cap with a tap or outlet to divert water from the bore. This will usually be made and supplied by the drilling contractor. These methods are ways to control the normally violent expulsion of water during airlifting. Where contamination (including high salinity) is a concern, this allows groundwater to be diverted into an appropriate container (lined pit or IBC) and collected for offsite disposal.

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4.2 Materials

Materials and consumables that may be required to complete this task include:

- Buckets
- Potable water
- Phosphate free detergent (e.g. Decon 90)
- Deionised water
- Scrubbing brush
- Paper towels
- Liquid contaminated waste container
- Spray bottle for deionised water
- Solid contaminated waste bags
- Alcohol wipes
- Steel brush

5.0 Background

The purpose of groundwater well development is to:

- Remove any drilling fluids (water or mud) introduced into the aquifer during drilling;
- Stabilise the gravel filter pack; and
- Ensure groundwater obtained during sampling events is representative of groundwater from the aquifer.

Well development should be vigorous enough to ensure these objectives are met, but not so vigorous as to cause any damage to the bore.

Groundwater well development should be undertaken as soon as practical following well installation i.e. once grout has set.

Observations made during well development can assist in determining groundwater sampling rates and techniques and flow rates for aquifer testing purposes.

Groundwater levels and chemistry should be allowed to stabilise for at least 1 week prior to water level measurement, aquifer testing or water quality sampling.

Groundwater bore volumes involve talking into account the volume of water in the well and the volume of water in the filter pack, as per the following equation:

$$V = ((\rho \times \pi (R_1^2 - R_2^2) \times h) + (\pi \times R_2^2 \times h)) \times 1000$$

V = bore volume (L)

ρ = porosity of filter pack (assumed to be approximately 0.2)

R_1 = Radius of borehole (half of drilling bit diameter) (m)

R_2 = Radius of casing (half internal casing diameter) (m)

h = Water column (depth of well – depth to water) (m)

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The following table provides an indication of approximate multiplication factors to be used when calculating bore volumes (L) for typical groundwater bore installations by the following equation:

V = MP x (depth of well – depth to water)

Table 1 Multiplication Factors to be used when calculating bore volumes for typical casing and borehole diameters

	Casing Diameter (mm)								
Bore Diameter (mm) (approximate inches)	32	50	100	125	150	175	200	225	250
100 (4'')	2.2	3.1	-	-	-	-	-	-	-
125 (5")	3.1	4.0	8.7	-	-	-	-	-	-
150 (6")	4.2	5.1	9.8	13.4	-	-	-	-	-
175 (7")	5.5	6.4	11.1	14.6	19.0	-	-	-	-
200 (8")	6.9	7.9	12.6	16.1	20.4	25.5	-	-	-
225 (9")	8.6	9.5	14.2	17.8	22.1	27.2	33.1	-	-
250 (10")	10.5	11.4	16.1	19.6	24.0	29.1	35.0	41.6	-
275 (11")	12.5	13.5	18.2	21.7	26.0	31.1	37.0	43.7	51.2
300 (12")	14.8	15.7	20.4	24.0	28.3	33.4	39.3	46.0	53.4
325 (13")	17.2	18.2	22.9	26.4	30.7	35.8	41.7	48.4	55.9
350 (14")	19.9	20.8	25.5	29.0	33.4	38.5	44.4	51.1	58.5
375 (15")	22.7	23.7	28.4	31.9	36.2	41.3	47.2	53.9	61.4

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6.0 Fieldwork Instruction

(PRINT THIS SECTION FOR USE IN THE FIELD)

This section details the step by step processes for completing the task and should accompany AECOM field personnel in the field. Any variations to this Fieldwork Instruction required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

Note that if samples are to be collected for the analysis of Per- and Polyfluoroalkyl Substances (PFAS) additional equipment and clothing restrictions must be provided by the Project Manager.

Olfactory assessment (smelling) of groundwater shall not be undertaken due to the potential for atmospheric hazards of unknown type and concentration to be present. Only ambient odours should be recorded.

6.1 Decontamination

Any equipment placed into a groundwater well for development purposes shall be decontaminated prior to use and between each groundwater well location by the following procedure.

- Scrub the equipment with a stiff steel brush to remove excess dirt prior to decontamination. Collect the dirt over a waste bag and dispose in the bag. Wipe the equipment using disposable alcohol wipes. Dispose of the alcohol wipes into a contaminated waste bag.
- Aggressively wash the equipment using a plastic scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable, e.g. Decon 90).
- Rinse the equipment with potable water over another bucket and collect the rinse water for later disposal as contaminated waste.
- Rinse the equipment with deionised water (spray this over it generously with a plastic spray bottle) over a bucket for later disposal as contaminated waste. The deionised water should preferably be supplied by the laboratory with a batch number for traceability.
- The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product on the probe after rinsing or sheen in the wash solution buckets.

Where equipment is large and cumbersome such as drilling rods used for development, this equipment should be decontaminated prior to installation in the well, between each location and at the end of the well development program. Decontamination should involve:

- Removing large soil fragments from the equipment using a steel brush or by scraping. Any contaminated dirt should be collected over a waste bag or bund and disposed of in bags or contaminated waste drums.
- The equipment should be washed with high pressure potable water, preferably with a solution of potable water and detergent (phosphate free and biodegradable, e.g. Decon 90).
- High pressure potable water should be used for a final rinse of the equipment. The water used for decontamination purposes should be collected in a bunded area (either permanent or portable) and pumped into a liquid container for disposal offsite as a contaminated liquid.

6.2 Groundwater Well Development

6.2.1 Methods

The most often used methods of well development include mechanical surging and bailing for pumping, over pumping, airlift pumping and jetting. An important factor in any method is that the development work be started slowly and gently and increased as the well is developed. Most methods of well development requires the application of sufficient energy to disturb the gravel pack, thereby freeing the fines and allowing them to be drawn into the well. The coarser fraction settles and stabilizes the surrounding foundation.

When an air compressor is used, it should be equipped with an oil air filter or oil trap to minimize the introduction of oil into the well. The use of vegetable based oils should be considered if required of the contractor.

The well development method employed should be more vigorous than the proposed sampling method. However, development procedures for wells completed in fine sand and silt strata should involve methods that

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are relatively gentle so the strata material will not be incorporated into the gravel pack. Vigorous surging during development can produce mixing of the fine strata and gravel pack and produce turbid samples.

Development methods should be carefully selected based on the potential contaminants present, the quality of waste water generated, and the requirements for containment and treatment of waste water. The specific methods include:

- Mechanical surging – water is forced to flow into and out of the well screens by operating a plunger or surge block, or bailer up and down in the well casing. A pump or bailer should then be used to remove dislodged sediments from the well (the use of a Waterra foot-valve pump in small diameter well screens can in itself have a mechanical surging effect)
- Air lift pumping – an air lift pump is operated by cycling the air pressure on and off for short periods of time. This operation will produce a surging action that will dislodge fine-grained particles. Applying a steady, low pressure will remove the fines that have been drawn into the well by the surging action. Efforts should be made to avoid pumping air into the gravel pack and adjacent unit as the air may inhibit future sampling efforts or alter ambient water chemistry. High pressure should be avoided to prevent damage to small diameter PVC casings, screens and gravel packs. The sudden evacuation of water stored in the casing by airlift will create substantial hydrostatic imbalance between the formation and inside of the casing which may lead to screen collapse and failure.
- Over pumping – a submersible pump is used to stress the formation and force water out the formation from a larger radius than would otherwise be affected.

6.2.2 Generic Step – by Step

This step provides the methodology for general well development. Details of bailing and foot valve pump techniques are outlined in the individual work instructions indicated in Section 2 above. Short, general description of the mechanics of development (keywords: gentle start, dislodging sediment, surging action etc.).

1. The wells least likely to be contaminated should be targeted first so as to minimise any potential cross – contamination between wells.
2. Appropriate air monitoring for gases and volatile compounds should be undertaken (PID, LEL, landfill gas) prior to commencing and throughout the course of the well development where applicable.
3. -Standing water levels and total depth of the well should be measured using an oil water interface probe or water level meter. This is used to calculate groundwater bore volumes.
4. The chosen development apparatus should be installed into the well (bailer, airlifting lines, waterra tubing). Using the chosen development method, water should be removed from the well and contained in the appropriate containers for disposal. This may involve collecting water into a bucket or jerry can during bailing or waterra. When airlifting is being used, removed groundwater can be diverted via a T-piece or diversion head into an IBC. Where groundwater contamination, including elevated salinity levels, is not of concern, groundwater may be disposed of to ground with appropriate environmental considerations and approvals.
5. Water quality parameters (pH, EC, DO, ORP and temperature) should be measured and observations of colour, turbidity and odour made periodically during the well development. This should be recorded on the FQM Groundwater Sampling and Purging Record – ANZ – ENV . For bailing, suction pump and foot valve/surge block methods, water quality readings should be collected at the same rates as for groundwater sampling using these methods (outlined in FQM Groundwater Sampling – Bailer – ANZ - ENV and FQM Groundwater Sampling - Hydrasleeve – ANZ - ENV [in preparation]). When using airlifting, water should be collected in a bucket and quality readings should be taken and recorded every half an hour.
6. During development using waterra or airlifting, the groundwater flow rate should be estimated. This can be undertaken by allowing water to flow into a bucket which has volumetric markings and recording the time taken to fill a pre-determined volume using a stopwatch. This reading can then be converted to L/sec or L/min flow rate measurements. Flow rates should be measured periodically throughout the development process and recorded on the development records.
7. In general, well development should continue until a minimum of 2 bore volumes have been removed from the well. After 2 bore volumes have been removed, development should continue until water quality readings have stabilised (see FQM Groundwater Quality Measurements – ANZ - ENV [in preparation] for discussion on collecting water quality readings) Under the following scenarios, it is necessary to remove additional volumes of groundwater:

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- Where water has been used during drilling, an estimation of the water used should be made and this volume should be removed from the well as a minimum.
- Where bores are to be used for a production purposes, groundwater development should continue until less than 5 mg of sand sized particles are obtained for 1000L of groundwater or until no sand or silt is produced for an hour (NUDLC 2012).

8. Well development will begin after the monitoring well is completely installed and before water sampling. Development will be continued until representative water free of the drilling fluids, cuttings and other materials introduced during well construction is obtained. Representative water quality is assumed to be obtained when the pH, temp, and EC readings stabilise and the water is visually clear of suspended solids. The minimum duration of well development will vary with the method used to develop the well and with the nature of the aquifer material.
9. The method employed and results of the water quality parameters (pH, EC, DO, ORP and temperature) should be measured and observations of colour, turbidity and odour made periodically during the well development. This should be recorded on well development sheets (FQM Groundwater Sampling and Purging Record – ANZ – ENV). For bailing, suction pump and foot valve/surge block methods, water quality readings should be collected at the same rates as for groundwater sampling using these methods (outlined in FQM Groundwater Sampling – Bailer – ANZ - ENV and FQM Groundwater Sampling - Hydrasleeve – ANZ – ENV [in preparation]). When using airlifting, water should be collected in a bucket and quality readings should be taken and recorded every half an hour.
10. No time limit to development, although should be discussed with PM
11. Where mud has been used as a drilling fluid it is essential to break down the wall cake and remove the drilling mud used. Development of mudded holes should be continued until a significant reduction in groundwater turbidity is observed and groundwater parameters have stabilised.
12. Following development, the standing water level and total depth of the well should be measured and recorded for comparison to the original readings. Development may remove sediment from the base of the well so that it appears to be “deeper”.
13. Groundwater produced during development should be collected into drums or IBCs if it is considered to be potentially contaminated. The drums shall be appropriately labelled and stored in a secure location prior to collection and disposal by a licensed waste contractor.
14. If applicable, measure the concentration of vapours exiting the well using a PID by placing the intake nozzle above the well casing. Record the highest concentration measured by the PID in FQM Groundwater Sampling and Purging Record – ANZ - ENV.
15. Slowly lower the measurement probe down the well until the probe intersects groundwater.
16. Measure the depth to groundwater in metres (to two decimal places) from the measurement tape by holding the tape next to the top of casing. The top of casing may be the highest point on the well casing or a point that was previously marker on the casing for surveying.
17. Confirm the measured depth to groundwater by repeating Sections 5.2.11 to 5.2.12 until three consistent measurements are taken (i.e. ±0.01 m). Record the depth to groundwater in FQM Groundwater Sampling and Purging Record – ANZ - ENV.
18. Measure the total depth of the well by turning off the measurement probe and lowering the probe to the bottom of the well. This is usually determined by the point where there is no tension on the measurement tape.
19. -Measure the total depth of the well in metres (two decimal places may be sufficient) by holding the measurement tape next to top of casing. Record the total well depth in FQM Groundwater Sampling and Purging Record – ANZ - ENV.

7.0 Troubleshooting

I have purged 3 bore volumes from the bore but the groundwater parameters have not stabilised

Water quality parameters may not always stabilise within the realistic time frame of development. This may reflect aquifer heterogeneity.

Airlifting is only producing very small flow rates of groundwater to surface or is not being lifted out of the bore

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This may reflect a short static water column and slow groundwater recharge. It is possible to place two pieces of poly pipe inside each other and inject air into the thinner diameter piece. The large piece acts to restrict the “diameter of the bore” and forces water to the surface. However, this will produce water at a low flow rate. While this method will allow removal of water, it will be very slow and may not develop the bore to maximum efficiency.

I have been developing a bore for hours but it is still generating sand sized particles.

This may require an assessment of the original geology and bore construction. This should be completed in consultation with the PM or PiC. Sand may be produced where a borehole has been left open (not screened and cased), due to damaged casing/screen, shifted filter pack, or if the screen/filter pack used was not of an appropriate aperture/size.

8.0 Records

a. FQM Groundwater Well Development Form – ANZ – ENV Q4AN(EV)-402-FM1

b. FQM Groundwater Sampling and Purging Record – ANZ – ENV Q4AN(EV)-405-FM1

c. FQM Water Quality Meter Calibration Record – ANZ – ENV Q4AN(EV)-410-FM1

9.0 Change Log

Rev. #	Revision date	Affected sections	Description of change
1	2-May-2016	All	Conversion to AECOM Australia Pty Ltd.
2	1-Sep-2021	Sections 3, 6 and 8	Cautionary note. References update.

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FQM - Groundwater Sampling - Low Flow Pump

1.0 Purpose and Scope

To instruct field staff on how to collect representative site-specific groundwater samples from the aquifer formation, with minimal disturbance to the water column.

This Field Instruction (FI) describes the methodology for the collection of groundwater samples using a bladder pump (low flow technique). This procedure should be read in conjunction with the following Australian/New Zealand Standards:

- AS NZS 5667.1.1998 – Water Quality Sampling – Part 1 Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples; and
- AS NZS 5667.11,1998 – Water quality - Sampling guidance on sampling of groundwaters.

2.0 References

a. Standards Australia/New Zealand 1998, AS/NZ 5667.1:1998 Water Quality – Sampling, Part 1: Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples, Standards Australia, NSW.

b. Standards Australia/New Zealand 1998, AS/NZ 5667.11:1998 Water Quality – Sampling, Part 11: Guidance on Sampling of Groundwaters, Standards Australia NSW.

c. EHP Queensland, 2009. Monitoring and Sampling Manual 2009, Version 2, July 2013 format edits. Department of Environment and Heritage Protection. State Government of Queensland.

d. EPA Victoria, 2000. Publication 669: Groundwater Sampling Guidelines. Environment Protection Authority. State Government of Victoria.

e. National Environment Protection Council (December, 1999) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) (as amended 2013).

f. Puls, R.W. and Barcelona, M.J. 1996, 'Low flow (minimal drawdown) ground-water sampling procedures', EPA Ground Water Issue, EPA/540/S-95/504, Washington.

g. Sundaram, B., Feitz, A., Caritat, P. de, Plazinska, A., Brodie, R., Coram, J. and Ransley, T., 2009. Groundwater Sampling and Analysis – A Field Guide. Geoscience Australia, Record 2009/27 95pp.

h. US EPA, 1996. Low stress (low flow) purging and sampling procedure for the collection of ground water samples from monitoring wells, Revision 2.

i. FQM Photo-Ionisation Detector (PID) – ANZ - ENV Q4AN(EV)-003-PR1.

j. FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV Q4AN(EV)-004-PR1.

k. FQM Groundwater Monitoring Well Installation – ANZ - ENV Q4AN(EV)-401-PR1.

l. FQM Groundwater Well Development – ANZ - ENV Q4AN(EV)-402-PR1.

m. FQM Groundwater Level Gauging – ANZ - ENV Q4AN(EV)-403-PR1.

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3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methods detailed in this FI. To ensure equipment is in good working order prior to use, is maintained according to supplier's advice and is appropriately calibrated or verified, have a basic understanding of common faults and field based repairs. Any faults shall be reported to the Project Manager (PM) or the equipment supplier as soon as they are identified. To ensure Quality Assurance/Quality Control and Health and Safety Compliance.
Project Manager	Define the objectives and appropriate methodology to field staff prior to mobilisation into the field. The Project Manager should check (or designate another to check) the gauging data recorded by the fieldwork staff for anomalies such as measurements inconsistent with historical groundwater level fluctuations or well construction records. To ensure Quality Assurance/Quality Control and Health and Safety Compliance.
Regional SH&E Manager	The Regional Safety, Health and Environment (SH&E) Manager is one of the assigned person and is responsible for reviewing and approving the project specific risk assessment (e.g. Project Safety Plan/Safe Work Method Statement), monitoring the implementation of project specific risk assessment plans, interface with project managers in matters of safety, health and environment, and investigating reports of incidents or accidents.

4.0 Equipment and Materials

4.1 Equipment

Equipment required to complete this task includes:

- Low Flow (Bladder) Pump Casing;
- Wire hanger;
- Control Box;
- Compressor (Air or CO_2 Gas cylinder, Regulator and Hose);
- Water Quality Meter and Flow-through-cell; and
- Oil-water Interface Meter or Electronic Dip Meter drawdown meter.

Optional or supplemental equipment:

- Lower Explosive Limit (LEL) Detector; and
- Photo Ionisation Detector (PID).

For remote sites consideration should be given to providing a backup set of equipment, if the cost of remobilization is high, and there is no access to technical repair facilities.

4.1.1 Water Level Meter

A water level meter, also called electric dip meter, is used to measure the depth to standing water. Where Non Aqueous Phase Liquid (NAPL) is expected or suspected to be present in groundwater wells an oil/water interface meter should be used. A beeping sound is made when the electronic dip meter intersects the standing water level.

4.1.2 Drawdown Meter

A drawdown meter works differently to a water level meter: it makes a beeping sound when exposed to air and is silent in water. The probe should be locked in place in the water column above the pump inlet approximately 10 cm below the pre-pumping water level. As the water level drops during pumping the probe will beep when it is exposed to air. The probe can then be lowered until the beeping stops and the process repeated. The water levels will be recorded against time during the pumping on the field sheets.

4.1.3 Oil/Water Interface Meter

The oil/water interface probe should be used where Light Non Aqueous Phase Liquid (LNAPL) or Dense Non Aqueous Phase Liquid (DNAPL) are expected or suspected to be present in the wells. The probe emits two different sounds for distinguishing the depth to NAPL (continuous tone) and the standing water level (short beeping). Because LNAPL floats on top of water, the continuous tone will occur typically before the beeping tone;

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with DNAPL, the continuous tone would occur towards the base of the well, after the beeping tone of the water column. As the water level drops during pumping the probe will stop beeping when it is exposed to air. The probe can then be lowered until the beeping starts to gauge water level and the process repeated. The water levels will be recorded against time during the pumping on the field sheets.

4.1.4 Water Quality Meter

A water quality meter will typically comprise instrument probes to measure electrical conductivity (EC), pH, temperature, oxidation reduction potential (ORP) and dissolved oxygen (DO). Common water quality meters include YSI and TPS FLMV. When renting a water quality meter, the rental company should supply a calibration certificate indicating that the equipment has been cleaned, calibrated and is ready for use. Ensure that a flow-through cell is included with the water quality meter.

4.1.5 Low Flow Pump Casing/Wire Hanger

Casing which is lowered down the well to pump groundwater. Holds the bladder that is used to pump water, one bladder is used per well and replaced during decontamination. The pump is connected to both the discharge line and airline. Both these lines must be securely in place with a tight seal for the pump to work properly. The pump contains o-rings that must be checked each time before the pump is used, for if one is missing or worn the pump will not operate properly.

A wire cable/hanger is connected to the pump from the surface, to hold the pump in place as a safe guard to stop it falling down the well. The D-bolt on the hanger should be checked between each well during the decontamination process to prevent it from loosening and dropping the pump down the well.

4.1.6 Low Flow Control Box

Used to control the rate at which water is pumped (Cycle per Minute) and the pressure that the water is pumped out of the well. The control box (shown in **Figure 1)** may contain a compressor or is connected to the gas cylinder through the hose and regulator, and also the pump through the air line. Low flow controller may be connected via 12v cables to a battery.

Figure 1 Low Flow Control Box

4.1.7 Compressor, Gas Cylinder, Regulator & Hose (if required)

CO_2 gas cylinder can be used to pump groundwater. This is connected to a regulator and regulator is connected to the hose.

Note the pressure on the gas bottle. A full gas bottle should read 5,000 kpa (1,900 psi), and will allow you to sample approximately 20 wells (varying with well depth). If the bottle reads 500 kpa or less it should be marked empty and replaced.

Compressors can be either battery powered or powered using a combustion engine, make sure the pressures are appropriately controlled and that a clear knowledge of operation and the HSEP reflects compressor use prior to mobilization.

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4.1.8 Photo Ionisation Detector (PID)

Refer to FQM Operating a Photo-Ionisation Detector (PID) – ANZ – ENV , for applicability, operation and calibration of a PID.

4.1.9 Lower Explosive Limit (LEL) Detector

Refer to FQM Operating a Lower Explosive Limit (LEL) Monitoring – ANZ - ENV, for applicability, operation and calibration of a LEL.

4.2 Materials

Materials and consumables that may be required to complete this task include:

- Appropriate Buckets (based on COPC)
- Potable water
- Phosphate free detergent (e.g. Liquinox, **do not use Decon 90**)
- Deionised water
- Scrubbing brush
- Paper towel
- Alcohol Wipes
- Waste water container (e.g. jerry can)
- Laboratory supplied sampling containers
- Laboratory supplied rinstate water
- Garbage bags
- Field book
- Permanent markers
- Duct tape
- Nitrile gloves
- Hex keys
- Tools for opening well gatic (e.g. hammer, screw driver)
- Spare o-rings and hex bolts
- Scissors/Tube Cutters
- Funnel
- Tubing – Air & Discharge line (enough metres for all wells include spares)
- Esky/cool box
- Ice/ice blocks
- Low-flow bladders (1 per well with spares)
- Adjustable spanner
- Permanent markers and pens
- Stericup Filters or in-line filters (if required for COPCs)
- Hand pump (if Stericup filters are used);

5.0 Background

The objective of groundwater sampling is to obtain water samples that best represent natural undisturbed hydrogeological conditions. Low flow sampling is one of the techniques used to achieve this. It works by lowering the pump to a specified depth in the bore screen, thus pumping water coming into the bore from the aquifer, to achieve representative samples of the aquifer with minimal disturbance to the standing water in the well.

Before commencing low flow sampling, some important factors should be considered including, the method used historically on the site for sample collection. The groundwater characteristics may take some time to stabilise after installation and development of new wells. Refer to FQM Groundwater Monitoring Well Installation – ANZ - ENV and FQM Groundwater Well Development – ANZ - ENV for further information regarding the monitoring well installation and development.

Pumping should be done in a manner that minimises stress (drawdown) to the system to the extent practical.

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6.0 Fieldwork Instruction

(PRINT THIS SECTION FOR USE IN THE FIELD)

Any variations to this Fieldwork Instruction required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

Note that if samples are to be collected for the analysis of Per- and Polyfluoroalkyl Substances (PFAS) additional equipment and clothing restrictions must be provided by the Project Manager.

Olfactory assessment (smelling) of groundwater shall not be undertaken due to the potential for atmospheric hazards of unknown type and concentration to be present. Only ambient odours should be recorded.

6.1 Decontamination

The equipment (low flow pump/interface probe) shall be decontaminated prior to use and between sampling each surface sample location by the following procedure.

1. Wipe the probe and measuring tape (the length that comes into contact with groundwater) using disposable alcohol wipes. Dispose of the alcohol wipes into a contaminated waste bag.
2. Empty pump bladder and leftover groundwater in waste water container using a funnel.
3. Wash the low flow pump, suspension wire, probe and associated tape using a scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable).
4. Rinse the low flow pump, probe, wire and tape with potable water in another bucket.
5. Final rinse of all apparatus using deionised water in a spray bottle/bucket or directly from the deionized water container.
6. The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product on the probe after rinsing or sheen in the wash solution buckets.

6.2 Low Flow Groundwater Sampling

- YSI model WQMs should be turned on 30 minutes before sampling to allow sensors to stabilise. Ensure protective covers are removed from probe;
- Check the pressure on the gas cylinder – a full cylinder should read initially on the regulator 5000 kpa; and
- Check for leakage of CO_2 or air in the system, if identified immediately turn off CO_2/compressor and undertake repair/change equipment with apparatus isolated and de-energized.

1. The wells on the site least likely to be contaminated should be targeted first so as to reduce the risk of potential cross contamination between sample locations.
2. (If using CO_2) Connect gas cylinder/compressor to regulator, the regulator to hose and the hose to the control box.
3. Turn on the gas/start compressor, control box and Water Quality Meter (WQM).
4. Ensure pump casing and hanger cable have been decontaminated. Install new disposable bladder in pump, check o-rings are all in place correctly and undamaged. Connect hanger cable to pump casing, ensuring d-bolt is tightly secured.
5. Connect the tubing line to the pump casing, discharge line (larger diameter) and air line (thinner diameter). If using twin tubing (joined tubing), ensure the excess glue has been removed from tubing line using scissors or tube cutters before connecting to pump and controller to prevent damage to inlets and o-rings. Once connected pull on the tubing to test they are secure.
6. Open the monitoring well cover by (a) unlocking the flush mount well gatic with a hex key or (b) lifting the hinge lid on the monument/stick up well cover or (c) removing the lid on any other well cover as required (e.g. quarter turn well covers).

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Monitoring well covers can cut / injure hands. Use cut resistant gloves to open well covers. Be careful for wells with positive pressure (such as landfill leachate bores that could pop off the loosened well cap. Keep body parts clear of well when opening).

Biological hazards (e.g. spiders, ants) may be present within gatic covers, exercise caution when opening wells. Wear gloves and remove cobwebs before placing hands into the well.

7. Remove the well cap (e.g. J-plug), PVC end cap, torque cap.

High concentrations of vapours can build up in the well and be released into the breathing zone when the well cap is removed. Implement appropriate work space monitoring (e.g. LEL, PID, colorimetric gas detection tubes) and HSE procedures (e.g. maintain appropriate fire extinguishers in work area) prior to removal of well cap.

8. Measure the SWL in the well with the interface probe. This depth will be taken as the original SWL on your purging sheet.

Wells should be gauged prior to the commencement of any sampling, where possible.

9. Lower pump into well slowly to avoid water column disturbance (pump should not be lowered to the bottom of well as this could cause resuspension of solids which will have collected at the bottom of the well). Lower tubing and wire carefully together to prevent tangling which can lead to the pump becoming lodged in the well. Review each well completion log to select the depth to which the pump inlet will be set. The pump should be positioned dependent on the contaminant of concern or to target high permeability zones. Where this is not known, the pump inlet should be located approximately in the middle of the screened interval so as not to disturb the bottom of the well and allow for sufficient water above the pump. Ensure the hanger cable is tight and that the cable reel has been locked in place. The depth of the pump inlet can be measured by using the interface probe / water meter to measure the depth to the top of the pump. Record depth to pump on purging sheet.

10. Attach the tubing airline to the control box (see **Figure 1**). Attach discharge line (larger diameter) to the flow cell in the bottom outlet to allow flow cell to fill with water before discharge. Place flow cell into a bucket to ensure overflow from discharge is contained.

11. Remeasure the SWL in the well, or use the drawdown meter to monitor any drawdown during pumping.

The difference in depth between the SWL recorded before the pump was lowered into the well and after will give a rough estimate of how quick the well will recharge if no historical data is available (the larger the difference in depths the slower the recharge as a general rule).

12. Measure depth to top of pump and record as purging depth on purge sheet. If this is not possible i.e. in wells with a diameter greater than 50 mm, an estimate can be made.

13. For CO_2 setup - Set the air pressure on the gas cylinder regulator and control box throttle to required pressure. Using the formula Purging Depth (1 metre = 1 psi) + 10 psi = Air Pressure e.g. 15m depth = (15x1) +10 = 25. The pressure should be slightly greater on the gas cylinder regulator compared to the control throttle. Watch the rate at which water is discharged and adjust pressure as necessary.

Review previous sampling sheets to obtain an idea of the appropriate pumping rate. Set the controller to the estimated flow rate or if unknown start on 100 ml/min (CPM 1). One cycle yields approximately 100 ml of water. Groundwater flow should be between 0.1-0.4 L/ min.

14. For O_2 setup – set the fill and discharge times. Discharge times are the time it takes to squeeze the bladder and fill time is the time allowed for the bladder to refill. Fill and discharge rates depend on hydrostatic pressure (i.e. water above the pump). The airline pressure gauge should not exceed the equivalent depth to water 1 PSI = 0.7 m of water.

Review previous sampling sheets to obtain an idea of the appropriate flow rate. If discharge falls off before the discharge cycle is complete, the discharge time can be lowered. If drawdown is significant, fill time can be increased.

15. Start the pump. Allow purged water to overflow (into a container) the flow-through cell before starting to take water quality parameter readings and standing water level readings, once this occurs take readings every three minutes (where sampling rate is 100ml/minute or more) or five minutes (if flow rate is less than 100ml/minute).

16. Fill in data on CPM or fill/discharge rate, SWL readings and water quality parameters on the field purging sheet.

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The drawdown should not exceed 10 cm difference from the original SWL at any time. However it is more important that the groundwater quality parameters stabilise before sampling. If the drawdown is dropping continuously lower the flow rate to see if the SWL will stabilise. Once the SWL stabilises wait for three successive stable parameter readings before sampling (at 3 to 5 minute interval between each successive reading).

If you are still getting drawdown with the very low pump rates, contact PM for advice.

17. Once field parameters have stabilised samples can be collected (a minimum of 1 L of groundwater should be removed prior to sampling). The water quality parameters are considered stable when for three successive readings the parameters are within the following: ±10% Dissolved Oxygen; ±3% Electrical Conductivity; ±0.05 pH; ±10 mV Redox Potential; and ±0.2°C Temperature. Pay attention to water quality parameters and check that readings are as expected based on site knowledge and chemistry. Issues often occur with WQMs. Parameters can also be easily recorded incorrectly if the wrong units or parameter is referenced. Taking time to set-up WQM display screen with the required parameters and units may help as parameters that are not recorded (e.g. salinity) are not displayed. Contact PM and/or equipment supplier if unsure of readings or experiencing issues with WQM.

Record all purging and sampling details on the FQM Groundwater Sampling and Purging Record – ANZ - ENV.

If water quality parameters have changed significantly since last GME call the PM.

18. Maintain the same pumping rate for sampling. Disconnect the pump's tubing from the flow-through-cell so that the samples are collected from the pump's discharge tubing. Air pressure on the gas cylinder can be turned down so samples can be filled with minimal turbulence (if applicable).
19. Fill samples over a bucket/basin to minimise spillage.
20. Store samples in esky with sufficient ice or ice bricks. Ice should form a bed beneath samples and cover samples. Glass vials and bottles should be stored in bubble wrap and eskies should not be over-filled.
21. Turn the controller off. Remove the pump from the monitoring well. Decontaminate the pump and probe following steps decontamination steps in section **6.1** and dispose of the tubing, bladder and other waste. The flow-through cell doesn't need to be rinsed between wells (unless a sheen, strong hydrocarbon odour or sediment is noticed to keep it in good working condition). Water quality sensors should be rinsed with tap water.

- If SWL varied during purging, measure the SWL after sampling to ensure that levels did not exceed 10 cm difference from the original SWL.
- If this is the last well for the day, or before a break, the gas line should be turned off and de-pressurised before leaving by turning the gas off at the cylinder and running the controller through one or two cycles. All caps should be replaced on the WQM.

22. Replace cap on well, lock gatic. Check area for anything left behind before leaving.

7.0 Troubleshooting

a. **Water isn't discharging from the pump:**

1. Check gas bottle is not empty/compressor is operating.
2. Check air pressure gauges on the gas bottle and controller are at appropriate levels (if applicable).
3. Re-connect air hose to compressor to ensure there isn't a leak.
4. Remove pump from well.
5. Check water and air lines connecting pump to ensure there isn't a leak.
6. Check o-rings are in place in pump; replace any worn o-rings.
7. Check bladder hasn't broken and is in good condition.
8. Decontaminate or clean pump and inlet to remove sediment.

b. **There are air bubbles (observed audibly from the well head) in the water discharge tube:**

1. O-rings are missing or worn, check and replace if needed.

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2. Air line connecting to pump is leaking causing water bubble in discharge line, re-connect both air and water tubes connecting to pump.
3. Bladder is missing or not sealed.

c. **The water level keeps fluctuating up and down rapidly:**

1. O-rings are missing or worn, check and replace if needed.
2. Air line connecting to pump is leaking causing water to bubble in well, re-connect both air and water tubes connecting to pump.
3. Bladder is missing or not sealed.

8.0 Records

a. FQM Groundwater Sampling and Purging Record – ANZ - ENV Q4AN(EV)-405-FM1.

9.0 Change Log

Rev. #	Revision date	Affected sections	Description of change
1	2-May-2016	All	Conversion to AECOM Australia Pty Ltd.
2	1-Sep-2021	Sections 3, 6, 8	Cautionary note References update

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FQM - NAPL and Groundwater Level Gauging

Q4AN(EV)-414-PR1

1.0 Purpose and Scope

To obtain accurate and representative measurements of non-aqueous phase liquid (NAPL) levels and groundwater levels in groundwater monitoring wells.

This Fieldwork Instruction describes the methodology for gauging light (floating on groundwater) non-aqueous phase liquid (LNAPL) levels, dense (sinking in groundwater) non-aqueous phase liquid (DNAPL) levels and groundwater levels in monitoring wells.

This document is applicable to the measurement of groundwater levels only using an oil/water interface probe and should be used in preference to FQM Groundwater Level Gauging – ANZ - ENV for investigations at sites that may have NAPLs present in the subsurface.

2.0 References

a. Clements, L., Palaia, T. & Davis, J., 2009. Characterisation of site impacted by petroleum hydrocarbons: National guideline document, CRC CARE Technical Report no. 11, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

b. EPA South Australia, 2007. EPA Guidelines: Regulatory monitoring and testing, Groundwater sampling. Environment Protection Authority. State Government of South Australia.

c. EPA Victoria, 2000. Publication 669: Groundwater sampling guidelines. Environment Protection Authority. State Government of Victoria.

d. ISO, 2005. International standard. ISO 21413:2005(E). Manual methods for the measurements of a groundwater level in a well. International Organization for Standardization. Geneva, Switzerland.

e. NEPC, 20092013. National Environmental Protection (Assessment of site contamination) Measure. Schedule B (2): Guideline on data collection, sample design and reporting. National Environment Protection Council, Canberra.

f. NSW DEC, 2007. Guidelines for the Assessment and Management of Groundwater Contamination. March.

g. Sundaram, B., Feitz, A., Caritat, P. de, Plazinska, A., Brodie, R., Coram, J. and Ransley, T., 2009. Groundwater Sampling and Analysis – A Field Guide. Geoscience Australia, Record 2009/27 95 pp.

h. FQM Photo-Ionisation Detector (PID) – ANZ - ENV Q4AN(EV)-003-PR1.

i. FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV Q4AN(EV)-004-PR1.

j. FQM Groundwater Level Gauging – ANZ - ENV Q4AN(EV)-403-PR1.

k. FQM NAPL Sampling – ENV – ANZ Q4AN(EV)-415-PR1 (in preparation)

3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methodology detailed in this Fieldwork Instruction. To ensure equipment is in good working order prior to use and is maintained according to supplier's advice. Report all anomalies to the Project Manager or the equipment supplier as soon as they are identified. Maintain accurate fieldwork data and observation records and provide to the Project Manager for review and filing in the project central file.
Project Manager	Define the task objectives and provide all relevant information to field staff prior to mobilisation into the field. The Project Manager should check (or designate another to check) the gauging data recorded by the fieldwork staff for anomalies such as measurements inconsistent with historical level fluctuations or well construction records.
Regional SH&E Manager	The Regional Safety, Health and Environment (SH&E) Manager is is responsible for reviewing and approving the project specific risk assessment (e.g. Project Safety Plan/Safe Work Method Statement), monitoring the implementation of project specific risk assessment plans, interface with

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Role	Responsibility
	project managers in matters of safety, health and environment, and investigating reports of incidents or accidents.

4.0 Equipment and Materials

4.1 Equipment

Equipment required to complete this task include:

- Oil/water interface probe;
- Photo Ionisation Detector (PID); and
- Lower Explosive Limit (LEL) Detector.

Optional or supplemental equipment:

- Non-electrical water level meter such as “plopper” or “Fox Whistle”;
- AB(E) fire extinguishers; and
- Oil/fuel spill kit.

4.1.1 Oil/Water Interface Probe

The oil/water interface meter is suitable for LNAPL, DNAPL and groundwater level measurements. Check the equipment user guide for specific operating principles.

4.1.2 Photo Ionisation Detector (PID)

Refer to FQM Photo-Ionisation Detector (PID) – ANZ - ENV , for applicability, operation and calibration of a PID.

4.1.3 Lower Explosive Limit (LEL) Detector

Refer to FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV , for applicability, operation and calibration of a LEL Detector.

4.2 Materials

Materials and consumables required to complete this task include:

- Buckets;
- Potable water;
- Phosphate free detergent (e.g. Liquinox, **do not use Decon 90**, especially if sampling for per and poly-fluoroalkyl substances [PFAS] is to be conducted);
- Scrubbing brush;
- Paper towel;
- Alcohol wipes;
- Liquid contaminated waste container;
- Steel rod for electrical grounding (e.g. screwdriver);
- Allen key set;
- Tools for opening well covers, e.g. magnet or pair of pliers;
- Spare o- rings and hex bolts;
- Bailers for confirming presence of NAPL;
- Steel measuring tape;
- Bailer twine;
- Solid contaminated waste bags; and
- Spare batteries.

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5.0 Background

Accurate and reliable groundwater level measurements are essential in determining the hydraulic head, hydraulic gradients (vertical or along the water table), and the likely directions for groundwater flow and contaminant transport at a site. Before commencing a groundwater gauging round, some important factors should be considered, including:

- The groundwater level may take some time to stabilise after development of new wells.
- Groundwater levels fluctuate naturally (e.g. rainfall infiltration and tidal influences) and anthropogenically (e.g. pumping and irrigation), therefore groundwater gauging of a site should be completed in one day or less if possible. If a site is influenced by tidal variations, gauging should ideally be completed within a single tidal stage and water level data loggers may be needed to determine groundwater elevation.
- Effervescent groundwater such as in mineral spring areas or at landfills may cause difficulty gauging.
- Highly saline groundwater can cause the alarm of a dip meter or oil-water interface probe to sound even when the probe is lifted out of the water in the well. This usually occurs if the probe initially was lowered below the water level in the well. The probe may need to be washed, dried and the water level re-measured.
- Highly turbid wells can cause the continuous tone of an oil-water interface meter to sound even when NAPL is absent. If the occurrence of NAPL is unlikely or new, its occurrence should be checked using a new bailer or by looking for evidence of oils on the tape of the meter.
- Electronic dip meters and oil/water interface probes have co-axial conductive wires within a graduated plastic tape. A damaged tape may result in stretching of the graduations and inaccurate measurements. The tape should be calibrated for length against a steel tape prior to use and markings should be checked for legibility.

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6.0 Fieldwork Instruction

(PRINT SECTION 6 AND 7 FOR USE IN THE FIELD)

This section details the step by step processes for completing the task and should accompany AECOM field personnel in the field. Any variations to this Fieldwork Instruction required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

Caution: An explosive atmosphere may be present in the vicinity of an open monitoring well due to vapours emanating from a well with LNAPL floating on groundwater. Refer to the project Health, Safety and Environment Plan (HSEP) for specific controls to manage the potential acute safety hazard.

6.1 Decontamination

The measurement equipment (oil/water interface probe) shall be decontaminated prior to use and between measuring each monitoring well by the following procedure.

1. Wipe the probe and measuring tape (the length that comes into contact with groundwater) using disposable alcohol wipes. Dispose of the alcohol wipes into a contaminated waste bag.
2. Wash the probe and measuring tape (the length that comes into contact with groundwater) using a scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable, NOTE: do not use Decon 90, especially if sampling for PFAS is to be conducted).
3. Rinse the probe and washed section of the measuring tape with potable water over another bucket and collect the rinse water for later disposal as contaminated waste.
4. The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product remains on the probe after rinsing or sheen is present in the wash solution buckets.

6.2 NAPL and Groundwater Level Gauging

This section provides the methodology for the relative measurement of LNAPL (if present), groundwater and DNAPL (if present) levels in that order. Water and NAPL levels should be measured in a sequence from clean to contaminated wells to avoid cross-contamination of wells. A gauging round should be conducted of all monitoring wells at the site as quickly as possible before any samples are collected.

1. Open the monitoring well cover by (a) unlocking the flush mount well gatic with an Allen key (typically 7 mm) or (b) lifting the hinge lid on the monument/stick up well cover or (c) removing the lid on any other well cover as required (e.g. quarter turn well covers).

Monitoring well covers can cut / injure hands. Use cut resistant gloves to open well covers. Be careful for wells with positive pressure (such as landfill leachate bores that could pop off the loosened well cap. Keep body parts clear of well when opening).

Biological hazards (e.g. spiders, ants) may be present within gatic covers, exercise caution when opening wells. Wear gloves and remove cobwebs before placing hands into the well.

2. Remove the well cap (e.g. J-plug), PVC end cap, torque cap. Stand upwind from the well and allow hydrocarbon vapours to dissipate.

High concentrations of vapours can build up in the well and be released into the breathing zone when the well cap is removed. Implement appropriate work space monitoring (e.g. LEL, PID, colorimetric gas detection tubes) and HSE procedures (e.g. maintain appropriate fire extinguishers in work area) prior to removal of well cap.

3. Check the breathing zone above the well using a PID. Only proceed with gauging when the safety requirements stipulated in the project HSEP have been attained, i.e. vapour concentrations are below action levels or appropriate PPE is in use where action levels are exceeded.
4. Measure the concentration of vapours exiting the well using a PID by placing the intake nozzle immediately above the well casing.

Record the highest concentration measured by the PID and also the general condition of the monitoring well (e.g. missing or broken cover or well cap, well head filled with surface water) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV.

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5. Electrically ground the interface probe by attaching the grounding clip to the well casing or to a steel rod (e.g. screwdriver) inserted into the ground.

Caution: Static electricity may cause a spark and ignite vapours if the interface probe is not suitably grounded.

6. Slowly lower the interface probe down the well until the probe intersects LNAPL (if present) as indicated by the noise made by the equipment (typically a continuous tone - refer to equipment user guide for details). Measure the depth to LNAPL in metres (to three decimal places) from the measurement tape by holding the tape next to the top of casing.

The top of casing may be the highest point on the well casing or a point that was previously marked on the casing for surveying.

Record the depth to LNAPL in metres below top of casing (mBTOC) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

7. Slowly continue to lower the probe down the well until groundwater has been intersected (typically beeping tone – refer to equipment user guide for details). Measure the depth to groundwater in metres (to three decimal places) from the measurement tape by holding the tape next to the marked measuring point of the top of casing.

Record the depth to groundwater in metres below top of casing (mBTOC) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

8. Confirm the measured depth to LNAPL and groundwater by repeating Step 6 and 7 until three consistent measurements are taken (i.e. ± 0.002 m).

9. To check for and measure DNAPL (if applicable), continue to lower the probe down the well through groundwater until the probe intersects DNAPL (typically a continuous tone - refer to equipment user guide for details). Measure the depth to DNAPL in metres (to three decimal places) from the measurement tape by holding the tape next to the marked measuring point of the top of casing.

10. Confirm the measured depth to DNAPL and groundwater by repeating Step 9 until three consistent measurements are taken (i.e. ± 0.002 m).

Record the depth to DNAPL in metres below top of casing (mBTOC) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

If historical NAPL and groundwater levels are available for the monitoring well, compare the water level measurements with previous results for a reality check. That is, if groundwater levels have decreased in most wells since the previous gauging event but increased in one or two, then the anomalous measurements should be re-measured to confirm.

11. Measure the total depth of the well by turning off the interface probe and lowering the probe to the bottom of the well. This is usually determined by the point where there is no tension on the measurement tape. Measure the total depth of the well in metres (to two decimal places) by holding the measurement tape next to the marked measuring point at the top of casing.

Record the total well depth in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

TIP: It may be required to measure the height of the riser pipe in stick up wells. Check with your PM.

12. Where confirmation of NAPL is required by collecting a sample of LNAPL or DNAPL from the well refer to Fieldwork Instruction FQM NAPL Sampling – ENV – ANZ.

Record observations of NAPL (i.e. colour, odour, viscosity) on the interface probe or from a bailer used to collect a NAPL sample in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

13. Lock the well cap after gauging is complete.

7.0 Troubleshooting

a. I can't find the monitoring well I am supposed to sample

i. Use the figure to identify nearby features and attempt to triangulate its location.

ii. Ask field staff involved in previous monitoring events.

iii. Use a metal detector to sweep the general area.

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iv. Request GPS co-ordinates from the GIS team and use a GPS to locate the well. If possible have a surveyor locate well position.

v. Check the project folder (and historical project folders) for any photographs of the well location.

b. The stickup well has a padlock

i. Check with the PM to ensure AECOM does not hold a key for the well.

ii. Check with client / land owner that a key is not available for the well.

iii. Cut the lock off.

iv. Re-secure the stickup using a cable tie unless client/PM indicates a lock should be replaced on the stickup.

c. The well is dry

i. Confirm that the measured depth to bottom matches the information in the well log / historical gauging logs.

ii. Check to see if the well is seasonally dry

iii. If blocked, unblock the well using appropriate means.

d. I can't get the well cover open or the well cap off

i. Check that the tool is right for the job i.e. the right size Allen key is being used. A welder's magnet may be useful in opening flush mounted well covers.

ii. Gently tap the well cover with a hammer to loosen.

iii. Replace O-rings and cover plate bolts as necessary to avoid the same problem next gauging round.

iv. Do not overexert and risk an injury or damage to the well head. Make a note on the gauging record and contact the Project Manager.

e. I can't get three stable measurements

Atmospheric pressure has the potential to affect the SWL. Wait a few minutes after opening the well cap for the SWL to stabilise and confirm again after an hour.

i. Inspect the measurement tape (whole length) for damage.

ii. Check the tip of the probe for damage, dirt or NAPL.

iii. Try the probe in a bucket of water.

iv. Check the battery.

Refer to the dip meter / interface probe user manual.

8.0 Records

a. FQM NAPL and Groundwater Level Gauging – ANZ - ENV Q4AN(EV)-414-FM1.

9.0 Change Log

Rev #.	Revision date	Affected sections	Description of change
1	2-May-2016	All	Conversion to AECOM Australia Pty Ltd.
2	1-Sep-2021	Sections 3, 6, 8	Cautionary notes, References update

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Appendix G

Site Specific Remediation Criteria

Site Specific Remediation Criteria

In order to assess risks and inform potential remediation works required to allow development of the Macquarie Point Site (the Site) in accordance with the Site *Masterplan* (Macquarie Point *Strategic Framework and Masterplan 2015 – 2030*), AECOM prepared *Derivation of Remediation Criteria* (AECOM, 2016) to develop Site specific Remediation Criteria (RC) for soil and groundwater which are protective of human health under the proposed future land uses at the Site.

The RC were reviewed and updated in 2025 (AECOM, 2025e) for the changes in proposed Site development to the current plan, described in **Section 2.3** of the main report text. A summary of the initial formulation, and updates from the review, are provided below.

The RC consider the following scenarios and land uses based on the initial and current proposed development of the Site:

- High density residential development (slab-on-grade buildings and buildings with a communal basement car park).
- Recreation / open space
- Multi-storey car park
- Commercial/light industrial (slab-on-grade buildings and working within a basement car park).

It is noted that residential development is now only proposed in Regatta Point, which is not one of the assessment areas with existing Site Suitability Statements considered in this report. However, high density residential land use is known to occur off-Site and hydraulically down-gradient along Evans Street to the south of the Site, and the potential exists for groundwater migration from the Site to reach this area. As such, the RC protective of residential use have been applied to groundwater data from the Site.

Information about proposed Site layout, uses and building design can be used to refine the RC to be more Site-specific and reduce conservatism where appropriate based on any changes to the Masterplan or Site uses in future. Any changes to RC should be prepared by a qualified environmental professional, and if changes allow higher concentrations of Chemicals of Potential Concern (CoPC) to remain on Site, be reviewed and endorsed by a Contaminated Land Auditor.

Assumptions

The following key assumptions have been made when deriving the RC and should be noted as limitations when applying the RC:

- NAPL impacts at the Site will be remediated to the extent practicable and therefore risks associated with exposure to NAPL, and volatile contaminants derived from NAPL were not considered in the derivation of the RC.
- Intrusive maintenance work at up to 1 m bgl may be undertaken in all land uses.
- An engineered break layer will be present at the ground surface to mitigate the potential for future Site users (with the exception of maintenance workers) to have direct contact with soils.
- A reticulated water supply will be available, based on the urban setting of the Site, and abstraction of groundwater for any purposes other than remediation or monitoring, or temporary extraction during construction, will not be required. Potential exposure to contaminants in groundwater during any construction, remediation, or monitoring will be managed by task specific safety documentation informed by the SEMP.
- A SEMP will be prepared and put in place to maintain/manage surface cover.
- With regard to basements:
    - Use of any future basements is assumed to be limited to car parking. If basements are constructed for other purposes, a risk assessment specific to the intended use should be conducted.

- Where basements are associated with future residential or commercial buildings, it is assumed that these will be communal areas for multiple properties, for example, as part of a strata scheme that is managed by a body corporate. Private basements will therefore not be associated with individual residences.
- Where there is access to a basement car park, it is assumed that any groundwater seepage collects in floor drains and a physical barrier is present, and therefore, groundwater will not be directly contacted by basement users, with the exception of maintenance workers. It is assumed that individual tenants will not be involved in the maintenance of any associated services, including drainage pumps or sumps.

- For potential future multi-storey car park users, the most sensitive receptor in this scenario would be considered to be a parking attendant present at the Site for a typical eight hour working day. It is considered that RC derived for potential future commercial/light industrial workers (working within a basement) would be protective of all other basement users. This includes multi-storey car park users and residential tenants who access basement car parks and are likely to have lower frequency and duration of exposure, therefore the multi-storey car park users scenario is not evaluated separately in this assessment.
- Adjacent off-Site land uses include open space, commercial/industrial, and residential areas. As these potential land uses have been considered on-Site, the derived RC are considered to also be protective of potential exposures to off-Site receptors (e.g. via groundwater migration beyond the Site boundary), as:
  - Extractive groundwater use is not known to occur within 2 km of the Site, based on review of registered groundwater bores undertaken in 2024 (AECOM, 2025), and the urban setting and reticulated water supply indicate that groundwater extraction and use is unlikely to occur
  - No basements are known to be present in the surrounding buildings, and are considered unlikely due to the additional costs which would be required for basement construction, based on shallow groundwater elevation, hydraulically downgradient of the Site.
- It is considered that potential exposure to workers undertaking remediation and/or development activities can effectively be mitigated through the implementation of an appropriate Construction Environmental Management Plan (CEMP). The CEMP should be prepared during the planning stage for any future remediation and/or development activities.
- A separate assessment of the potential risks to on-Site visitors was not undertaken as it was considered that the chronic exposure duration assessment of commercial/light industrial workers or residents is sufficiently protective of the shorter exposure duration visitor scenario.

Soil

Table 1 below provides the adopted Site specific RC (reported to two significant figures) for soil concentrations which are considered to be protective of human health for proposed future uses.

Table 1 Site Specific Land Use RC for Soil (mg/kg)

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/ Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
Lead	-	-	-	-	-	-	-	620
Benzo(a)pyrene	-	-	-	-	-	-	-	110
Naphthalene	2.7	13	20	12	160	97	>Sat	38,000
Benzene	0.5*	0.5*	0.5*	3	3*	3*	360	170
Toluene	160	200	290	950	2500	1400	>Sat	660,000
Ethylbenzene	57	81**	120**	340	990**	570**	>Sat	290,000
Xylenes (total)	40	67	93	240	830	430	>Sat	530,000
C6-C10 fraction (minus BTEX)(F1)***	12	27	36	67	340	170	-	110000
>C10-C16 (minus Naphthalene)(F2) ***	25	130	170	140	-	770	-	110000
>C16-C34 fraction***	-	-	-	-	-	-	-	65000
>C34-C40 fraction***	-	-	-	-	-	-	-	65000
TPH C6-C8 (Aliphatic)	54	94	120	310	>Sat	570	>Sat	1,000,000
TPH >C8-C10 (Aliphatic)	88*	88*	88*	510	510*	510**	>Sat	270,000

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/ Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
TPH >C8-C10 (Aromatic)	12	27	36	67	340	170	>Sat	110,000
TPH >C10-C12 (Aliphatic)	51	140	>Sat	300	>Sat	>Sat	>Sat	270,000
TPH >C10-C12 (Aromatic)	25	130	170	140	>Sat	770	>Sat	110,000
TPH >C12-C16 (Aliphatic)	330	>Sat	>Sat	1700	>Sat	>Sat	>Sat	270,000
TPH >C12-C16 (Aromatic)	110	>Sat	>Sat	510	>Sat	>Sat	>Sat	110,000
TPH >C16-C21 (Aliphatic)	-	-	-	-	-	-	-	1,000,000
TPH >C16-C21 (Aromatic)	-	-	-	-	-	-	-	65,000
TPH >C21-C34 (Aliphatic)	-	-	-	-	-	-	-	1,000,000
TPH >C21-C34 (Aromatic)	-	-	-	-	-	-	-	65,000
TPH >C34-C40 (Aliphatic)	-	-	-	-	-	-	-	1,000,000
TPH >C34-C40 (Aromatic)	-	-	-	-	-	-	-	65,000

*Notes: # Source = CRC CARE (2011) Appendix F, * Where the soil criteria derived using the infinite source model were more conservative than the CRC CARE (2011) screening values based on a finite source model, the CRC CARE (2011) values are proposed for adoption, ** Adopted RC for ethylbenzene are based on a site specific toxicity assessment (AECOM, 2025e); *** The minimum criteria for aliphatic/aromatic fractions have been adopted for broader TRH fractions; >Sat – greater than saturation concentrations of this CoPC*

Groundwater

Table 2 below provides a summary of Site specific RC (reported to two significant figures) for groundwater concentrations which are considered to be protective of human health for proposed future uses.

Table 2 Site Specific Land Use RC for groundwater (mg/kg)

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
Benzo(a)pyrene	-	-	-	-	-	0.05	-	-
Naphthalene	2	3	7	12	28	6	>Sol	>Sol
Benzene	0.8	0.8	6	5	9	5	>Sol	>Sol
Toluene	>Sol	>Sol	>Sol	>Sol	>Sol	5,500	>Sol	>Sol
Ethylbenzene	>Sol	>Sol	>Sol	>Sol	>Sol	1,600	>Sol	>Sol
Xylenes (total)	>Sol	>Sol	>Sol	>Sol	>Sol	2,800	>Sol	>Sol
C6-C10 fraction (minus BTEX)(F1)**	30	30	>Sol	>Sol	>Sol	79	>Sol	>Sol
>C10-C16 (minus Naphthalene)(F2)**	>Sol	>Sol	>Sol	>Sol	>Sol	40	>Sol	>Sol
>C16-C34 fraction**	-	-	-	-	-	39	-	-
>C34-C40 fraction**	-	-	-	-	-	39	-	-
TPH C6-C8 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	16,000	>Sol	>Sol
TPH >C8-C10 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	79	>Sol	>Sol
TPH >C8-C10 (Aromatic)	30	30 *	>Sol	>Sol	>Sol	360	>Sol	>Sol

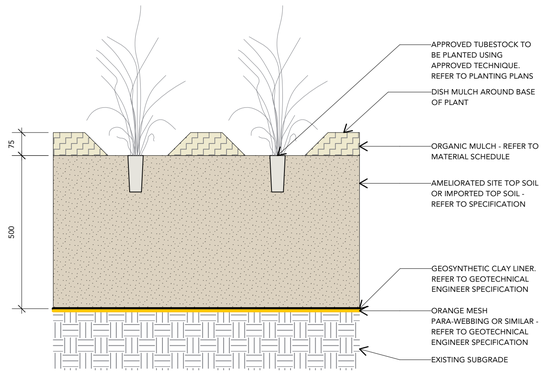
Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
TPH >C10-C12 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	40	>Sol	>Sol
TPH >C10-C12 (Aromatic)	>Sol	>Sol	>Sol	>Sol	>Sol	190	>Sol	>Sol
TPH >C12-C16 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	67	>Sol	>Sol
TPH >C12-C16 (Aromatic)	>Sol	>Sol	>Sol	>Sol	>Sol	160	>Sol	>Sol
TPH >C16-C21 (Aliphatic)	-	-	-	-	-	3,300	-	-
TPH >C16-C21 (Aromatic)	-	-	-	-	-	94	-	-
TPH >C21-C34 (Aliphatic)	-	-	-	-	-	3,300	-	-
TPH >C21-C34 (Aromatic)	-	-	-	-	-	39	-	-
TPH >C34-C40 (Aliphatic)	-	-	-	-	-	3,300	-	-
TPH >C34-C40 (Aromatic)	-	-	-	-	-	39	-	-
Dimethylphenol, 2,4-	-	-	-	-	-	1,300	-	-
Methylphenol-2 (cresol, o-)	-	-	-	-	-	4,300	-	-
Methylphenol-3 (cresol, m-)	-	-	-	-	-	4,200	-	-
Methylphenol-4 (cresol, p-)	-	-	-	-	-	4,300	-	-

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
Aniline	-	-	-	-	-	890	-	-
Dibenzofuran	-	-	-	-	-	8	-	-
Styrene	96	99	>Sol	>Sol	>Sol	160	>Sol	>Sol

*Notes: # Source = CRC CARE (2011) Appendix F, * Where the soil criteria derived using the infinite source model were more conservative than the CRC CARE (2011) screening values based on a finite source model, the CRC CARE (2011) values are proposed for adoption, ** The minimum criteria for aliphatic/aromatic fractions have been adopted for broader TRH fractions; >Sol – greater than the solubility concentration of this CoPC*

Appendix H

Inground Planting Designs



1 SOIL PROFILE TYPE 01 - GARDEN BED
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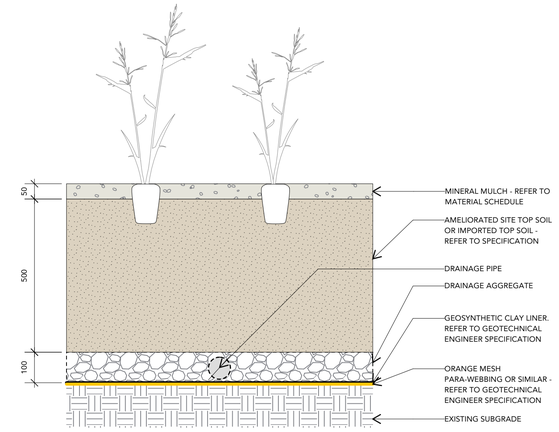

2 SOIL PROFILE TYPE 02 - SOAK GARDEN
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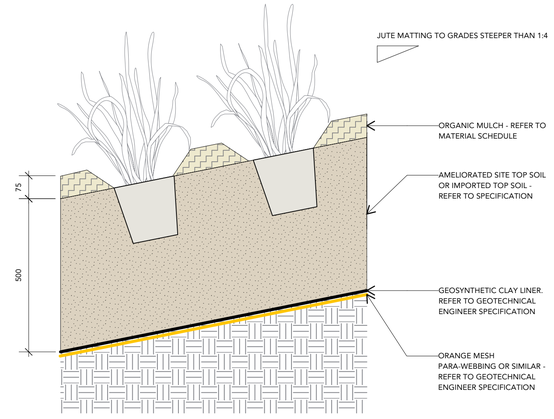

3 SOIL PROFILE TYPE 03 - EMBANKMENT PLANTING
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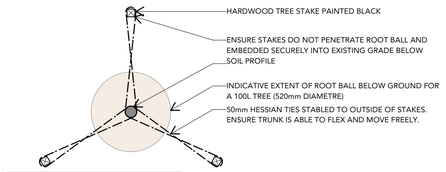
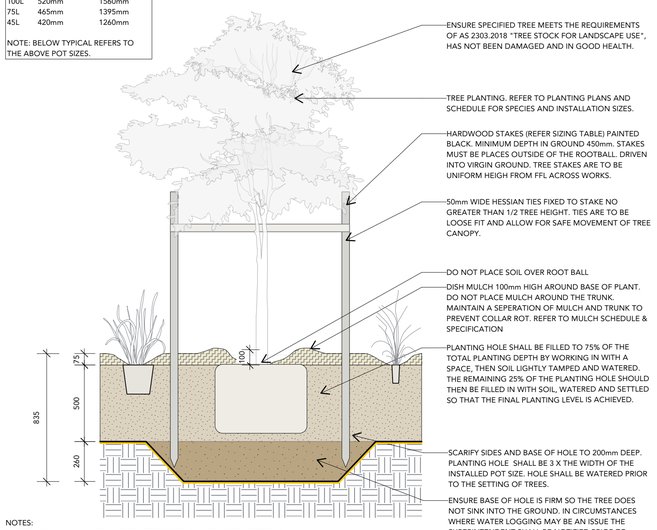


TREE STAKES TABLE TREE SIZE	NO. STAKES	STAKE SIZE (MIN)
100L-200L	3	50 X 50 X 1800MM
45L	1	35 X 35 X 1500MM

4 TREE PLANTING TYPICAL ON EXISTING GRADE
Scale: 1:20

PLANTING HOLE SIZE:		
POT SIZE	ROOT BALL SIZE (DIA)	PLANTING HOLE (MIN)
400L	980mm	2940mm
200L	700mm	2100mm
100L	520mm	1560mm
75L	465mm	1395mm
45L	420mm	1260mm

NOTE: BELOW TYPICAL REFERS TO THE ABOVE POT SIZES.

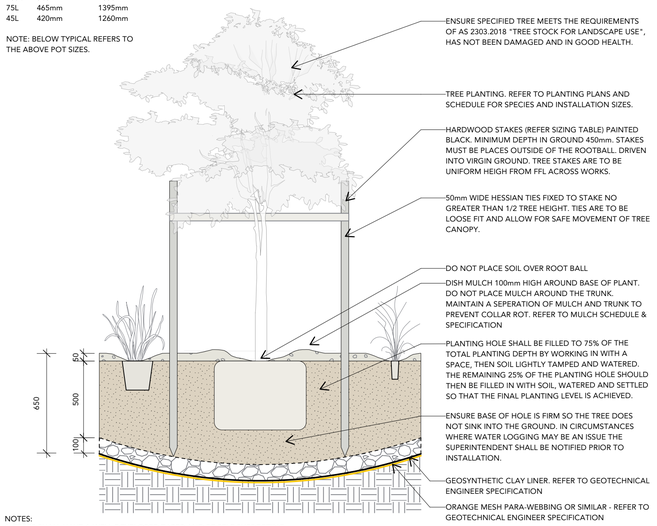


NOTES:
1. TREES SHALL HAVE A WELL DEVELOPED TAPER AND BE SELF SUPPORTING.
2. SPECIFIED TREE TO MEET THE REQUIREMENTS OF AS 2303.2018 "TREE STOCK FOR LANDSCAPE USE"
3. ENSURE ALL LABELS, WIRES, TWINE AND OTHER BINDING MATERIALS ARE REMOVED FROM PLANTING MATERIAL, INCLUDING ROOTBALLS PRIOR TO BACKFILLING.
4. TO PROMOTE LATERAL ROOT GROWTH THE PLANTING HOLE SHALL BE NO LESS THAT THREE (3) TIMES THE DIAMETER OF THE ROOT BALL. IF SPACE RESTRICTIONS EXIST STAKE SPACING SHALL BE REDUDED TO NO LESS THAN TWO (2) TIMES TH DIAMETER OF THE ROOT BALL. SLOPE ALL SIDES AT 45 DEGREES.
5. WATER IMMEDIATELY FOLLOWING PLANTING, SAUCER TO BE FILLED TWICE
6. SITE TO BE LEFT CLEAN AND TIDY ON COMPLETION OF PLANTING, REMOVE WEEDS AND BUILDING SPOIL FROM TREE PLANTING ZONE.
7. REFER SPECIFICATION FOR ALL TREE PLANTING.

5 TREE PLANTING - GARDEN BED
Scale: 1:20

PLANTING HOLE SIZE:		
POT SIZE	ROOT BALL SIZE (DIA)	PLANTING HOLE (MIN)
400L	980mm	2940mm
200L	700mm	2100mm
100L	520mm	1560mm
75L	465mm	1395mm
45L	420mm	1260mm

NOTE: BELOW TYPICAL REFERS TO THE ABOVE POT SIZES.

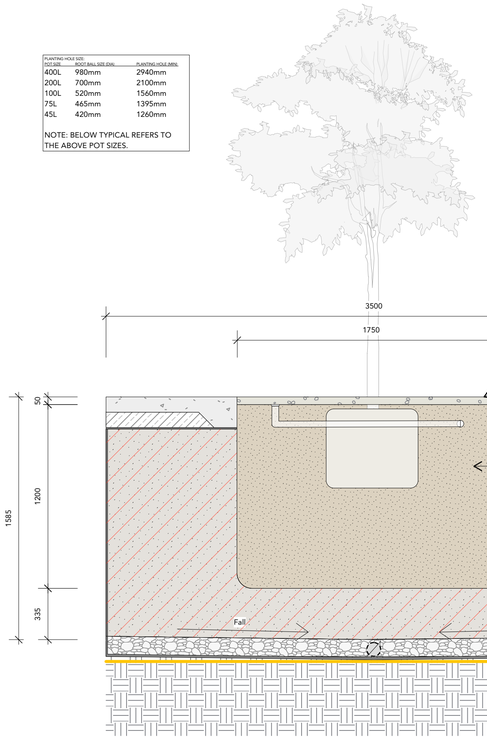


NOTES:
1. TREES SHALL HAVE A WELL DEVELOPED TAPER AND BE SELF SUPPORTING.
2. SPECIFIED TREE TO MEET THE REQUIREMENTS OF AS 2303.2018 "TREE STOCK FOR LANDSCAPE USE"
3. ENSURE ALL LABELS, WIRES, TWINE AND OTHER BINDING MATERIALS ARE REMOVED FROM PLANTING MATERIAL, INCLUDING ROOTBALLS PRIOR TO BACKFILLING.
4. TO PROMOTE LATERAL ROOT GROWTH THE PLANTING HOLE SHALL BE NO LESS THAT THREE (3) TIMES THE DIAMETER OF THE ROOT BALL. IF SPACE RESTRICTIONS EXIST STAKE SPACING SHALL BE REDUDED TO NO LESS THAN TWO (2) TIMES TH DIAMETER OF THE ROOT BALL. SLOPE ALL SIDES AT 45 DEGREES.
5. WATER IMMEDIATELY FOLLOWING PLANTING, SAUCER TO BE FILLED TWICE
6. SITE TO BE LEFT CLEAN AND TIDY ON COMPLETION OF PLANTING, REMOVE WEEDS AND BUILDING SPOIL FROM TREE PLANTING ZONE.
7. REFER SPECIFICATION FOR ALL TREE PLANTING.

6 TREE PLANTING - SOAK GARDEN
Scale: 1:20

PLANTING HOLE SIZE:		
POT SIZE	ROOT BALL SIZE (DIA)	PLANTING HOLE (MIN)
400L	980mm	2940mm
200L	700mm	2100mm
100L	520mm	1560mm
75L	465mm	1395mm
45L	420mm	1260mm

NOTE: BELOW TYPICAL REFERS TO THE ABOVE POT SIZES.



7 TREE PLANTING - CUT OUT IN PAVING
Scale: 1:20

OCULUS
REALM studios

0 1 2 3 4 5
1:100 @ A1
1:200 @ A3

NOTFORCONSTRUCTION

DRAWING
SOFT AND HARD LANDSCAPE DETAILS

PROJECT
MACQUARIE POINT STADIUM

DRAWING NO. SHEET 11
SCALE @ A1 1:250

Appendix I

Change Register

Appendix I Change Register

Any change or modification to the SEMP, or activities or designs which do not conform to the SEMP, but include suitable management of any environmental risks which has been reviewed and accepted by a suitably qualified and experienced Contaminated Land Auditor, should be recorded on **Table I1** below, and evidence of review and Contaminated Land Auditor acceptance should be added to this Appendix.

The change register should be reviewed as part of the regular SEMP review and update process (**Section 5.4**) and incorporated as appropriate into any updates of the SEMP.

Table I1 Change Register

#	Change	Person who conducted update or change		Record of Contaminated Land Auditor Review and Acceptance	
		Who	Date	Who	Date
1	Issue of SEMP Revision 5 with initial change register attached. Changes from Revision 4 made to: • Incorporate outcomes of *Review of Site Suitability Statements* (AECOM, 2026a). • Inclusion of Change Register • Changes to body text for design variances (**Section 1.2**).	Robert Crowe Associate Director – Environment, AECOM Australia Pty Ltd	16 February 2026	David Lam Contaminated Land Auditor accredited by the Director of EPA under Section 39(F) of the *Macquarie Point Development Corporation Act 2012*, TetraTech Coffey Pty Ltd	16 February 2026
2	Issue of SEMP Revision 6. Updates: • Outcomes of *Acid Sulfate Soil Investigation* (AECOM, 2025d) added. • Additional data on tested hydraulic conductivity added • Outcomes of *The Precinct South - CUTEP Report* (AECOM, 2026b) added • Planning controls for future management of ISS-treated material added • Appendix H – Unexpected Discovery Plan – Aboriginal Artefacts and Relics and Appendix J – Asbestos have been removed from the SEMP. Reference to the Corporation's separate procedures, which must be made available and complied with by anyone undertaking intrusive works, has been added to the relevant sections of the SEMP. • Minor wording changes made.	Robert Crowe Associate Director – Environment, AECOM Australia Pty Ltd	10 April 2026	David Lam Contaminated Land Auditor accredited by the Director of EPA under Section 39(F) of the *Macquarie Point Development Corporation Act 2012*, TetraTech Coffey Pty Ltd	16 February 2026

#	Change	Person who conducted update or change		Record of Contaminated Land Auditor Review and Acceptance	
		Who	Date	Who	Date
3					
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APPENDIX B – FACT SHEET 'REGISTER OF INTERSTATE CONTAMINATED LAND AUDITORS'

EPA TASMANIA

FACT SHEET

Register of Interstate Contaminated Land Auditors

What is the *Director, EPA's Register of Interstate Contaminated Land Auditors*? (hereafter referred to as the Register)

The Register is a listing of persons qualified to perform contaminated land audits under interstate Legislation and who have successfully applied to the Director, EPA to be included on the Register.

The purpose of the Register is to specify which persons are suitable to act as:

(a) *A person approved by the Director* under the Potentially Contaminated Land Code and thus able to certify that land is suitable for the intended use or to approve a plan to manage contamination and associated risk.
(b) A person able to provide a determination as required on a case by case basis under an Environment Protection Notice served under section 44 of the *Environmental Management and Pollution Control Act 1994* (EMPCA) or a Notice served under Part 5A of EMPCA.
(c) A person able to provide a certification under section 39F(1) of the *Macquarie Point Development Corporation Act 2012.*

Who is placed on the Register?

The Director, EPA determines the requirements for inclusion on the Register.

Principally an applicant must be accredited as a contaminated land auditor under one of the following:

- New South Wales – the site auditor scheme administered by the Environment Protection Authority under Part 4 of the *Contaminated Land Management Act 1997*.
- South Australia – the statutory audit system established in the *Environment Protection Act 1993* and the *Environment Protection Regulations 2009*.
- Victoria – the statutory appointment of environmental auditors established under the *Environment Protection Act 1970*.

- Western Australia – Contaminated sites auditors accredited under the *Contaminated Sites Act 2003*.

- Queensland – Contaminated Land Auditors established under the *Environmental Protection Act 1994* and the code of professional conduct.

Contaminated land auditors are highly experienced consultants accredited under legislation listed above, who are able to provide competent technical advice and increased certainty in regards to the 'sign-off' of contaminated site assessments and remediation. Clients can engage an auditor to independently review a consultant's reports on assessment, remediation and validation work to ensure that the consultant's methodology and interpretation of data are consistent with current regulations and EPA-endorsed guidelines.

An auditor wishing to apply for inclusion on the Register should send their request to the Director, EPA and specify the details of their current accreditation including any disciplinary action they may be subject to. EPA requests that only auditors prepared to undertake such work in Tasmania apply.

What is a contaminated land audit and a Contaminated Land Audit Report?

A contaminated land audit is a formal evaluation of the environmental condition of a described site (generally one or more Land Titles) in terms of risks to human health and/or the environment associated with the presence of soil or groundwater contamination. Each jurisdiction may use different terminology in regards to this audit process but technical requirements are generally consistent. The conduct of a contaminated land audit will result in a Contaminated Land Audit Report. Such a report comprises an unambiguous determination, written and signed by the registered auditor, which describes the suitability of the site for specific uses. Where appropriate, the Contaminated Land Audit Report will describe any management conditions that must be applied to ensure ongoing suitability for certain site uses, and any uses for which the site is unsuitable.

As part of the auditing process an auditor may, as appropriate, provide written endorsement of plans for remediation and/or management of sites, prior to the final determination of site suitability. Such endorsements may provide greater certainty for stakeholders in relation to the likely requirements for, and outcomes of, on-site works. However, auditors cannot guarantee remediation outcomes, and will only be able to provide formal determination of site suitability for specified uses in a final Contaminated Land Audit Report once remediation and validation are completed, and it is confirmed that no additional remediation is necessary for the proposed uses. Where a site is not remediated such that it is suitable for the proposed uses, but a formal Audit Report is nonetheless required, an auditor may complete a Contaminated Land Audit Report that describes the issues that prevent the use of the site until remediated, and a general description of the anticipated remediation requirements for the site to be made suitable.

Do auditors need to register before undertaking audits in Tasmania?

Yes. Should a client wish to contract an auditor who is not on the Register but does comply with the principal requirement above it will be a simple matter of sending in a request for the

auditor's inclusion and this can be addressed expediently by EPA, subject to the Director, EPA determining the suitability of the candidate auditor.

What starts the process of a contaminated land audit?

A person may choose to commission an Audit Report where they plan to redevelop a site and a determination by a person approved by the Director, EPA is a requirement under the Acceptable Solution in the Planning Code. Specific site legislation (i.e. the *Macquarie Point Development Corporation Act 2012*) or Notices served under EMPCA may also require the use of an auditor approved by the Director.

Who engages the auditor and how are they chosen?

The contaminated land auditor is normally engaged by the person commissioning the contaminated land assessment work. The client should firstly refer to the Register to determine auditors that have expressed interest in Tasmanian auditing work. When contacting an auditor, clients should confirm that the accreditation remains current in their accrediting State. Other auditors may also be contacted, but they would need to successfully apply for inclusion on the Register to be able to conduct auditing work in Tasmania.

Are there fees, and what is the process, to be placed on the Register?

No, there are no fees. The EPA Division requires an "expression of interest" from an auditor to work in Tasmania, to be considered for inclusion on the Register. This request should be made in writing to the Director and include details of the auditor's accreditation including whether any conditions are in place in relation to their accreditation or whether the auditor is subject to any disciplinary action in any State in which they are accredited. If the accreditation is appropriate, inclusion on the list is expedited.

Do I need an Auditor Insurance Certificate to conduct audits in Tasmania?

Yes. The Auditor Insurance Certificate needs to specifically cover audits carried out in Tasmania. Proof of such insurance must be provided to the EPA on request.

Do auditors have to comply with Jurisdictional Guidelines of the State where they hold their primary accreditation?

Auditors must comply with the technical standards and practices that relate to conducting an audit as detailed in the legislation, mandatory guidelines and Codes of Practice that apply to them in the State/s in which they hold appropriate accreditation. Auditors must comply with the standards expressed in the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, which is a State Policy in Tasmania. Where a policy matter seems ambiguous, a determination from the Director, EPA may be requested and the auditor must comply with Director's determination.

Does an auditor have to notify the EPA Division if he or she has been requested to undertake a contaminated land audit?

Yes, but only where this audit is being conducted in response to a regulatory instrument i.e. an Environment Protection Notice or a Notice served under Part 5A of EMPCA or where the audit is being conducted under the *Macquarie Point Development Corporation Act 2012.* Audits being conducted to satisfy planning requirements do not need to be notified to the EPA Division.

The Director requests that an auditor notifies EPA within 2 weeks of being commissioned to undertake an audit, with the details of the site address, client and reason for the audit. Removal from the Director's Register may occur if this request is not complied with.

Does an auditor have to supply the EPA Division with an Audit Report?

Only reports required by a regulatory instrument (as outlined above) should be submitted to the EPA. Audits being conducted to satisfy planning requirements should not be submitted to the EPA.

What will EPA Division do with Audit Reports?

Reports submitted to satisfy specific Notice conditions will be reviewed by the EPA Division to determine whether the conditions in the Notice have been satisfied.

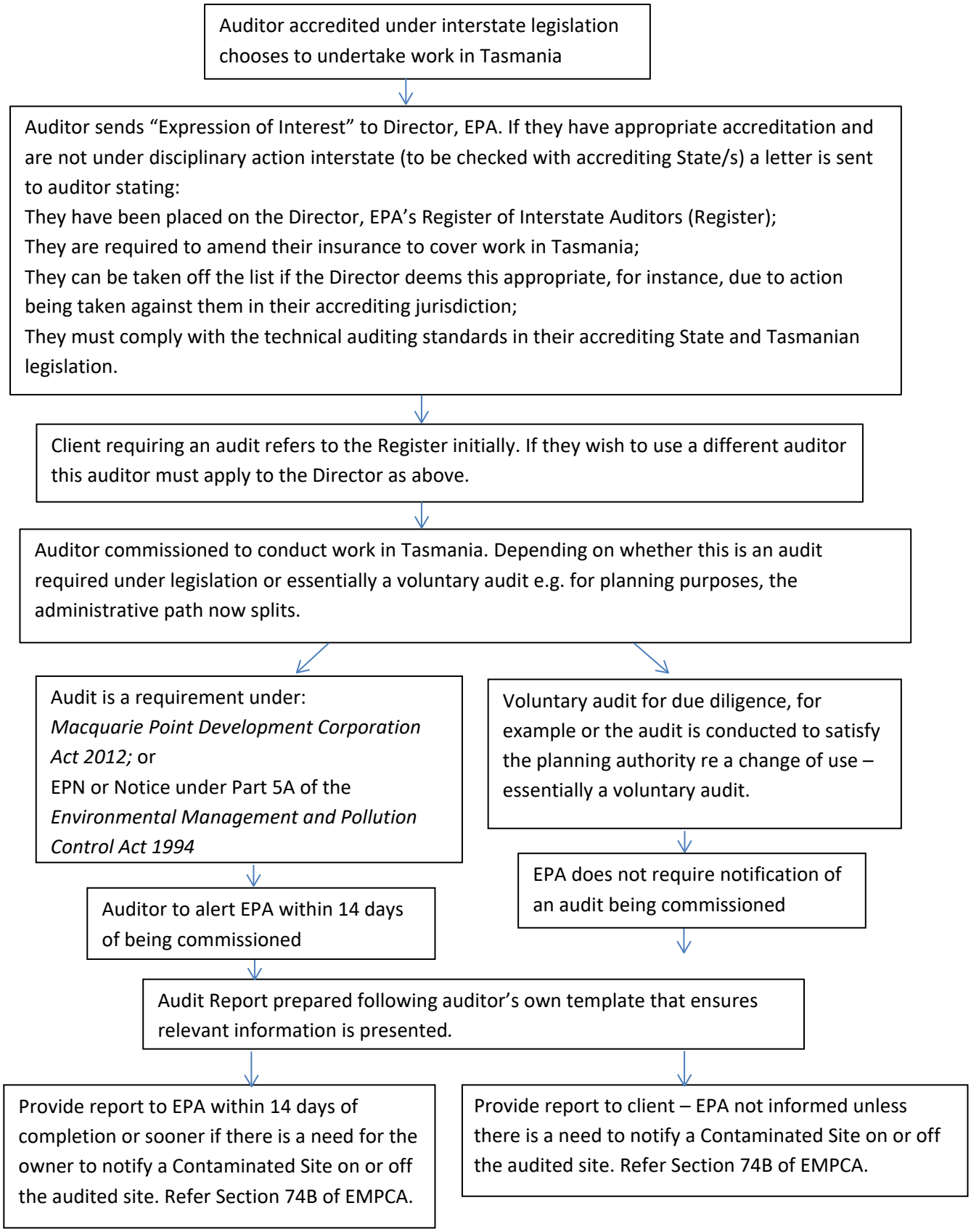
Are there procedures for disciplinary action for auditors providing false information?

The accrediting state would be provided with information in relation to such matters and would include this in their reviews of the auditor.

The Director, EPA may remove any person from the Register where this is reasonable, including where an auditor fails to comply with relevant technical guidance or legislation, where the auditor's accreditation is under review in the accrediting State or where such accreditation is no longer current. The *Macquarie Point Development Corporation Act 2012,* Section 39F (6), also specifies that the Director may revoke accreditation if the person fails to comply with any conditions of their accreditation.

Where information has been provided under legislation (i.e. an Environment Protection Notice or a Notice served under Part 5A of EMPCA) there are penalties for false and misleading statements (section 43A of EMPCA).

Flowchart: Administrative Process for conducting a contaminated land audit in Tasmania



APPENDIX A – SITE SUITABILITY STATEMENT AND SITE ENVIRONMENT MANAGEMENT PLAN

SITE SUITABILITY STATEMENT

This Statement provides a summary of the findings of a Contaminated Land Environmental Audit of the Macquarie Point Development Project – **The Precinct South**, Evans Street, Hobart, in accordance with the following

- Placement of the Auditor on the Register of Interstate Contaminated Land Auditors by the Director, Environment Protection Authority (Tasmania)
- EPA Tasmania 'Register of Interstate Contaminated Land Auditors'
- Macquarie Point Development Corporation Act 2012 (consolidated 2015)

I, David Lam of Tetra Tech Coffey, a person appointed by the Victorian Environment Protection Authority ('EPAV') under the *Environment Protection Act 1970* ('the Act') as an environmental auditor for the purposes of the Act, and also a person placed on the *Register of Interstate Contaminated Land Auditors* by the Director, Tasmania Environment Protection Authority (Tas EPA), having

1. been requested by Mr Greg Cooper on behalf of Macquarie Point Development Corporation (MPDC) to issue a Site Suitability Statement in relation to the Precinct South located at Evans Street, Hobart (as defined in Table 3 and Figure F2 in the attached document: *Site Environment Management Plan*) ('the Site') owned by MPDC.

2. had regard to, among other things,
   (i) guidelines issued by EPAV for the purposes of conducting Environmental Audits (contaminated land) and guidelines issued by Tas EPA for conduct of a contaminated land audit, noting that EPAV is allowing ongoing reference to pre-existing guidance documents in Environmental Audits commenced prior to 1 July 2021, regardless of changes to legislation from that date
   (ii) the beneficial uses and protected environmental values that may be made of the Site
   (iii) relevant (Victorian) State environment protection policies/industrial waste management policies, namely
      SEPP Waters
      SEPP Ambient Air Quality and Air Quality Management
      IWMP Prescribed Industrial Waste
      SEPP Prevention and Management of Contamination of Land
   (iv) relevant (Tasmanian) *State Policy on Water Quality Management*

   in making a total assessment of the nature and extent of any harm or detriment caused to, or the risk of any possible harm or detriment, which may be caused to any beneficial uses/protected environmental values associated with use of the Site, by any industrial processes or activity, waste or substance (including any chemical substance), and

3. completed a contaminated land environmental audit report in accordance with Clause 39F of the Macquarie Point Development Corporation Act 2012, a copy of which has been sent to Tas EPA.

HEREBY STATE that I am of the opinion that

The Site is suitable for the Site uses as follows: commercial/industrial use, recreational/public open space use and other less sensitive uses subject to the following Conditions:

1. Nature of development: the Site shall be developed in accordance with the layout provided in Figure F2 of the attached *Site Environment Management Plan* (SEMP), dated 10 April 2026 (or as modified from time to time), with reference to the following details:
    a. The Site uses shown within SEMP Figure F2 consist of a Multipurpose Stadium occupying the northwestern part of the Precinct South, and Complementary Integrated Mixed Use Zone across the balance of the Precinct South. These uses are considered to be consistent with commercial and public open space uses, for which the Site is considered conditionally suitable, other more sensitive uses must not be undertaken without reconsideration of required management or additional remediation.
2. Implementation of SEMP: from the date of issue of this Site Suitability Statement, the owner/occupier of the Site must implement and maintain the SEMP attached to this Site Suitability Statement (or as modified from time to time), including requiring any parties conducting works or otherwise at risk of exposure to residual contamination at the Site to conform to the SEMP. The key features of the SEMP include but are not limited to the following:
    a. Any party conducting subsurface works (including any earthworks for construction of the development or later maintenance) must prepare a Workplace Health and Safety Plan as specified in the SEMP, and allow for potential contaminant exposures.
    b. The developed Site area must be maintained with a hardstand or an engineered break layer to prevent direct human access to soil as detailed in the SEMP. Where the hardstand or engineered break layer is breached, such as for construction or maintenance works, it must be reinstated to achieve the same or better prevention of access to soil.
    c. Vapour intrusion protection must be implemented to manage assessed risks from methane and hydrocarbons, as detailed in the SEMP.
    d. Where future development may cause surface levels to be lowered or groundwater levels to rise in parts of the Site, such that the depth to groundwater beneath a building slab or any other structural void becomes less than 1 m, design and construction must include measures to prevent groundwater entering into buildings and structures, or reaching the Site surface. If groundwater drainage is included in protective measures, any drained groundwater must be considered potentially contaminated waste and be removed accordingly. Any drained groundwater must be managed in a way that considers contaminants which may pose risks, including methane.
    e. Garden plantings must be in above ground planter boxes and not into the soil directly, or (for deeper rooted plantings) installed in accordance with Appendix H (‘*Inground Planting Designs*’) of the SEMP.
    f. Specified requirements must be followed for managing excavated soil and for importation of Fill Material.
    g. Where works may cause soil disturbance or drainage posing risks from potential acid sulfate soils (PASS), an *Acid Sulfate Soil Management Plan* (ASSMP) and *Dewatering Management Plan* (DWMP) must be prepared as specified in the SEMP.
    h. Unexpected finds must be managed as specified in the SEMP.
    i. The *Groundwater Quality Management Plan* (GQMP) in Appendix F of the SEMP must be implemented. The GQMP includes restrictions on use of extracted groundwater, requirements for disposing of extracted groundwater, and consideration of vapours to arise from groundwater, such as potential methane in drainage infrastructure.
    j. The *Asbestos Management Plan* (AMP) referenced in the SEMP must be implemented to manage any asbestos that may be encountered during construction or operations at the Site.

3. Any (substantive) changes to the SEMP referred to in Conditions 1 and 2 must be prepared for the Site by a suitably qualified professional and verified as acceptable by an Environmental Auditor.
4. Groundwater at the Site is contaminated and must not be used for extractive uses other than environmental monitoring or remediation. Where groundwater is encountered during construction or maintenance works, such as in short-term removal during construction, or ongoing drainage, it must be managed in accordance with the SEMP.
5. Removal of any services or pipelines, such as the Hobart Main Pipeline (sewer), which are in contact with groundwater must be conducted in a way that will minimise the potential for creation of preferential pathways for potentially contaminated groundwater by either
    a. Being backfilled with a graded engineered fill with a maximum hydraulic conductivity of 2 m/day; or
    b. Being removed under a documented methodology which prevents creation of a preferential pathway for groundwater flow, where the methodology has been verified as acceptable by an Environmental Auditor.

The condition of the Site is detrimental or potentially detrimental to some possible beneficial uses/protected environmental values associated with the Site, and so requires ongoing management. The Site conditions which would need to be addressed so that no management would be necessary in any use scenario include the following:

- Material containing contaminant concentrations above human health-based criteria considered protective of sensitive land uses and above ecologically-based criteria considered protective of ecosystems would need to be removed or remediated.
- Aesthetically impacted materials would need to be removed.
- Groundwater would need to be cleaned up to the extent that all relevant beneficial uses/protected environmental values associated with all extractive uses were protected.

Other related information

1. This Site Suitability Statement has been adapted from the EPAV Statement of Environmental Audit. The EPAV *Guidelines for Issue of Certificates and Statements of Environmental Audit* (Publication 759.3, December 2015) have been followed so far as reasonably practicable. This Statement varies from the Victorian document in order to suit the Site requirements and Tas EPA's *Fact Sheet Register of Interstate Contaminated Land Auditors* (February 2016), and Tas EPA web-based guidance.
2. The Auditor has determined that groundwater does not have further practicable remediation options and therefore is assessed to have been cleaned up to the extent practicable (CUTEP).
3. Groundwater at the Site is polluted with respect to use for Drinking Water, Irrigation, Stock Watering, Industrial use, and Primary Contact Recreation. Groundwater is not considered to preclude Ecosystem Protection at a point of discharge to a surface water, or Buildings and Structures, although as noted in Condition 2 of this Site Suitability Statement, potential for acid generation where PASS may be disturbed or drained would require an *Acid Sulfate Soil Management Plan* (ASSMP), and this may address possible changes to groundwater acidity.
4. Groundwater monitoring wells present on and adjacent to the Site may be retained for monitoring under the GQMP. Within 12 months of cessation of use, the groundwater monitoring wells are to be decommissioned in accordance with the requirements of '*Minimum Construction Requirements for Water Bores in Australia*', published by the National Uniform Drillers Licensing Committee, [Fourth Edition, 2020].

5. Not all land uses for which the land is considered suitable by this audit may be allowed under the existing zoning of the Sullivans Cove Planning Scheme 1997.

This Site Suitability Statement forms part of contaminated land audit report (Tetra Tech Coffey), *Contaminated Land Audit Report, Macquarie Point Development Project – The Precinct South*, ref. 754-MELEN225720.1-R01, dated 21 April 2026 Further details regarding the condition of the Site may be found in the contaminated land audit report.

DATED: 21 April 2026
Signed:
David Lam

ENVIRONMENTAL AUDITOR (Listed on the Tasmanian *Register of Interstate Contaminated Land Auditors*)

Attachments: Attachment 1 - *Site Environment Management Plan* (SEMP) dated 10 April 2026.

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   in making a total assessment of the nature and extent of any harm or detriment caused to, or the risk of any possible harm or detriment, which may be caused to any beneficial uses/protected environmental values associated with use of the Site, by any industrial processes or activity, waste or substance (including any chemical substance), and

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DATED: 21 April 2026
Signed:
David Lam

ENVIRONMENTAL AUDITOR (Listed on the Tasmanian *Register of Interstate Contaminated Land Auditors*)

Attachments: Attachment 1 - *Site Environment Management Plan* (SEMP) dated 10 April 2026.

Prepared for
Macquarie Point Development Corporation
ABN: 92 657 409 841

Site Environment Management Plan

Macquarie Point Development Project

10-Apr-2026
Doc No. MPMS-MPDC-MP-ES-04-02

aecom.com

Delivering a better world

Site Environment Management Plan

Macquarie Point Development Project

Client: Macquarie Point Development Corporation

ABN: 92 657 409 841

Prepared by

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10-Apr-2026

Job No.: Macquarie Point Development Project

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Quality Information

Document Site Environment Management Plan

Ref 60693007

Date 10-Apr-2026

Prepared by Robert Crowe

Reviewed by Paul Carstairs

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	15-Oct-2021	Draft	Paul Carstairs Technical Director - Environment	
0	22-Oct-2021	Final	Paul Carstairs Technical Director - Environment	
1	17-Nov-2021	Updated Final	Paul Carstairs Technical Director - Environment	
2	18-Dec-2024	Updated Final	Paul Carstairs Technical Director - Environment	
3	10-Oct-2025	Updated Final	Paul Carstairs Technical Director - Environment	
4	03-Dec-2025	Updated CNVM and addition of asbestos register	Paul Carstairs Technical Director - Environment	
5	16-Feb-2026	Updated Final	Paul Carstairs Technical Director - Environment	
6	10-Apr-2026	Updated Final	Paul Carstairs Technical Director - Environment	

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List of Acronyms

ACM	Asbestos Containing Material
BCA	Building Code of Australia
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BTEXN	Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene
CEMP	Construction Environment Management Plan
CNMP	Construction Noise Management Plan
CoPC	Chemicals of Potential Concern
CUTEP	Clean Up to the Extent Practicable
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	Environment Protection Authority
GPR	Ground Penetrating Radar
ha	Hectare
HDPE	High Density Polyethylene
ISS	*In situ* solidification
JSA	Job Safety Analysis
LNAPL	Light Non-Aqueous Phase Liquid
mAHD	metres Australian Height Datum
m bgl	metres below ground level
MPDC	Macquarie Point Development Corporation
NAPL	Non-Aqueous Phase Liquid
NDD	Non-Destructive Digging
PAH	Polycyclic Aromatic Hydrocarbons
PEV	Protected Environmental Value
PPE	Personal Protective Equipment
RC	Remediation Criteria
SEMP	Site Environment Management Plan
SVOC	Semi-volatile Organic Compound
SWL	Standing Water Level
SWMS	Safe Work Method Statement
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WHS	Work Health and Safety
WHSP	Work Health and Safety Plan
WMP	Waste Management Plan

1.0 Introduction

1.1 Purpose

This Site Environment Management Plan (SEMP) has been developed by AECOM Australia Pty Ltd (AECOM) on behalf of the Macquarie Point Development Corporation (the Corporation) for implementation at the Macquarie Point site in Hobart, Tasmania (the Site).

The purpose of this SEMP is to identify known areas of contamination on the Site and to provide an overview of appropriate management measures to address potential human health and environmental risks associated with subsurface contamination, and to maintain compliance with relevant environmental management requirements, and related safety management requirements.

The SEMP:

- Documents:
  - The current contamination status of the Site.
  - Environmental management measures (including contaminant management associated with intrusive works such as excavation/disposal of soil, dust and odour control, stormwater and sediment management, noise control and groundwater management).
  - Responsibilities for implementation of the SEMP and for managing identified environmental issues in accordance with the SEMP.
- Defines:
  - Preventative exposure measures for intrusive works (e.g. subsurface excavation) undertaken at the Site.
  - Roles and responsibilities for owner/managers and occupiers/contractors at the Site, or subsections thereof, when undertaking intrusive works.
- Provides a framework for the implementation of measures so that human health and environmental risks to Site users are low and acceptable where the existing preventative exposure barriers and controls remain in place.

All subsurface work and any work that may change the risk profile to receptors on the Site while this SEMP is in place should follow the guidance provided in this SEMP. Maintenance of the SEMP has been identified as a condition of interim Site suitability statements issued as part of the Site Audit (discussed in **Section 1.6**) for management of human health and environmental risks at the Site.

1.2 Applicability

This SEMP applies to the management of contaminated soil, groundwater and soil vapour on the Site. The following parties should be provided with a copy of the SEMP, prior to undertaking any activities which may interact with soil, groundwater or soil vapour:

- Owners or Managers (and delegates) of the Site or subsections of the Site.
- Workers who undertake subsurface work at the Site during which they may be exposed and/or come into contact with contaminated soil and/or groundwater.

It is noted that this SEMP is an active document, which is to be updated as conditions at the Site change (e.g. development changes, changes to the known contamination status, etc.). If activities to be undertaken at the Site are not covered in this SEMP, the Site Owner or Manager, or owner of smaller areas of the Site, should update the SEMP to include those activities.

All future building or structure design must include appropriate environmental management mitigations as specified by the SEMP. If any design variance is proposed as part of Site development, which does not comply with the current wording, it must not be implemented or constructed on-Site unless:

- It has been assessed by a suitably qualified and experienced environmental professional, who has determined that any environmental risks presented by the action or design can be safely managed and does not represent an unacceptable level of risk to human or ecological receptors on- or off-Site; and
- This assessment has been reviewed and verified by a suitably qualified and experienced Contaminated Land Auditor.

A record of the proposed design variance, and verification by a Contaminated Land Auditor, must be maintained by the person responsible for the SEMP (i.e., the Site owner or occupier, or their designated delegate, as defined on **Table 1**), and communicated by them to any contractors or other workers who are undertaking Site activities which may be affected by the design variance.

Within three months of the approval of any design variance by a suitably qualified and experienced Contaminated Land Auditor, the SEMP must be re-issued by the Site owner/occupier (or their designated delegate), with either:

- The record of design variance and Contaminated Land Auditor review and approval added to **Appendix N**; or
- Update of the body text of the SEMP, reviewed and approved by a Contaminated Land Auditor as described in **Section 5.4**.

A description of any design variance, or general changes to the SEMP, must be added to **Appendix N** as part of the update.

Alternatively, should the requirement for a more specific application be determined, a Construction Environment Management Plan (CEMP) may be required which specifically addresses the proposed tasks and a framework to mitigate potential environmental impacts posed by the activities to be undertaken.

If a sale or division of areas at the Site occurs in the future, owners of subdivisions at the Site should communicate changes to owners of other Site subdivisions or develop their own SEMP specific to the subdivision in question. A distribution list is provided in **Appendix B** for tracking the transfer of the SEMP, or copied thereof, if subdivision occurs.

Any significant amendment to this SEMP, such as a change in land use, or changes as part of an Environmental Audit, should be reviewed and verified by a suitably qualified and experienced Contaminated Land Auditor prior to implementation, including by new owners/occupiers if subdivisions occur in the future. Minor changes or reviews should be conducted by a suitably qualified and experienced environmental professional.

1.2.1 Additional Procedures Referenced Within the SEMP

The following documents and procedures are referenced in the SEMP. The most recent issue of each document should be provided by the Site owner/occupier to anyone undertaking intrusive works at the Site:

- *MPMS-MPDC-PC-ES-05-01 – Unanticipated Discovery Plan - Aboriginal Heritage*
- *MPMS-MPDC-FW-MP-04-02 – Construction Noise & Vibration Management Framework*
- *MPMS-IMP-MP-WH-04-01 – Asbestos Management Plan*
- *MPMS-ELG-RG-WH-04-01 – Site Asbestos Register*

1.3 Training and Induction

The appropriate Site representative (i.e. the Owner, Manager or delegates) is to ensure the health, safety and environment (HSE) requirements outlined in this SEMP are met during works. The SEMP should be available to all persons conducting work which may involve contact or disturbance of Site soil or groundwater, and the information about environmental impacts and management requirements in the SEMP incorporated into health and safety documentation for such work.

All persons conducting subsurface work on the Site, including but not limited to Site occupiers, tenants and maintenance workers, will be required to be trained and inducted to this SEMP. All workers should sign the induction form (provided in **Appendix B**) to acknowledge an understanding of the content of this SEMP and completion of the induction and training, or a similar record if the requirements of the SEMP have been incorporated into other environment safety documentation, for example a CEMP.

This training induction recommendation is limited to those personnel and contractors who are in control of the Site (i.e., landowners or managers) or undertaking subsurface works at the Site. It is not the intention that this document be applied to passive users of the Site such as those using it for the purposes of short-term commercial activities (e.g. market holders), car parking, pedestrian thoroughfare or visitors engaging in public uses of the area.

Training should be structured to ensure that relevant workers understand their obligation to exercise due diligence in relation to environmental matters. The following items should be presented in the induction:

- General overview of the work to be conducted
- Overview of Site contamination issues
- Familiarisation with environmental controls
- Chemicals of Potential Concern (CoPC), and associated exposure risks and potential symptoms of exposure
- Hazard identification and prevention
- Personal Protective Equipment (PPE).

Records of all training should be maintained and include:

- Name of the individual receiving training
- When the individual was trained
- Name of trainer
- A general description of the training content.

It should be noted that this SEMP does not preclude the need for a Safe Work Method Statement (SWMS) or equivalent document for each task, but rather should be included as part of the general training for working on the Site and consulted when preparing safety documentation. The requirements and recommendations within this document do not replace or override the responsibility of any other person in ensuring that Site activities are conducted safety and within the requirements of applicable legislation and regulations.

1.4 Responsibilities

The distribution and implementation of this SEMP will be the responsibility of the Owner/Manager of the Site, or of future sub-divisions at the Site. The Site Owner/Manager may at times delegate responsibility for individual items or tasks to maintenance contractors and other persons. However, the Site Owner/Manager retains the overall responsibility for the implementation of this SEMP during any subsurface works and ongoing use of the Site or future subdivisions which they hold responsibilities for.

All contractors, including workers engaged in any subsurface works where groundwater or soil vapour infiltration may occur (such as accessing service conduits or trenches) or works which may come into contact with Site soil or groundwater will be responsible for adhering to the management measures described herein.

Table 1 below provides a summary of the key roles and responsibilities associated with the implementation of this SEMP.

Table 1 Roles and Responsibilities

Role	Key Responsibilities
Site Owner/ Manager (or delegate)	• Provide a full copy of the current version of the SEMP to Site occupiers/ contractors undertaking subsurface works and discuss as part of the Site induction process. • Manage and/or enforce the SEMP for Site occupiers/ contractors undertaking subsurface works. • Implement and complete corrective actions as required. • Complete and keep up to date all necessary registers and records as required in the SEMP. • Undertake reviews and revision of the SEMP every three years (or more frequently, as deemed appropriate based on-Site activities or changes). • Review evidence of compliance to this SEMP every three years (or more frequently, as deemed appropriate). • Undertake visual inspections of existing controls, such as hardstand areas every three years. • Review and revise the SEMP to reflect changes that occur at the Site. • Transfer of the SEMP, and any records associated with it, to new Site owners or occupiers in the event of a change in ownership or land transfer.
Site Occupiers / Contractors undertaking subsurface works or works which may come into contact with Site soil or groundwater.	• Implement the requirements of the current version of the SEMP. • Complete all necessary registers and records as required in the SEMP. • Complete all activities at the Site in a safe and environmentally responsible manner. • Implement a Work Health and Safety Plan (WHSP) and ensure that suitable PPE is worn, and monitoring is undertaken, where required, for tasks that involve potential contact with contamination. • Ensure all contractors or subcontractors comply with the requirements of the SEMP.

1.5 Site Environment Management Plan Revision

This SEMP will remain in place indefinitely, and will require revision:

- In the event that areas of the Site undergo remediation or land use changes.
- Following changes to the conditions at the Site which may change the risk of exposure to contamination on the Site.
- In response to additional data to inform the understanding of the contamination status of the Site.

Regardless of the above-listed considerations, this SEMP should be reviewed (and updated if required) every three years. It is recommended that a suitably qualified environmental practitioner be engaged to review evidence of compliance to this SEMP, including records of works on the Site and compliance with the conditions of implementation contained within **Section 5.5** of this SEMP. A visual inspection of the Site should be conducted as part of this review, as described in **Section 5.1**.

1.5.1 Previous SEMPs

This SEMP combines and supersedes the following SEMPs which have been previously issued for some or all of the Site:

- *Site Environmental Management Plan, Macquarie Point Development Project* (AECOM, 2018a)
- *Site Environmental Management Plan, Macquarie Point – Audit Area 1* (AECOM, 2019a)

- *Audit Area 4 – Site Environmental Management Plan, Macquarie Point Development Project* (AECOM, 2020a)
- *Lot E and Underground Carpark – Site Environmental Management Plan, Macquarie Point Development Project* (AECOM, 2021a)

The information and management procedures within the previous documents have been combined in this SEMP, and have been updated to account for changes in proposed Site development and additional environmental information received or management/mitigation measures identified since issue of earlier SEMPs or versions of this SEMP. A record of revisions to this SEMP is provided in the Revision History at the start of this document.

1.6 Environmental Audit

In conjunction with the amendment of the *Macquarie Point Development Corporation Act 2012*, the Corporation has engaged a Contaminated Land Auditor, David Lam of Tetra Tech Coffey (the Auditor). David is included on the Director of the Tasmanian Environment Protection Authority (EPA) Register of Interstate Contaminated Land Auditors and is considered suitably qualified by EPA to undertake an Environmental Audit to review the progress of environmental assessment, remedial planning and execution works at the Site.

The role of the Auditor is to ensure that the works are carried out in compliance with local Tasmanian legislation and guidelines with consideration given to the requirements of the Victorian EPA Environmental Audit framework in the absence of an Audit scheme in Tasmania. It is noted that Victoria legislation which defines the Audit process was updated and superseded by the *Environment Protection Act 2017* (the EP Act), which came into effect on 1 July 2021, and contains significant changes to Audit methodology and terminology under the Victorian framework. Under Section 478 of the EP Act, existing Audits where an Auditor has been engaged prior to 1 July 2021, and the Audit has not been completed by 1 July 2021, can be conducted under either the EP Act or the previous framework. To maintain continuity with the portions of the Audit already completed, the Site Audit will continue under the previous framework and terminology.

The overarching outcome required for the Environmental Audit is a Contaminated Land Audit Report (i.e. sign off) prepared by the Environmental Auditor confirming that Clean Up to the Extent Practicable (CUTEP) has been achieved and that the Site is suitable for the intended future uses. Site Suitability Statements have been issued by the Auditor for Site sub-areas (described in **Section 2.2**) as part of Contaminated Land Audit Reports as CUTEP has been achieved, and are listed on **Table 2** below.

It is noted that the proposed future Site uses and development as described in **Section 2.3** have altered since issue of some of the Contaminated Land Audit Reports listed on **Table 2**. A review of new information collected and changes in proposed Site use has been undertaken and provided to the Auditor for review (AECOM, 2026a), and has been accepted by addenda as listed on **Table 2** below.

Table 2 Status of Environmental Audit by Area

Site Area	Approx. Area (ha)	Contaminated Land Audit Reports or Remaining Actions and Activities
Site Suitability Statement Issued[1]		
The Goods Shed and Yard (Audit Area 1)	0.86	*Contaminated Land Audit Report – Macquarie Point Development Project – Audit Area 1*, issued by Tetra Tech Coffey Pty Ltd on 5 June 2019 *Addendum to Contaminated Land Audit - Macquarie Point - Audit Area 1 (The Goods Shed and Yard)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026
The Escarpment (Audit Area 4 West)	1.68	*Contaminated Land Audit Report – Macquarie Point Development Project – Audit Area 4 West*, issued by Tetra Tech Coffey Pty Ltd on 24 September 2020 *Addendum to Contaminated Land Audit - Macquarie Point - Audit Area 4 West (The Escarpment)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026

Site Area	Approx. Area (ha)	Contaminated Land Audit Reports or Remaining Actions and Activities
The Promenade and Underground Carpark (Lot E and UGC)	1.73	*Contaminated Land Audit Report – Macquarie Point Development Project – Lot E and Underground Carpark*, issued by Tetra Tech Coffey Pty Ltd on 23 July 2021 *Addendum to Contaminated Land Audit - Macquarie Point – Lot E and Underground Carpark (The Promenade and Underground Carpark)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026
The Precinct North (Lot B)	1.04	*Contaminated Land Audit Report – Macquarie Point Development Project – Lot B*, issued by Tetra Tech Coffey Pty Ltd on 22 November 2021 *Addendum to Contaminated Land Audit -Macquarie Point – Lot B (The Precinct North)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026
Site Suitability Statement Not Issued		
The Precinct South	1.40	No remaining remediation actions identified. A CUTEP assessment of the Precinct South was prepared and submitted to the Auditor in late 2024 (AECOM, 2024d). Comments have been received and an additional Site investigation has been completed, and an updated CUTEP report issued (AECOM, 2026b), and is currently undergoing update in response to Auditor comments to inform a Contaminated Land Audit Report, including a Site Suitability Statement.
The Gateway	1.46	Remediation (removal of remnant infrastructure and treatment of gasworks wastes) was undertaken in 2024, and follow-up sampling of groundwater and soil vapour conducted in 2025. No remaining remediation actions have been identified. The existing Gateway DSI (AECOM, 2024a) is currently being updated to include a CUTEP assessment, and will be submitted to the Auditor to inform a Contaminated Land Audit Report, including a Site Suitability Statement.
Audit Area 4 East	1.20	Audit Area 4 East is currently proposed to be split, with the northern portion handed to the Tasmanian Department of State Growth. A DSI and assessment of the suitability of the proposed future development is currently being prepared for the portion of this land to remain in the control of the Corporation.
Regatta Point	0.7	This area is not yet included in the Macquarie Point Environmental Audit but is considered likely to be included in the future. An initial intrusive investigation to allow preparation of a Detailed Site Investigation (DSI) report for this area was conducted in late 2024, and the collected data is currently being assessed and a DSI prepared. Any remediation or further investigation requirements to allow issue of a Site Suitability Statement will be identified in the DSI and inform future work requirements and timeline.

Site Area	Approx. Area (ha)	Contaminated Land Audit Reports or Remaining Actions and Activities
Royal Engineers Building	0.19	This area is not currently included in the Macquarie Point Environmental Audit and is not considered likely to be included. However, Royal Engineers Building and surrounding land parcel is likely to be added to the Site as part of future development plans (see **Section 2.3**). To date, no potentially contaminating land uses have been identified, or intrusive investigation undertaken, at the Royal Engineers Building.

2.0 Site Details and Background

2.1 Site Identification and Layout

The Site details are provided in **Table 3** below. It is anticipated that the areas referred to as Regatta Point and the Royal Engineers Building will be added to the Site in future, but as land transfer has not yet occurred, these areas have been listed separately:

Table 3 Site Details

Item	Description
Macquarie Point	
Site Address	10 Evans Street, Hobart, Tasmania (refer to the Site Location plan provided as **Figure F1** in the **Figures** section)
Site Area	Approximately 9.3 ha
Current Land Owner	State of Tasmania (Crown Land)
Title Details	The Site includes the following land titles: • 179192/2, consisting of land against the northern border of the Site below the Hobart Cenotaph. • 179192/3, consisting of southern portion of the Site. • 179192/4, consisting of land previously proposed for development as a road/transport corridor between 17919/2 and 17919/3. • 45404/1, consisting of a small narrow band of land in front and to the west of the Goods Shed. This title boundary overlaps 179192/3. • 129483/6, consisting of the south-west corner of the Site, historically occupied by the former Hobart Gasworks.
Current Zoning	In accordance with the Hobart City Council (HCC, 2021), the *Sullivans Cove Planning Scheme 1997* notes that the Macquarie Point site falls within the *Macquarie Point Mixed Use Zone* and is subject to the following use areas: • Commercial and Institutional • Mixed Use • Open Space.

Item	Description
Current Uses	The following is noted with regard to current Macquarie Point use and features: • The majority of Macquarie Point is currently vacant. Portions of the north and west of Macquarie Point are currently in use for remediation activities, including stockpiling of excavated materials. • The Goods Shed, a heritage building, is located on the southern boundary of the Site and is subject to intermittent uses including public events. • An office building (8A Evans Street) is located on the western boundary of Macquarie Point and is occupied by the Corporation. • The "Red Shed", located in the south eastern portion of Macquarie Point, is currently used by a microbrewer and includes a public bar. • A warehouse (the SeaRoad Shed) was located in the south-east corner of Macquarie Point but was demolished in 2023. A large slab (the SeaRoad Slab) remains in place and has been used for intermittent storage of construction equipment. • Small retail outlets are located in the area adjacent to the Red Shed (Red Square) which is also used regularly for markets, music and other outdoor events with food vans. • A public car park is present in the south eastern and eastern portion of Macquarie Point. • A roadway (the Northern Vehicular Access) is present on the northern portion of Macquarie Point.
Closest Surface Water Body	• Sullivans Cove to the southwest (170 m) • River Derwent to the southeast (280 m) and to the northeast (25 m).
Site Layout	• **Figure F2** in the Figures Section
Regatta Point	
Address	A street address is not allocated. Located adjacent to McVilly Drive, Queens Domain
Area	Approximately 0.7 ha
Current Land Owners	The land comprised within Regatta Point is under the authority of: • Department of Natural Resources and Environment Tasmania (DNRET) Property Services (Potential Property ID 2513934), under Crown lease Regatta Point is currently being transferred to the control of the Corporation.
Title Details	Title details are not available for the public reserve (Potential Property ID 2513934).
Current Zoning	In accordance with the Hobart City Council (HCC, 2021), the *Sullivans Cove Planning Scheme 1997* notes that the Regatta Point site falls within the *Macquarie Point Wharf & River Zone B* and is subject to the following use areas: • Commercial • Mixed Use • Open Space

Item	Description
Current Uses	The following is noted with regard to current Regatta Point use and features: • A public reserve in the southern portion of Regatta point is used for public open space and recreation. Carparking and access to the River Derwent (via two marine jetties and two boat ramps) are present in this area, and accessible via McVilly Drive. • A pumphouse (under Crown Licence) is present in this area. It is not known if this pumphouse is operational, what use is authorised under its licence, or what historical uses it may have had, but it is assumed to be related to fuel and oil transfer via underground pipelines which are present beneath Regatta Point. • A small two-storey building of unknown use is in this area. • A disused rail line and corridor passes to the west of Regatta Point.
Closest Surface Water Bodies	• The River Derwent is located to the east, immediately adjacent to Regatta Point. • Sullivans Cove is located approximately 560 m to the south at the closest point. Recreational fishing restrictions apply in the waters adjacent to Regatta Point.
Site Layout	**Figure F2** in the **Figures** section
Royal Engineers Building	
Address	2 Davey Street, Hobart, Tasmania
Area	Approximately 0.19 ha
Current Land Owners	State of Tasmania (Crown Land). The Royal Engineers Building is currently being transferred to the control of the Corporation.
Title Details	Land title 20452/2
Current Zoning	In accordance with the Hobart City Council (HCC, 2021), the *Sullivans Cove Planning Scheme 1997* notes that the Royal Engineers Building falls within the *Macquarie Point Mixed Use Zone* and is subject to the following use areas: • Commercial and Institutional • Mixed Use • Open Space. The Royal Engineers Building (described as the Royal Engineers Building and Stone Post) is also noted as a Place of Cultural Significance in Schedule 1 of the Sullivan's Cover Planning Scheme 1997.
Current Uses	The Royal Engineers Building is currently used as office/commercial space, with surrounding open grounds and garden spaces. Portions of the surface are sealed with bitumen or concrete, or cover in crushed rock, for foot and vehicle passage.
Closest Surface Water Bodies	• Sullivans Cove, approximately 400 m to the south. • River Derwent, approximately 380 m north-east.
Site Layout	• **Figure F2** in the **Figures** section

2.1.1 Surrounding Land Uses

The surrounding land use comprises a number of aspects including public access and cultural significance; commercial and professional services; retailing; health care; port facilities; light industry; marine industry; fishing industry; and education. The immediate local setting is summarised in **Table 4**.

Table 4 Surrounding Land Uses

Direction from Site	Land Use
North	• The Site is bound to the north by the Hobart Cenotaph and associated public open space. • The River Derwent is located in a general northeast direction from the Site.
South	• The Site is bound to the south by Evans Street, with residential apartments and commercial properties beyond, which extend towards Hunter Street and Sullivans Cove.
East	• The Site is bound to the east by the TasPorts' port operations and further east by the River Derwent. • A Wastewater Treatment Plan (WWTP) is located in a general northeast direction from the Site. It is understood that planning is currently being undertaken by TasWater to decommission and remove the WWTP and construct a replacement pump station, with excavation of an interment basin commenced by TasWater in 2025.
West	• The Site is bound to the west by a public bike path and Davey Street, with commercial properties beyond.

2.2 Areas of Site

For the purpose of assessment and completion of the Environmental Audit, the Site has been divided into sub-areas for assessment based on the nature of identified contamination, historic activity, and the intended future uses of each area. Each area may have specific development controls or work requirements, which are discussed in **Section 4.0**. The sub-areas of the Site are shown on **Figure 1** below.

It is noted that a division of title is currently underway and the northern portion of Audit Area 4 East is planned to be handed to the control of the Tasmanian Department of State Growth. As this has not occurred yet, this area is still included in this SEMP.

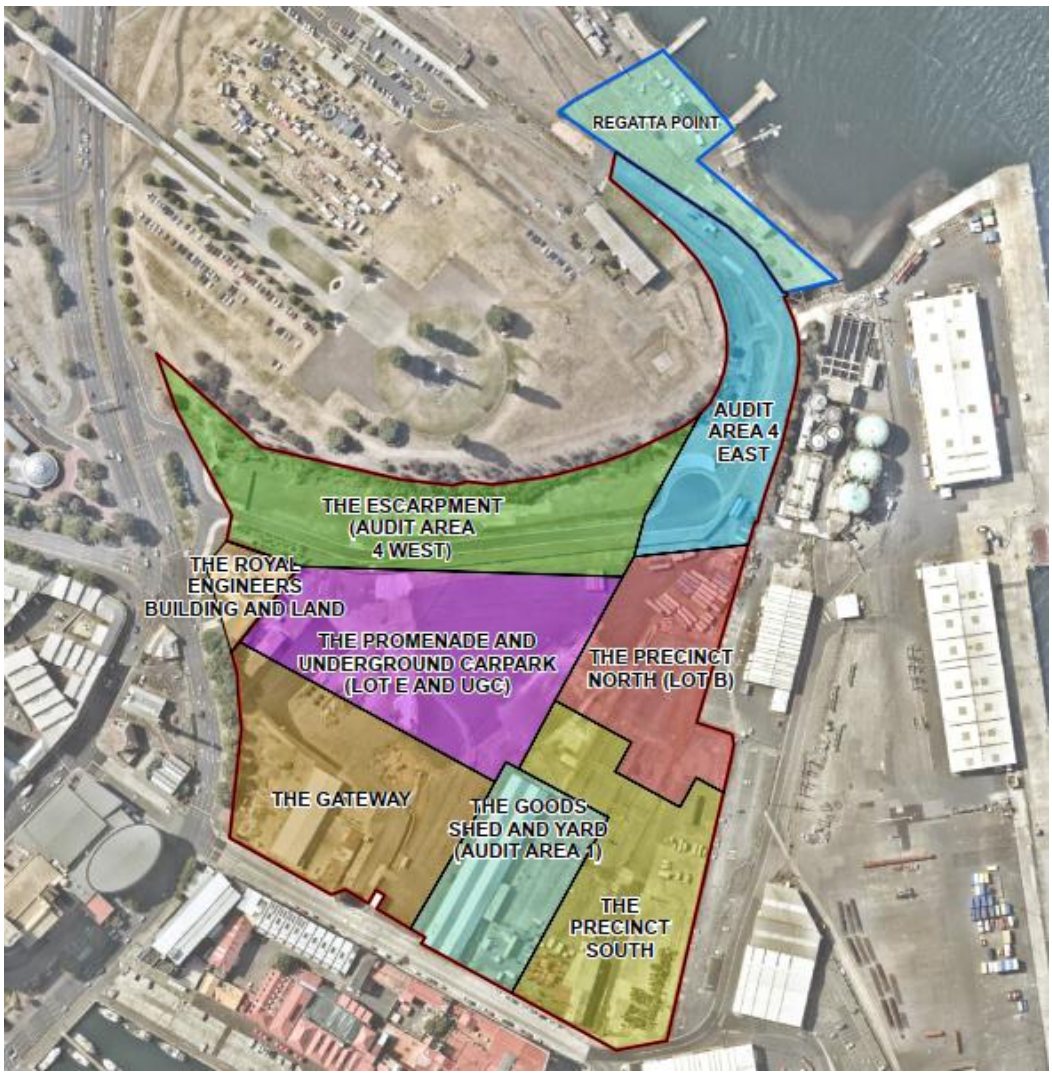

Figure 1 Site Areas

The Site was previously divided into Audit Areas (named Audit Area 1 to Audit Area 7) for assessment. Due to changes in the remediation approach and planned development of the Site, these have been replaced with the sub-areas above. However, the locations of the former Audit Areas are shown on **Figure F2** for reference to earlier documents.

2.3 Future Land Use

Under the previous Site development plan, *New Territory from Old Ground – Macquarie Point Strategic Framework and Masterplan 2015-2030* (the former Masterplan) (MPDC, 2015), the Precinct South was intended for development for a mixture of future uses including residential, commercial and open space.

Environmental assessment and remediation of the Site prior to 2023 was guided by the former Masterplan. However, in September 2022, it was announced by the Tasmanian Government Department of State Growth that the Macquarie Point Site is the preferred location for a future sports stadium and multipurpose area. In August 2024, the *Mac Point Precinct Plan* (the Precinct Plan) (MPDC, 2024a) was finalised for the redevelopment of the Site.

The Precinct Plan outlines the concept for the Site which comprises mixed use precincts summarised in **Table 5** below.

Table 5 Precinct Plan - Proposed Development Precincts

Precinct	Likely Land Use
Aboriginal culturally informed zone	Open space and commercial
Multipurpose stadium and associated concourse zone	Open space and commercial, with an underground carpark in the north-eastern corner.
Royal Engineers building and land	Open space and commercial
Complementary integrated mixed use zone, including restaurants, cafes, hotels, medical facilities and commercial office space	Open space and commercial
Antarctic facilities zone including commercial spaces and connections with the complementary integrated mixed use zone	Commercial and underground car parking
Residential development and public foreshore zone accommodating a variety of tenures and housing opportunities, along with a new public promenade and food and beverage offerings	Medium to high density residential, commercial and open space
A transport corridor and roadway linking Regatta Point to the main areas of the Site	Open space / vehicle traffic / foot traffic
A vegetated area along the northern boundary of the Site. It is proposed that the historic Goods Shed, currently located in the southern central portion of the Site, be moved to this area.	Open space and commercial (the Goods Shed)

Subsurface utilities and maintenance activities are anticipated to occur in all Site areas, and the final surface elevation in some areas is planned to be reduced from the current elevations. The change in development plan and proposed modifications to Site surface elevations affect some previously identified environmental management and mitigation measures, which were included in individual area SEMPs and previous versions of this SEMP (see **Section 1.5.1**). This SEMP has been updated to include the revised measures to suitably manage the Site and avoid unacceptable risks to on- or off-Site users and the environment.

The concept layout of the Site in the Precinct Plan is shown in **Figure 2** below, and on **Figure F2**. The current and proposed final surface elevations are shown on **Figure F3**.

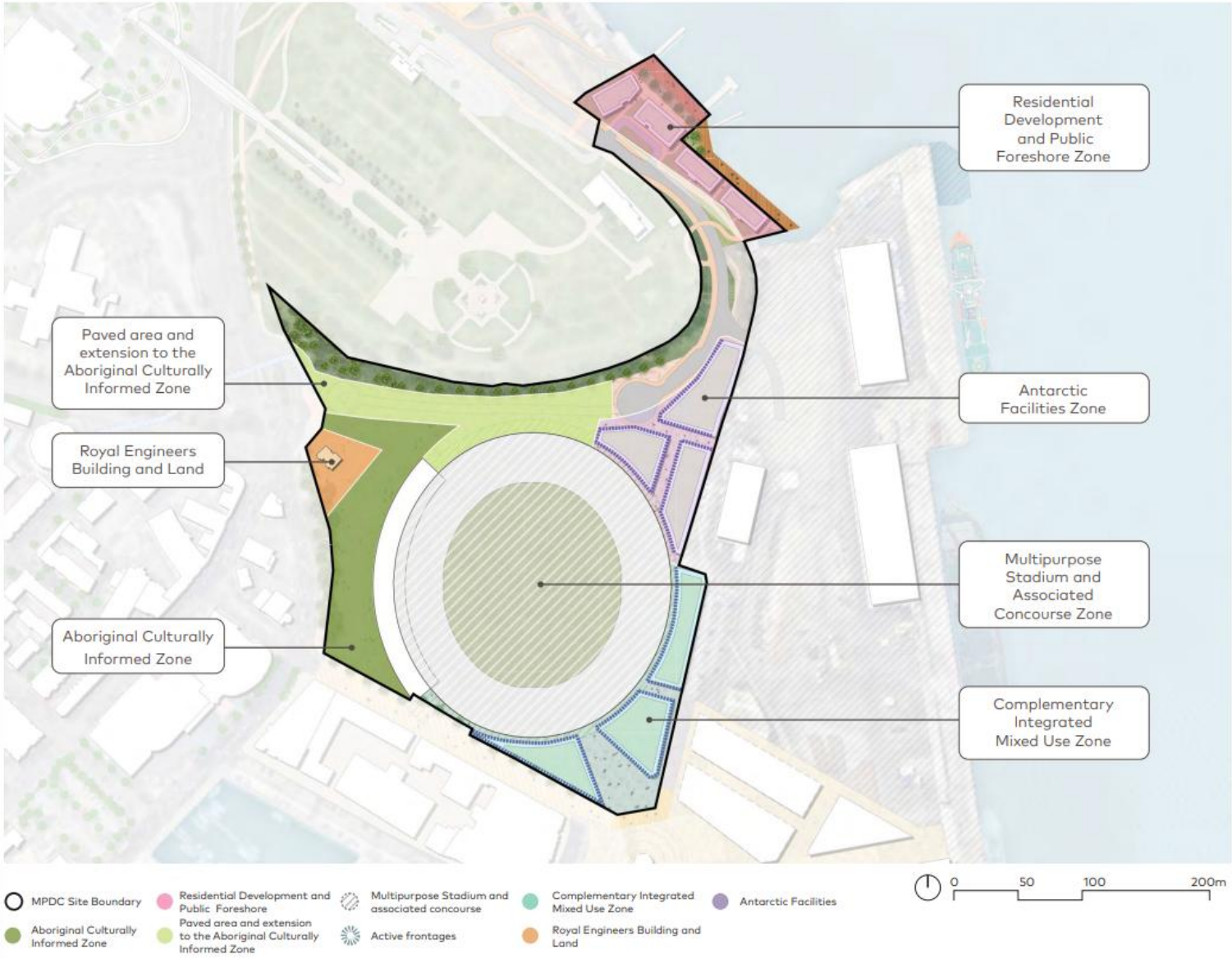

Figure 2 Mac Point Precinct Plan (MPDC, 2024)

The development or future use of the Site may interact with contamination at the Site through contact with potentially impacted soil or groundwater via:

- Excavation of soil.
- Construction of building foundations.
- Extraction of groundwater.
- Construction over or within contaminated soil and groundwater.
- Intrusive maintenance works such as installation or access to buried conduits or pipelines.
- Vapour intrusion into structures or conduits.

2.4 Subsurface Features

Table 6 below provides a summary of currently known subsurface features that may present contaminant source risks or influence subsurface hydrogeology/contaminant transport mechanisms. A plan showing the current known location of subsurface infrastructure is presented in **Figure F5**.

It should be noted that during Site investigations, the Corporation has encountered redundant pipe works and other abandoned services which are not on any records and the origin and purpose of which remains unknown. The potential for unidentified pipe networks or other features to be present below the Site should be considered during future excavation works.

Table 6 Subsurface Feature Summary

Feature	Comment
Gasworks Infrastructure	Historical gasworks infrastructure is located beneath the Gateway area and former gasworks subsurface infrastructure has been backfilled as part of previous Site development. Remediation (via removal) and validation of identified infrastructure which represents a potential source of contamination in the Gateway, was undertaken in 2024 (AECOM, 2025b), and all known pipelines and services related to gasworks operations were removed from the Site. However, the potential remains for unknown pipelines to be present, and should be considered when planning works in this area. Buried concrete slabs may also be encountered in soil in the Gateway area. As part of the same work program, two areas of gasworks waste were remediated by *in situ* solidification and are discussed in **Section 3.4**. Notably, a buried tank base is present around the area of solidified material referred to as Tar Plume B.
Roundhouse	A former Roundhouse was located in the western portion of the Site on the boundary of the Gateway and the Promenade and Underground Carpark areas, and subsurface infrastructure associated with the Roundhouse was backfilled as part of previous Site development. Parts of remaining Roundhouse infrastructure (the central turntable) were excavated and exposed by works in 2021, but other features, such as the maintenance bays, may remain *in situ*.
Buried Railways	During remediation work in 2023, a buried section of railway located between the Red Shed and the SeaRoad Shed Slab was uncovered and removed from the Site. Assessment of samples from the buried railway sleepers reported PAH concentrations below the laboratory limit of reporting (LOR), and as a result it is not considered likely that the railway was treated by creosote and represented a potential source of impact to soil or groundwater. Removal of other Site railway lines was conducted in 2017. However, review of historical aerial photographs identified that the potential exists for two

Feature	Comment
	additional buried railway lines to be located in the Precinct South if not removed as part of this program - one north of the Red Shed, and one beneath the carpark on the western boundary. Potential buried railways are not considered to represent a potential source of environmental risk, as they are from the same time period.
Underground Storage Tanks (USTs)	While no USTs are currently known to exist on the Site, previous known or suspected UST locations are described below and shown on **Figure F5**. • Six USTs were located or suspected to have been historically located to the west of the Goods Shed. - The exact number and location of UST 1 to UST 5 is not known, but based on a historic marked-up plan titled *Hammond Palmer Transport Hobart Tasmania New Pumps & Tanks* and dated 12 June 1984, which indicated fuel tanks associated with freight vessel refuelling may have been present in this area. Investigation of this area in 2017 (AECOM, 20218b) using ground penetrating radar (GPR), Non-Destructive Digging (NDD), and collection and analysis of soil samples, located evidence of former USTs, including backfill sand and fragments of concrete rubble with a metal diesel fill point tag, but did not identify any USTs or hydrocarbon contamination in soil, and later groundwater sampling from wells MW122 and MW148 in the area has not detected any fuel impacts in groundwater. No record of the installation or removal of USTs in this area have been identified, however it is considered unlikely that they are present. - UST 6 was excavated and removed in 2019 (AECOM, 2019b), and is confirmed as no longer present on the Site. • Two USTs (labelled as UST 7) and associated infrastructure were previously located in the central southern portion of the Precinct South and have been removed. A backfilled former UST pit, and associated hydrocarbon odour and residual impact, were identified during the target investigation undertaken in this area in 2014, and excavated and removed in 2023. • A review of historical information indicates that potentially two USTs and associated infrastructure were planned for installation in the north western portion of the Escarpment, in the vicinity of the current StairLink connecting the Site to the Hobart Cenotaph. The exact location of USTs was not provided in the documentation, and no record of UST installation has been located. However, as dolerite bedrock is shallow (approx. 0.5 m bgl) in this area, no indications of fuel impact have been observed in soil or groundwater, and no evidence of USTs were observed during construction of the StairLink in 2021, it is considered unlikely that a UST is present. There is the potential that more USTs are present at the Site that have not yet been identified.

Feature	Comment
Fuel Transfer Lines	Disused fuel transfer lines are known to be currently present in the northern portion of Audit Area 4 East and Regatta Point. Removal of the fuel line in Regatta Point is considered likely to occur as part of remediation of this area of the Site in the future. However, the remaining section of pipeline within Audit Area 4 East is within the land proposed to be handed to the control of the Tasmanian Department of State Growth, as discussed in **Section 1.6**. Portions of fuel lines present in the Precinct North, the Precinct South, and in the eastern section of the Promenade and Underground Carpark area have been excavated and removed in between 2019 and 2023. Removal of pipeline excavations have been validated (noting that Auditor acceptance of validation of pipelines in the Precinct South is still pending). Where pipelines could not be fully removed, they have been plugged with concrete as part of the removal process. At some locations where pipelines exited the Site, pipelines could not be fully removed to the Site boundary due risk of undermining fences or buildings, or high risk subsurface services along Evans Street, and sections of up to 2m in length may remain on Site. Locations where this occurred are noted on **Figure F5**.
Sewer (Main Hobart Pipeline)	The Sewer (Main Hobart Pipeline) currently traverses the central portion of the Site from southwest to northeast. Lead impacts are known to be present in soil around this sewer in the Precinct North area. A realignment of this sewer is planned to occur as part of the replacement of the WWTP to the east of the Site discussed in **Section 2.1.1**. The new sewer alignment will not be within Site boundaries, but will fall below Evans Street to the south and TasPorts land to the east. A sewer line also runs from the Main Workshop area connecting to the Sewer (Main Hobart Pipeline) in the general central portion of the Site. It is understood that both these sewer lines will be removed as part of the Site development.
Stormwater	Stormwater infrastructure is located in the general central portion of the Site traversing the Site in a north-south and east–west direction.
Seawalls/ Engineers Jetty	Seawalls: Historically established for land reclamation purposes. Engineers Jetty: Constructed on the historical outer edge of the former slaughter yard. GHD, 2014 identified the likely location of the Engineers Jetty in the general central portion of the Site and a seawall on the eastern Site boundary.
Former Building Footings	Remnant infrastructure associated with former buildings (such as footings) located across the Site. It is noted that select structures may have archaeological significance.
Telecommunication services	Telecommunications enter the Site in the north western portion of the Escarpment. An exclusion zone of 2 m applies around this telecommunications cable, and works should not be completed within this radius without consultation with the asset owner (Telstra Tasmania). Soil with lead impacts is known to be present within the exclusion zone. The depths of these services are typically between 0.6 m – 1.2 m below ground level (m bgl).
Other Services	Water, electricity, gas and communications services are located across the Site.

Feature	Comment
	Notably, a two power cable (one high voltage and one low voltage) are located within a single conduit in the south-western corner of the Site. A 3 m exclusion zone is in place around the high voltage power line, and maintenance of this exclusion zone is considered required due to the presence of gasworks impacts below the power lines.
Areas of notable impact	Soil and contamination treated by *in situ* solidification (ISS) as part of remediation in 2024 is located in the south-west portion of the Site. Non-Aqueous Phase Liquid (NAPL) impacts are present in soil or groundwater in the southern and central portions of the Site and are described in **Section 3.4**. Some areas of notable higher soil contamination have been identified, at locations where, due to either depth or Site boundaries, remediation excavation could not be continued to fully chase out and removed impacts. Areas of notable contamination are discussed in more detail in **Section 3.0**

2.5 Geology

2.5.1 Fill Material

The Site has been subject to significant filling (controlled or otherwise) since the early 1800's with up to 600 m of land reclaimed in stages from the original 1800's shoreline (Department of the Environment, *Australian Heritage Database*, 2007). Fill material has been encountered across the Site to depths of up to approximately 12.0 m bgl.

Fill material has been described as generally containing a combination of clays, sands, gravels, cobbles and bricks. Virgin Excavated Natural Material (VENM) consisting of crushed dolerite, or reused inert construction materials (crushed concrete and bitumen), has been used as backfill in areas in the Escarpment, the Precinct North, and the Promenade and Underground Carpark Area. The thickness of fill is variable across the Site (0.2 – 12.0 m bgl) and generally increases from north to south across the Site consistent with historical land reclamation activities.

Deeper fill material generally consists of silty sands, similar to the underlying natural marine deposits, indicating that the deeper fill material may be associated with reworked natural material or dredged material. PASS Type 1, as described in **Section 2.5.2** below, has been detected in some fill material.

Staining and odours consistent with gasworks and fuel storage has also been encountered in fill material at select locations.

2.5.2 Natural Soil

Two main natural soil types have been encountered at the Site including marine deposits (silty sands) and slope deposits (weathered Dolerite including clays, gravels and cobbles).

Marine deposits have generally been encountered in the south east portion of the Site, ranging in depth from 3.7 to 15.0 m bgl. Slope deposits generally underlay the marine deposits (with the exception of the northern portion of the Site where the marine deposits are absent). The slope deposits are generally encountered at near surface to 1.4 m bgl in the northern portion of the Site and 11.2 to 19.0 m bgl in the south eastern portion of the Site.

Dolerite bedrock underlies the fill and natural soils at the Site. Dolerite has generally been encountered at near surface in the northern portion of the Site and slopes down in the southerly and south easterly direction and has been encountered at depths up to 25.0 m bgl (GHD, 2014). GHD, 2014 also notes that there are potentially three bedrock highs (i.e. 'reefs') in the general central portion of the Site. The dolerite has been described as of high strength and slightly to highly fractured. A dolerite hill is located to the north of the Site, with the ground of the Hobart Cenotaph present, and exposed dolerite from quarrying of this area in the early 1800s is visible on the escarpment face along this boundary.

In the following instances, the interface between various natural soil types has been difficult to distinguish:

- Between fill material and natural marine sediments given the similar material type, and the possibility that natural soil of similar characteristics may have been used as fill on the Site previously.
- Between the changes from slope deposits to the underlying dolerite bedrock given the weathering of the slope deposits, which consist of fine to coarse cobbles and boulders similar to the dolerite.

The Site is mapped as having a low probability (6-70%) of Potential Acid Sulfate Soils (PASS), as indicated on LISTmap's Coastal Acid Sulfate Soils (0 – 20m AHD) layer (DNRET, 2025). An investigation of PASS was conducted at the Site in 2024 and 2025 and is reported in *Acid Sulfate Soil Investigation* (AECOM, 2025d), with results summarised below.

While Site soil generally has good Acid Neutralising Capacity (ANC), and Site groundwater is generally alkaline and should have a reasonable capacity to buffer against acidification, PASS which will require management measures, if dewatered or disturbed in quantities greater than 100 m^3 (DPIPWE, 2009), is present in:

- Saturated soil, and soil which has been intermittently saturated at the surface of the water table.
- Pockets of unoxidised estuarine sand in unsaturated fill.

PASS was considered in three types of soil, based on the results of assessment and the proposed future activities likely to occur at the Site:

- Type 1 – Estuarine material within the unsaturated fill across the Site.
- Type 2 – Saturated soil within 3 m of the top of the water table, or soil at the water table which may be intermittently wetted, which is considered more likely to be disturbed by direct excavation and construction activities, or by dewatering for construction.
- Type 3 – Saturated soil at greater than 3 m below the water table, which may be disturbed by piling activities, or other activities which disturb deeper soil. This soil is expected to be similar to Type 2, but may have historically had less opportunity for oxidation during land reclamation or due to groundwater fluctuations.

Plate 1 to **Plate 3** show examples of each type of PASS encountered. Requirements for future activities with potential to come into contact with or disturb PASS are provided in **Section 4.12.3**.

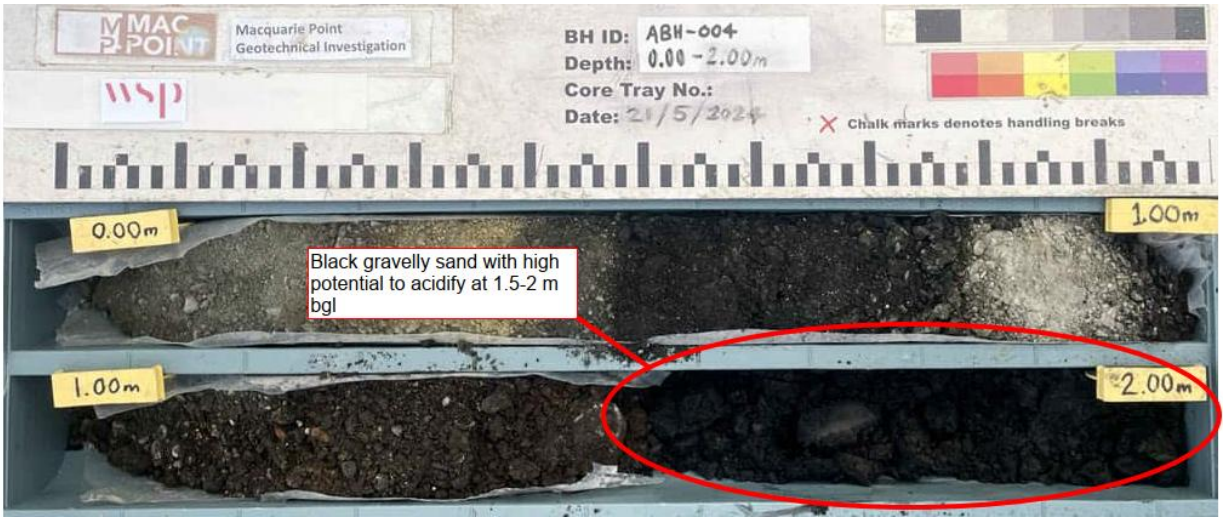

Plate 1 PASS Type 1 - Estuarine material in unsaturated fill (ABH-004 – Core Log at 0 to 2 m bgl) (AECOM, 2025d)

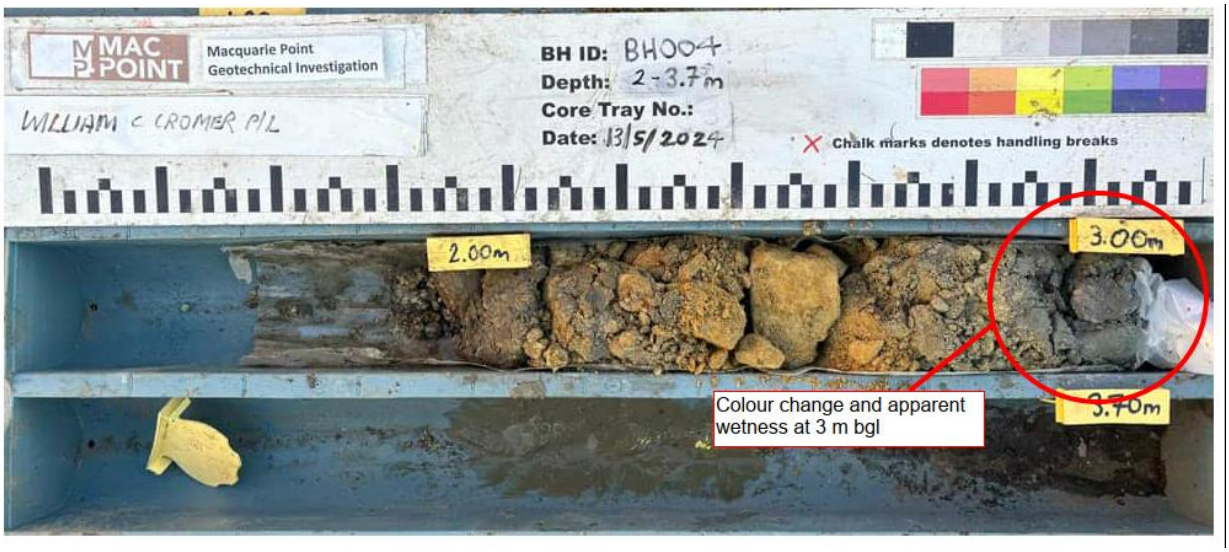

Plate 2 **PASS Type 2 - Intermittently saturated soil at the water table (BH-004 - Core Log at 2 to 3.7 m bgl) (AECOM, 2025d)**

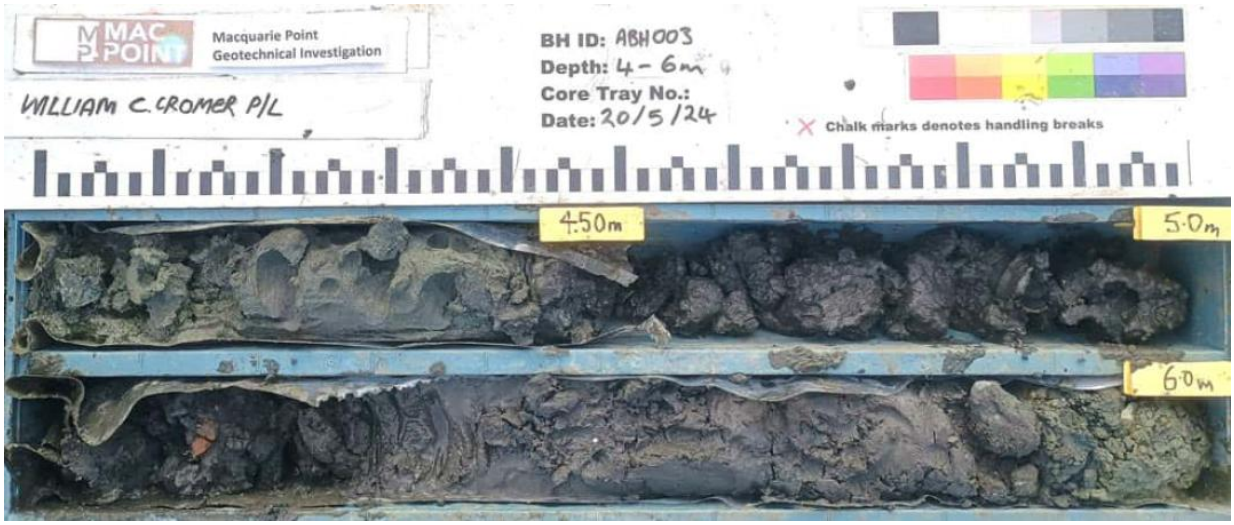

Plate 3 **PASS Type 2 and Type 3 - Saturated soil below the water table (ABH-003 - core log 4 to 6 m bgl) (AECOM, 2025d)**

2.6 Hydrogeology

The River Derwent is located approximately 280 m southeast of the Site boundary and Sullivans Cove is located approximately 170 m south west of the Site boundary.

Based on investigations completed to date, the Site is underlain by a single aquifer unit extending to greater than 25.0 m bgl (the maximum depth assessed). Groundwater has generally been encountered in fill material in the central, southern and eastern portions of the Site, extending into the underlying natural material including marine deposits, slope deposits and fractured Dolerite.

Observations from intrusive investigations have not identified any consistent confining layers between the fill material, natural sediments or the fractured Dolerite to indicate that the lithologies are hydraulically separated. This is supported by similar standing water levels (SWLs) reported for nested groundwater wells screened within different portions of the aquifer, which may indicate that the shallow and deeper portions are likely to be hydraulically connected.

During the last Site-wide groundwater monitoring event (GME), undertaken in June 2025 (AECOM, 2025c), groundwater was encountered below the Site between 1 to 5 m bgl, with deeper groundwater in

the north-west corner. Groundwater elevations ranged between 4.684 mAHD in BG1 in the northern portion of the Site, to 0.423 mAHD in off-Site well MW152, south of the south-east corner of the Site in an off-Site carpark.

Groundwater elevation contours generally followed the pattern of topographic elevation across the Site, indicating a relatively steep up-gradient flow direction to the south-east, prior to flattening out to a very gentle gradient across the central and south-eastern down-gradient areas. Groundwater flow direction followed the steep north-easterly slope towards Regatta Point further around the headland to the far north of the Site.

Groundwater is inferred to have southeast and southerly components of flow in the main area of the Site, with some westerly flow along the eastern boundary with TasPorts land which may be due to a buried seawall in this area, and northeasterly from Regatta Point. The inferred ultimate discharge points of Site groundwater are the River Derwent and Sullivans Cove

Other subsurface structures such as sewer mains (understood to be at a depth of approximately 4.0 m bgl), stormwater pipes, former fuel transfer lines and former sea walls may cause localised variations in groundwater flow direction, and the Hobart Rivulet, which passes north of the Site and through the northern portion of Audit Area 4 East, is considered to present a barrier to groundwater flow.

Testing of hydraulic conductivity across the Site and on TasPorts land to the east was conducted by AECOM in 2015 (AECOM, 2106b), by GHD in 2015 and by SKM in 2001, and was summarised in *Hydraulic Conductivity Interpretations* (GHD, 2015). **Table 7**, below, presents the results of GHD (2015).

Table 7 Adopted Hydraulic Conductivity (m/day) Statistics (GHD, 2015)

Material	Minimum	Maximum	Average	Geometric Mean	Number of Tests
All	0.0053	50	13	2.6	50
All (excluding 50m/day values)	0.0053	35	4.4	1.4	41
Fill	0.14	50	17	5.1	36
Fill (excluding 50m/day values)	0.14	35	6.1	2.4	27
Sediment / Marine Deposits	0.27	5.1	2.3	1.4	5
Weathered Dolerite	0.16	0.56	0.33	0.29	3
Dolerite	0.0053	1.4	0.62	0.25	6

The GHD (2015) interpretation of results noted that:

- Higher areas of high or very high hydraulic conductivity in fill, which are likely to be connected to surface water, were located only in wells in the TasPorts area to the east of the Site.

  Areas of high or very high hydraulic conductivity on the Site (which were identified in the centre of the Site, north-west of the Precinct South) appear to be hydraulically isolated from the coastal boundary, which may be due to either the distance from the Site to surface water, the influence of buried seawalls, or differences in the materials used as fill on- and off-Site.

- Hydraulic conductivity for sediment / marine deposits was calculated based primarily on groundwater wells screened in silts and sands. Wells screened in estuarine clays were not tested, but GHD (2015) notes that estuarine clay visibly appears to have significantly lower hydraulic conductivity.

- Variability in hydraulic conductivity in dolerite is attributed to fracture connectivity, with higher hydraulic conductivity in areas with higher numbers or connections of fractures in the bedrock.

The hydraulic conductivity testing undertaken in 2015 by AECOM (AECOM, 2016a) was undertaken to estimate the hydraulic conductivity of the different lithological units along the southern boundary of the Site. Outcomes of this assessment are listed on **Table 8** below.

Table 8 Southern Boundary Aquifer Tests (AECOM, 2016b)

Formation	Hydraulic Conductivity (m/day)	Test Location
Fill	0.52	MW122, MW123A, MW124A and MW126A
Marine Deposits	0.59	MW124B
Weathered Dolerite / Slope Deposits	0.26	MW123B and MW126B
Bedrock	5.3×10^{-3}	MW128B

3.0 On-Site Contamination

Remediation of the Site has been conducted at the Site to address impacts from contamination and enable future development. However, residual impacts remain on the Site where remediation could not be practicably conducted to completely remove contamination.

Residual impacts are not considered to represent unacceptable risks to users or the environment of the Site or surrounding areas, if managed in accordance with this SEMP.

The following sections of the SEMP provide a description of known residual contamination at the Site to inform those responsible for planning and conducting future Site activities.

3.1 Chemicals of Potential Concern

Based on the known Site history, **Table 9** below presents a summary of the Chemicals of Potential Concern (CoPC) that may be present based on known historical activities or uncovered during investigation of the Site

Table 9 Chemicals of Potential Concern Summary

Area	Historical Land Uses	Chemicals of Potential Concern
Goods Shed and Yard	• Freight storage and handling • Vehicle Maintenance. • Fuel Storage and Handling • Land Reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities. • Chlorinated solvents associated with vehicle maintenance activities. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.
The Escarpment	• Locomotive refuelling comprising fuel storage and transfer facilities • Railway maintenance workshop • Rail corridor and fuel transfer infrastructure historically located within the area • Concrete batching plant • Land reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities. • Chlorinated solvents associated with locomotive maintenance activities and the storage of hazardous materials. • Heavy metals, chlorinated solvents and hydrocarbons associated with workshop and maintenance areas. • Phosphorus and sulphur associated with locomotive washing. • ACM sourced from historical structures (i.e. cladding). • Hydrocarbons associated with the truck wash. • Heavy metals, chlorinated solvents and hydrocarbons sourced from the historical incineration of paint/ solvents. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.
The Promenade and Underground Carpark	• Locomotive refuelling comprising fuel storage and transfer facilities. • Locomotive maintenance. • Freight storage and handling. • Land reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel (diesel) storage and transfer activities. • LNAPL has been detected on groundwater. • Chlorinated solvents associated with locomotive maintenance activities. • Heavy metals, asbestos and PAHs sourced from materials used to backfill Roundhouse structures. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.

Area	Historical Land Uses	Chemicals of Potential Concern
The Precinct North	• Freight storage and handling. • Fuel storage and handing • Land reclamation	• TPHs, BTEXN, PAHs, and phenolic compounds associated with historical fuel (diesel) storage and transfer activities. • Chlorinated solvents associated with locomotive maintenance activities. • LNAPL has been detected on groundwater. • Metals[1] inferred to be due to historic land reclamation have been detected in fill. • PFAS associated with bulk off-Site fuel handing[2]
The Precinct South	• Freight storage and handling. • Fuel storage and handling • Land reclamation	• TPHs, BTEXN, PAHs, phenolic compounds, and lead associated with historical fuel storage and transfer activities undertaken adjacent to the Site's eastern boundary. • LNAPL has been detected on groundwater. • Metals[1] inferred to be due to historic land reclamation have been detected in fill. • PFAS potentially associated with bulk fuel handing which extended to the east of the Site, although portions of the Precinct South formed part of the bulk fuel storage facility[2]
The Gateway	• Former Hobart Gasworks. • Locomotive refuelling comprising fuel storage and transfer facilities. • Railway maintenance workshop. • Land reclamation	• TPHs, PAHs, BTEXN and phenols sourced from coal tar and tar oils, or from historical fuel storage and transfer activities. • Heavy metals, chlorinated solvents and hydrocarbons associated with workshop and maintenance areas. • Phosphorus and sulphur associated with locomotive washing. • ACM sourced from historical structures (i.e. cladding). • Chlorinated solvents associated with locomotive maintenance activities and the storage of hazardous materials. • Complex cyanides, free cyanides and metals sourced from spent oxides. • TPHs, PAHs and metals sourced from coke, coke breeze, ash and clinker residues. • TPHs and BTEX associated with light and drip oils. • DNAPL has been detected in soil. • Phenols, nitrates, sulphates, sulphides, ammonia and PAHs sourced from ammoniacal recovery wastes. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.

Area	Historical Land Uses	Chemicals of Potential Concern
Audit Area 4 East	• Rail corridor and fuel transfer infrastructure historically located within the area. • Land reclamation	• TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities. • Buried ACM has been identified in a section of Audit Area 4 East and is currently temporally capped with a concrete layer. • Metals[1] inferred to be due to historic land reclamation have been detected in fill
Regatta Point	• Public boating, yachting, and port activities. • Rail corridor • Fuel pipeline • Land reclamation • Metals	• Heavy metals, TPH/TRH, PAH, BTEXN, phenolic compounds, SVOC, VOCs, TBT, OCPs, cyanide, ammonia and ACM have all been identified as potential CoPC in Regatta Point based on current and historical uses. Field investigations of Regatta Point were conducted in late 2024, and a DSI with the outcomes is being prepared but is not yet issued. • Metals[1] inferred to be due to historic land reclamation have been detected in fill.

Notes: TPHs – total petroleum hydrocarbons; TRH – total recoverable hydrocarbons; PAHs – polycyclic aromatic hydrocarbons; BTEXN – benzene, toluene, ethylbenzene, xylene, naphthalene; ACM – asbestos containing material; VOC – volatile organic compounds; SVOC – semi VOC; TBT – tributyl tin; OCP – organochlorinated pesticides; PFAS – Per- and Poly-Fluoroalkyl Substances; LNAPL – Light Non-Aqueous Phase Hydrocarbons; DNAPL – Dense Non-Aqueous Phase Hydrocarbons; 1 – aluminium, arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc; 2 - While review of historical information has not identified the use of products containing PFAS, PFOS has been detected in soil and groundwater in this area. There is potential for firefighting foams containing PFAS to have been applied as part of emergency response operations or for training purposes during bulk fuel storage in the short period between the adoption of PFAS-containing firefighting foam in the USA in 1967, and the cessation of bulk fuel storage in 1970.

In addition:

- Methane has been detected in soil vapour sampling, and at concentrations in groundwater which could potentially generate hazardous concentrations of vapour. It is considered likely that methane is present primarily due to the anaerobic degradation of organic materials in natural soil (former river- and sea-bed) which was buried during historic land reclamation, although fuel hydrocarbon impacts in soil and groundwater may also contribute some methane mass.

  While methane is non-toxic, it can accumulate and represent a risk of fire or explosion in structures or buried services.

- PASS has been detected in saturated natural soils.

Appendix C contains areas specific fact sheets which provide more detailed information on CoPC in each area of the Site which has had a CUTEP submission to the Environmental Auditor. The following areas have fact sheets prepared:

- The Goods Shed and Yard
- The Escarpment (Audit Area 4 West)
- The Promenade and Underground Carpark
- The Precinct North
- The Precinct South

The remaining areas of the Site, consisting of the Gateway and Audit Area 4 East, and Regatta Point and the Royal Engineers Building, if added to the Site, will have fact sheets prepared and added to this SEMP as investigation and remediation of these areas are completed.

3.2 Identified Soil Impacts

3.2.1 Fill Material

Shallow soil across the majority of the Site consists of fill material used for land reclamation or construction during the Site's history.

Soil samples collected during the investigation of the Site have been assessed against adopted Tier 1 Criteria for the following uses:

- Maintenance of Modified/Highly Modified Ecosystems
- Human Health
  - Low and Medium/High Density Residential
  - Recreation/Open Space
  - Commercial Industrial
  - Intrusive Maintenance Workers
- Buildings and Structures
- Aesthetics

The following CoPC have been detected in excess of one or more of the adopted Tier 1 criteria in soil samples collected from the Site:

- TRH – C_6–C_{16}, C_{10}-C_{40}
- Benzene, naphthalene, total xylenes
- PAHs – benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, Sum of PAHs
- Metals – arsenic, cadmium, chromium, copper, lead, nickel, zinc
- PFAS - PFOS

Further information on exceedances of the adopted Tier 1 Criteria for areas of the Site where a CUTEP submission has been made can be found in **Appendix C**. Although exceedances of the Tier 1 criteria are present in these areas, they may be managed by implementation of the safety and environmental control measures in this SEMP.

3.2.2 Natural Soil

The AECOM soil investigations undertaken between 2015 and 2025 identified a combination of copper, lead, nickel, zinc and TRH at concentrations in excess of the adopted Tier 1 screening criteria for the assessment of risk to human health and ecological receptors in natural soils at select locations.

In addition, assessment has identified PASS within saturated natural estuarine/alluvial soils below the water table (AECOM, 2025d).

3.2.3 Areas of Notable Impact

As part of the Environmental Audit process for sub-areas of the Site, the following areas of notable impact to soil have been identified:

Table 10 Soil Impacts - Areas of Notable Impact

Area	CoPC	Description
The Goods Shed and Yard	Lead	Areas of lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) were identified in soil proposed for removal as part of Site development and adjustment of the surface elevation of the Site. While removal of this soil is considered likely to occur as part of the development of the Site, these impacts should be considered in planning works prior to excavation or if the proposed development plan is altered.
The Promenade and Underground Carpark	Lead	Areas of lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) are present in the Promenade and Underground Carpark Area, generally at a depth of >2 m bgl. While removal of this soil is considered likely to occur as part of the development of the Site, these impacts should be considered in planning works prior to excavation or if the proposed development plan is altered. Lead-impacted soil may be present following development at two locations, G14 and H12, and should be considered in planning excavation activities.
	Asbestos	Isolated fragments of Asbestos Containing Material (ACM) have been uncovered in fill in this area. Anecdotal evidence indicated that trenches and service pits associated with the former Roundhouse which was present in this area may have been backfilled with building rubble including ACM, although investigation to date has not uncovered any.
The Escarpment	Lead	Lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) is present in the exclusion zone surrounding a telecommunications cable in this area.

Area	CoPC	Description
The Precinct North	Lead	Lead impacted soil which may present a risk to future Intrusive Maintenance Workers is present: • On the eastern site boundary • In the soil surrounding the Main Hobart Sewer line • In some soil locations at depths which are anticipated to be removed by Site development. • In one location (N10), lead impacted soil may be present at the base of the excavation following development. • At depths >2 m below the current Site surface elevation.
	Petroleum Hydrocarbons	Hydrocarbon impacted soil which may present a risk to future Intrusive Maintenance Workers is present on the eastern site boundary.
The Precinct South	Lead	Lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) may be present in the Precinct South at: • At 1 and 2 m bgl in soil bore BH67, noting that impacts are considered limited in volume and may have been removed or partially removed by remediation in 2020. • In some soil locations at depths which are anticipated to be removed by Site development. • At depths >2 m below the current Site surface elevation.
The Gateway	Coal Tar/DNAPL	Coal tar, associated with the historic Hobart Gasworks, has been detected in soil in the south and southwest sections of the of the Gateway area. Notable areas have been identified beneath the high voltage power cable exclusion zone on the western boundary of the Gateway, and trace tar may be present in soil in the area. In addition, tar plumes treated by ISS (Plume B, and the majority of Plume A) form hardened soil monoliths which have higher levels of contamination and should be treated as such if encountered by excavation.
	Lead	Lead-impacted soil which may present a risk to future Intrusive Maintenance Workers (i.e. workers installing or maintaining subsurface conduits) may be present in the Precinct South at: • In some soil locations at depths which are anticipated to be removed by Site development. • At depths >2 m below the current Site surface elevation. • In two locations (in validation samples collected from the base of the excavation which removed UST 6 and in BH88, which was advanced to assess the area where UST 1 to UST 5 were located [see **Table 6**]), lead impacted soil may be present at the base of the excavation following development.

Area	CoPC	Description
Audit Area 4 East	Asbestos	Fragments of corrugated roofing materials between 5 and 300 mm in size were detected within an embankment within Audit Area 4 East, adjacent to the boundary with the Escarpment.

In addition:

- Notably impacted soil is present in the vicinity of known NAPL impacts, as discussed in **Section 3.4**.
- As part of assessment and remediation prior to the update of the Site development plans in 2024, which informed the Contaminated Land Audit Reports for the Goods Shed and Yard, the Escarpment, the Promenade and Underground Carpark, and the Precinct North (see **Table 2**), it was not considered probable that intrusive maintenance workers would come into contact with soil greater than 2 m below the Site surface at the time of investigation, as changes in surface elevation (**Section 2.3**) were not planned at that time. Soil contamination which may represent a risk to intrusive maintenance workers, notably lead, may be present in soil greater than 2 m below the current surface.

These areas are shown on **Figure F5**. Further detail on the location and extent of these impacts, and management controls required for safe future works in the vicinity of these impacts, can be found in the area fact sheets in **Appendix C**, and should be consulted for prior to subsurface works in these areas.

If any future investigation, assessment, or development activity at the Site identifies other notable soil impacts, the SEMP must be updated to include these details in **Table 10** unless removed from the Site, with any such soil removal validated and recorded.

3.3 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) were routinely conducted for monitoring groundwater wells located on-Site between January 2015 and November 2019. Targeted GMEs have been conducted in 2022 in the Gateway and in 2023 in the Precinct South, and the most recent Site-wide GME was conducted in June 2025 (AECOM, 2025c).

Groundwater sample analytical results have been assessed against adopted Tier 1 Criteria for the following uses:

- Drinking water
- Irrigation
- Industry
- Stock watering
- Ecosystem protection
- Recreation - Primary and Secondary Contact
- Aesthetics
- Buildings and Structures
- Vapour Intrusion – Residential and Commercial/Industrial.

The following CoPC have been detected in excess of one or more of the adopted Tier 1 criteria in soil samples collected from the Site:

- Total Dissolved Solids (TDS)
- TPH - C_{10}-C_{36},
- TRH - C_{10}-C_{40}
- Benzene, naphthalene

- PAHs – anthracene, benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, dibenzofuran, phenanthrene, fluoranthene, 2.4-dimethylphenol
- Metals – aluminium, arsenic, boron, cobalt, copper, iron, lead, manganese, vanadium, zinc
- Ammonia (as N), chloride, sodium, phosphorus, sulphate
- Cyanide
- PFAS – PFOS
- Methane
- E. Coli[1]
- pH[1].

Further information on exceedances of the adopted Tier 1 Criteria for areas of the Site where a CUTEP submission has been made can be found in **Appendix C**. Although exceedances of the Tier 1 criteria are present in these areas, they may be managed by implementation of the safety and environmental control measures in this SEMP.

3.4 Non-Aqueous Phase Liquids (NAPL)

NAPL, consisting of both Light Non-Aqueous Phase Liquid (LNAPL) and Dense Non-Aqueous Phase Liquid (DNAPL), is currently known to be present in five locations on the Site, consisting of:

- LNAPL Plumes A1 and A2, in the Promenade and Underground Carpark area.
- LNAPL Plume B, in the Precinct South
- Tar (DNAPL) Plumes C and D, and a portion of Tar Plume A, in the Gateway

NAPL was previously known to be present in the following areas, but has been removed or immobilised by remediation work:

- LNAPL Plume A3, in the Precinct North
- The majority of Tar Plume A, and Tar Plume B, in the Gateway

The location and status of each NAPL Plume is listed on **Table 11**, and current or historic locations are shown on **Figure F5**.

Table 11 Known NAPL Impacts

ID	Location	Contaminants Identified	Inferred Contamination Source
Current NAPL Plumes			
LNAPL Plume A1	Central portion of the Site, Promenade and Underground Carpark	Metals, TPH, PAH	LNAPL (likely diesel) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c).
LNAPL Plume A2	Central portion of the Site, Promenade and Underground Carpark		No detectable LNAPL was present in wells associated with these plumes during gauging in June 2025, although other indicators (such as small volumes of LNAPL during well development or sheen on groundwater) were recorded.

[1] While E. Coli and pH are not “chemicals” of potential concern, they have been treated as such in assessment.

ID	Location	Contaminants Identified	Inferred Contamination Source
LNAPL Plume B	South eastern portion of the Site, Precinct South		LNAPL (likely a combination of diesel and petrol) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c). LNAPL in this area is considered co-sourced with the TasPorts land to the east, where the historic bulk fuel storage considered the original source of LNAPL in this area also occurred.
Tar Plume A (partial) (DNAPL)	The south-western boundary of the Site, the Gateway	Metals, TPH, PAH, BTEX, Phenolics	DNAPL is associated with tar from the production of coal gas which was previously undertaken in the Gateway and off-Site to the west. Tar Plumes C and D, and a portion of Tar Plume A, are located beneath the exclusion zone of a high voltage and power conduit and are not directly accessible. DNAPL is not considered mobile (AECOM, 2024a).
Tar Plume C (DNAPL)	The western boundary of the Site, the Gateway		
Tar Plume D (DNAPL)	The western boundary of the Site, the Gateway		
Former NAPL Plumes			
LNAPL Plume A3	Western portion of the Precinct North	Metals, TPH, PAH	LNAPL (likely diesel) has been identified at the water table and is likely associated with locomotive refuelling activities (AECOM, 2017c).
Tar Plume A (partial) (DNAPL)	The location of a former horizontal retort in the south-west corner of the Site, the Gateway	Metals, TPH, PAH, BTEX, Phenolics	DNAPL is associated with tar from the production of coal gas which was previously undertaken in the Gateway and off-Site to the west. Remediation via ISS of these plumes was conducted in 2024 (AECOM, 2025b), and the remaining material is considered solidified and at no risk of mobilisation. The solidified Tar Plume B is further located within an intact tank base and walls which act as an additional layer of protection against any ongoing impact.
Tar Plume B (DNAPL)	The location of a former tar tank in the south-west portion of the Site, the Gateway		

A detailed assessment of LNAPL impacts and remediation conducted at Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c). This report concluded that:

- Further recovery of LNAPL is considered to be impracticable.
- The remaining LNAPL plumes are sufficiently stable and are not migrating.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a SEMP or

similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

The status of LNAPL Plumes was reviewed using updated data collected between 2020 and 2025 (AECOM, 2025c), which concluded that the status of the plumes was the same as in the previous assessment. No LNAPL was detected in wells associated with LNAPL Plumes A1, A2 and former LNAPL Plume A3, although indicators of LNAPL such as odours, staining, sheen, and LNAPL in groundwater removed during development were observed and trace LNAPL may remain in soil in the vicinity. LNAPL Plume B remains present on and extending beyond the Site boundary in the south-east and should be consider

The *Remediation Work Plan – The Gateway* (AECOM, 2023a) was developed in 2023 to provide a framework and methodology, among other works, for remediation of DNAPL impacts in the Gateway via *in situ* solidification (ISS).

Tar Plume B, and the majority of Tar Plume A, were treated by ISS in 2024 (AECOM, 2025b), and analytical and field data indicates that ISS was successful in increasing the unconfined compressive strength (UCS) and reducing the hydraulic permeability of soil in and surrounding the tar plumes such that detected DNAPL is not accessible and has limited risk of ongoing impact.

Initially, ISS was intended to be undertaken on all four identified Tar (DNAPL) plumes. However, Tar Plumes C and D, and a portion of Tar Plume A, were identified as not being accessible for ISS (AECOM, 2024c) due to the presence of an exclusion zone surrounding an active high voltage power cable along the western and southern boundary of the Gateway. These areas are not considered to be mobile or represent a risk to future on- or off-Site receptors under the proposed development of the Site, however, the locations of potential DNAPL and the cable exclusion zone, shown on **Figure F5**, should be considered during any future works in these areas and additional controls on future works in these areas which may disturb tar have been recommended and are included in **Section 4.9.**

In addition, controls around residual impacts relating to gasworks, including soil management and soil vapour intrusion, have been identified by investigation following ISS remediation and are included in **Section 4.8**.

However, on the basis of the above, further LNAPL or DNAPL remediation is not practicable or required for the proposed future development, noting that Auditor acceptance of DNAPL remediation is still pending. Restoration of groundwater Protected Environmental Values (PEVs) is not practicable, and groundwater management will be required as discussed in **Section 4.13**.

3.5 Soil Vapour

Soil vapour monitoring events have been conducted at targeted locations across the Site between 2015 and 2025 at locations where concentrations of VOCs and SVOCs in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected (as noted in **Section 3.2** and **3.3**), or in the vicinity of the LNAPL and DNAPL impacts (**Section 3.4**) to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Assessment of potential vapour intrusion risks conducted as part of the Site Suitability Statements issued between 2019 and 2021 (see **Section 1.6**), and in subsequent investigations and assessments, including re-assessment of data in light of proposed changes in Site development made in 2024 (**Section 2.3**), has concluded that:

- Assessment of soil vapour impacts associated with LNAPL plumes conducted between 2015 and 2019 concluded that LNAPL does not represent an unacceptable risk to future Site users via vapour intrusion at the Site surface elevations present at the time of assessment (AECOM, 2021c).

  However, a review of vapour intrusion, as part of the assessment of changes to risks from the updated development plan (AECOM, 2026a), identified that, due to the decrease in distance between hydrocarbon impacts and building slabs or any other structural voids, and a reduced vadose zone, hydrocarbon species (such as TRH and BTEXN) may represent a risk to future Site users.

- Soil vapour concentrations of benzene, naphthalene, and TRH >C8-C10 (aromatic) in the former gasworks area (the Gateway) represent an unacceptable risk to future users of the Site under the

proposed development. Assessment and remediation of the Gateway was not complete when earlier versions of the SEMP were issued.

- Methane concentrations have been detected in soil vapour and groundwater which represents a hazard to future buildings and structures in the central, southern, and eastern areas of the Site, in all assessment areas excluding the Escarpment, Audit Area 4 East, and Regatta Point.

  The methane risks beneath parts of the Site have been assessed at Characteristic Situation 3 (CS3) (AECOM, 2026a), as defined in *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020).

- Soil vapour has the potential to migrate under the base of large structures which extend across multiple areas of the Site, and could present risks in adjacent assessment areas following migration. Unlike the current proposed Site development (see **Section 2.3**), the Site development proposed prior to 2024 did not include structures which extended across multiple assessment areas. As a result, some vapour protection measures identified for individual areas are now considered to be required for adjacent areas.

Table 12, below, provides a summary of the assessed potential vapour risks for each assessment area. It is noted that:

- Any requirement for vapour mitigation or protection for each assessment area also applies to the entirety of any buildings or structures (including utility conduits) which are within and extend beyond the boundary of the assessment area, and under which soil vapour may potentially accumulate and migrate.
- Previous investigations have assessed that, where concentrations of TRH/BTEXN above vapour intrusion criteria have been reported in soil samples collected from below the water table, partitioning of TRH/BTEXN to the vapour phase will be dominated by groundwater concentrations. TRH/BTEXN vapour protection or mitigation is considered to be required for any structures which include excavation and construction below the water table.
- Vapour mitigation or protection may not be required if future assessment can demonstrate that no unacceptable risk to Site users is presented. Any such assessment must be prepared by a suitably trained and experienced environmental professional, and verified by an independent Environmental Auditor.

Table 12 Vapour risks identified by Assessment Area

Assessment Area	Summary of Vapour Risks	Vapour Protection or Mitigation Required	
		TRH/BTEX	Methane
The Goods Shed and Yard (Audit Area 1)	• No unacceptable TRH/BTEXN vapour risks have been detected from media within this area for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, the proposed changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including hydrocarbons in soil) in this area • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Sub-slab vapour sampling within the Goods Shed in 2015 did not detect potentially hazardous concentrations of methane, and methane intrusion has been assessed as not presenting an unacceptable risk for this building. However, methane concentrations in groundwater and in soil vapour in this area exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022). Future structures may not have the same ventilation as the Goods Shed (previously assessed in 2015), and methane may represent a risk in new structures or if the ground elevation is altered.	Yes	Yes[2]
The Escarpment (Audit Area 4 West)	• No TRH or BTEXN concentrations in soil have been detected at any depth which exceed the adopted vapour intrusion criteria for 0 – 1 m bgl for the proposed development land uses (commercial) or less sensitive land uses such as industrial or open space. As such, changes in Site elevation are not considered to represent a change in risk of TRH/BTEXN vapour intrusion from soil. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • TRH/BTEXN concentrations in groundwater are below the Site specific RC, which consider potential vapour intrusion as a risk pathway and an assumption of 1 m distance between groundwater and the bottom of building slabs or any other structural voids. • No methane concentrations above criteria have been detected in groundwater in this area.	Yes under the following conditions: - Groundwater present ≤1 m below the bottom of building slabs or any other structural voids. - Structures which extend beyond the Escarpment into an area which require TRH or BTEXN vapour protection or mitigation.	No

Assessment Area	Summary of Vapour Risks	Vapour Protection or Mitigation Required	
		TRH/BTEX	Methane
The Promenade and Underground Carpark (Lot E and UGC)	• No unacceptable TRH/BTEXN vapour risks have been detected for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including hydrocarbons in soil and LNAPL plumes) in this area. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Methane concentrations in groundwater and in soil vapour exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022).	Yes	Yes
The Precinct North (Lot B)	• No unacceptable TRH/BTEXN vapour risks have been detected for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including LNAPL plumes) in this area. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Methane concentrations in groundwater and in soil vapour exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022).	Yes	Yes

Assessment Area	Summary of Vapour Risks	Vapour Protection or Mitigation Required	
		TRH/BTEX	Methane
The Precinct South[1]	• No unacceptable TRH/BTEXN vapour risks have been detected for proposed development land uses (commercial) or less sensitive land uses such as industrial or open space at the current surface elevation. However, changes in elevation alter risk profiles by reducing the distance between the Site surface and detected hydrocarbons (including LNAPL plumes) in this area. • Proposed structures extending beyond the boundaries of this area introduce vapour risks. • Sub-slab vapour and indoor air sampling within the existing Red Shed, and previous structure the SeaRoads Shed, in this area between 2015 and 2025 did not detect potentially hazardous concentrations of methane, and methane intrusion has been assessed as not presenting an unacceptable risk for these buildings. However, methane concentrations in groundwater and in soil vapour exceed adopted criteria and are considered to represent a methane ground gas risk of CS3 (EPA NSW, 2022). Methane may represent a risk in new structures or if the ground elevation is altered.	Yes	Yes
The Gateway[1]	• Benzene, naphthalene, and TRH >C8-C10 (aromatic) have been detected in soil vapour above the adopted criteria for commercial/industrial and residential uses, and DNAPL and trace impacts from former gasworks operations are present in soil and groundwater this area which may represent a risk of TRH/BTEXN vapour generation. • Methane has not been detected above adopted criteria in soil, groundwater, or soil vapour in this area. However, exceedances of criteria have been detected in adjacent areas, including in soil vapour and in up- and cross-gradient groundwater, and the presence of gasworks hydrocarbons which may degrade under anaerobic conditions and indicate a risk of methane generation in future.	Yes	Yes
Audit Area 4 East[3]	Environmental assessment of this area is not yet issued.	To be specified in future	
Regatta Point[3]	Environmental assessment of this area is not yet issued.	To be specified in future	

Notes: TRH – Total Recoverable Hydrocarbons; BTEXN – Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene; 1. Environmental Auditor assessment of these areas is not yet complete; 2. Methane has been assessed as not representing an unacceptable risk in existing buildings in this area. However, risks may be present for future structures as different construction or ventilation may be present; 3. Environmental assessment of this area is not yet issued.

Further detail of the requirements to be fulfilled for mitigations are presented in **Section 4.8**.

3.6 Asbestos

Asbestos or ACM fragments have previously been observed in the following locations at the Site:

- Isolated small ACM fragments have been observed at the surface and encountered in fill material in the Promenade and Underground Carpark, and the Escarpment areas and have been collected and removed by the Corporation or a licensed asbestos subcontractor.
- Larger ACM fragments (5 to 300 mm in size) have been encountered in the side of an embankment in Audit Area 4 East, and are currently beneath a capped area to prevent contact by Site users.
- ACM was detected in piping cladding in a former fuel line which was present beneath the Precinct North and Precinct South areas, but was removed by remediation work in 2020 and 2023. No sections of this pipeline with ACM cladding remaining are known to remain on-Site.
- Asbestos has been observed within the Goods Shed building in the southern portion of the Site.
- Anecdotal reports have identified that ACM may be present in service bays buried beneath the former Roundhouse in the Promenade and Underground Carpark area. No ACM has been observed in service bays which have been excavated and inspected to date, however.

The Corporation maintains an Asbestos Management Plan (MPMS-IMP-MP-WH-04-01) and Site Asbestos Register (MPMS-ELG-RG-WH-04-01), and the most recent versions of these documents, or any future documents which supersede them, must be made available to and complied with by anyone undertaking intrusive works at the Site.

In the event that potential ACM is encountered in soil during subsurface works, all activities are to cease immediately in the immediate work area. The Asbestos Management Plan MPMS-IMP-MP-WH-04-01) should be consulted and utilised to develop an appropriate response to the handling and management of ACM.

4.0 Management of Environmental Risks

4.1 Overview

The following sections provide details of measures to be implemented to manage potential human health risks from the environmental condition of the Site.

This SEMP provides a framework for soil and groundwater management measures associated with subsurface works such as the excavation, disposal and/ or reuse of soil and importation of fill material, as well as the requirements and maintenance of barriers designed to mitigate direct and indirect contact with contaminated soils.

As previously noted, should any activities need to occur at the Site that are not currently covered in the SEMP, then the Site Owner/ Manager should update the SEMP to include these activities, where relevant. Alternatively, should the requirement for a more specific environmental management application be determined, a Construction Environment Management Plan (CEMP) may be required which addresses the proposed tasks and how the works shall comply with the general requirements of the SEMP. It is likely that a CEMP will be required during any future significant construction or development programs which occur on the Site.

The following is a list of appropriate legislative and regulatory guidelines that have been considered in the production of this SEMP:

- National Environment Protection Council, *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended in May 2013) [ASC NEPM]
- Tasmanian Government *Environmental Management and Pollution Control (Waste Management) Regulations 2010*
- Tasmania EPA (2018) Information Bulletin No. 105, *Classification and Management of Contaminated Soil for Disposal* (IB105).

4.2 Preventative Exposure Measures

Preventative exposure measures provided in this SEMP can be categorised as follows:

- **Physical Barriers**: Placement/maintenance of a permanent barrier (i.e. concrete, asphalt, clean soil etc.) to mitigate unrestricted access/exposure to the underlying contamination (as described in **Section 4.6**) and a vapour mitigation barrier to prevent vapour intrusion (as discussed in **Section 4.8**).
- **Administrative Measures** such as:
  - Management plans/documents (such as this SEMP or a WHSP) that provide control of the activities and/or use of the areas of the Site as described in **Section 4.3**.
  - Planning controls as described in **Section 4.4**.
  - Exclusion zones as described in Section **4.9**.
  - Site inductions.
- **Personal Protective Equipment (PPE)** as described in **Section 4.5** to mitigate exposure to potentially harmful chemicals in soil and groundwater during subsurface works.

In some cases, it may be necessary to employ multiple preventative exposure measures, beyond the SEMP, that act as a contingency (or 'fail-safe'). For example, two physical barriers (e.g. concrete and plastic marker layer), or a physical barrier (concrete) combined with an administrative barrier (management plan).

4.3 Work Health and Safety Plan

It is recognised that as part of current and proposed future uses of the Site, it may be necessary to undertake intrusive works. Such activities increase the exposure to potentially impacted materials and therefore protective measures are to be adopted prior to work commencing.

Any works conducted on the Site should be undertaken in accordance with a WHSP. This WHSP should provide guidance with respect to the minimum PPE requirements where workers are likely to come into contact with potentially contaminated materials. Specific Safe Work Method Statements (SWMS) for each task to be performed should also be included in the WHSP.

ANY COMPANY/CONTRACTOR ENGAGED TO CONDUCT SUBSURFACE WORKS AND/OR EARTHWORKS ON THE SITE MUST PREPARE A SITE-SPECIFIC WHSP COVERING THEIR WORKERS AND PLANNED ACTIVITIES.

The following is an overview of WHS considerations for any works that may be undertaken, at a minimum, at the Site:

- Identification of WHS roles and responsibilities
- Evaluation of the Site hazards and the risks associated with these hazards
- Risk assessment methods and the risk control measures
- Details on work practices and restrictions, assessment of anticipated protection levels (including PPE), controls on access to the Site and decontamination
- Methodology for handing and management of soil and groundwater in accordance with **Section 4.12** and **Section 4.13** (if required)
- Detail regarding appropriate ventilation of the work area
- First aid and emergency procedures
- The notification of accidents and other matters
- Environmental monitoring protocols.

Appropriate WHS measures should be established by the contractors for personnel involved in subsurface works at the Site. The levels of protection and the procedures specified in this section are related to contamination issues only and do not represent a WHSP for the Site.

The ultimate responsibility and authority for the health and safety of the individual rests with the individual themselves and their colleagues. Each worker is responsible for exercising utmost care and good judgement in protecting his or her own health and safety and that of fellow workers. It is the responsibility of Site owners and those working on Site to bring any observed potentially unsafe condition or situations to the attention of any worker or contractor. Should workers find themselves in a potentially hazardous situation, they should immediately discontinue the hazardous procedure and take effective corrective or preventative action.

All incidents and/or near misses pertaining to works carried out on Site should be reported immediately to the owner or occupier of the area of the Site in which they occur.

4.4 Planning Controls

Development of the Site as described in **Section 2.3** is intended under the following restrictions:

- Development of an area will not proceed without an area-specific Contaminated Land Audit Report and Site Suitability Statement issued by an Environmental Auditor approved under Section 37 of the *Macquarie Point Development Act 2012*.

  Currently, Auditor approval is being sought for the Site uses described in **Section 2.3** and shown on **Figure F2**. Modifications in Site uses or development (i.e. planning for residential uses in an open space area) will require approval by a Contaminated Land Auditor and may require other controls or management measures. The SEMP must be updated if there are any changes in land use, or in controls or mitigations for environmental risks.

- The Site surface will be covered with either hardstand and/or an engineered break layer, as specified in **Section 4.6** of this SEMP, which shall be implemented to provide a framework for ongoing maintenance and management of the Site during future use. This break layer should be instated if any existing Site structures are removed (i.e., such as the proposed relocation of the Goods Shed to the Escarpment)
- ACM has been previously identified within the Goods Shed building (see **Section 3.6** and separate procedures/documents *MPMS-IMP-MP-WH-04-01 – Asbestos Management Plan* and *MPMS-ELG-RG-WH-04-01 – Site Asbestos Register*).

  Prior to commencement of building-related works within the Goods Shed, or any other structures or areas where ACM is identified (i.e., old pipe lagging), a suitably qualified occupational hygienist must be consulted to confirm the nature and extent of ACM in the work area (if any), and to provide advice regarding the locations and management of ACM, including removal if practicable.
- If the Goods Shed is not relocated as proposed, the existing hardstand and flooring (including the slab, raised platform areas, crawl spaces and hard coverings etc.) must remain *in situ*.
- Any conduits or services at a depth of >2 m below the current Site level must be installed in protective shrouds or in trenches/corridors of clean fill. It is noted that as part of the proposed development of the Site, surface elevations in some areas of the Site will be decreased by up to 4.5 m in some areas of the Site (see **Figure F3**), and protective shrouds/clean soil corridors should be considered required for all subsurface services in areas where surface elevation is decrease by more than 1 m from the current level.
- The potential exists for methane, TRH and/or BTEXN migration into buildings or structures within the Promenade and Underground Carpark, the Precinct North, the Precinct South, and the Gateway areas(including continuous structures which extend beyond these areas). Protection against vapour intrusion must be included in work planning and in building and service design and installation, as described in **Section 4.8**.
- Future development in the vicinity of ISS-treated material in the Gateway must conform to the following requirements:
  - Any future structure over ISS-treated material must consider the bearing strength required by the footings of the building and maintain the integrity of ISS-treated material.
  - Any piling should avoid ISS-treated material if possible. If piling through ISS-treated material is unavoidable, the piling methodology should be planned and implemented to prevent fracturing of ISS-treated material to the extent practicable.
  - The tank walls and base present surrounding Tar Plume B are considered a secondary barrier against leaching of contaminants, and should be left intact as part of future development in this area. Any penetrations in the tank wall or base (i.e., if structural piles are required) must be sealed to prevent liquid ingress/egress.
  - No subsurface services should be installed in contact with or through ISS-treated material.
  - Any disturbance or removal of ISS-treated material should implement measures to minimise potential fracturing or cracking of any material which remains *in situ*.

  It is noted that a Contaminated Land Audit Report has not yet been issued for the Gateway area of the Site, and requirements for management of ISS-treated material in the Gateway may be subject to change in the future depending on the requirements of the Contaminated Land Audit Report.
- The proposed final surface elevations of the northern and north-western portion of the Multipurpose Stadium and Associated Concourse, and of the underground carpark in the north-west of the Site, have the potential to approach or be below the inferred groundwater elevation in these areas.

  Where future development causes (or is expected to cause) surface levels to be lowered or groundwater levels to rise in parts of the Site, such that the depth to groundwater beneath a building slab or any other structural void becomes less than 1 m bgl, design and construction must include measures to prevent:

- Groundwater and/or LNAPL from entering into buildings and structures, or reaching the Site surface. If groundwater drainage is included in protective measures, any drained groundwater must be considered potentially contaminated waste and be removed by a licensed waste transporter, discharged under a trade waste agreement, or otherwise disposed of in a manner which does not represent any unacceptable environmental risk.
- Drainage infrastructure and management of groundwater must consider the potential for dissolved methane to off-gas and the risks which may be generated if this occurs, and include management or mitigation measures.

Any dewatering must also consider potential exposure and oxidation of PASS in saturated soil, as described in **Section 4.12.3**.

4.5 Personal Protection Equipment

It is the responsibility of the contractor carrying out the works on-Site to develop SWMS for works to be undertaken, including the relevant PPE to be worn by the Site workers. This SWMS should be approved by the owner or occupier of the area of Site where works are occurring. The typical minimal level of PPE required for subsurface works includes:

- Neck to toe high visibility clothing
- Hard hat when working with plant equipment (i.e. excavator or similar)
- Protective gloves (Note: Impervious gloves are to be worn if there is potential for contact with potentially contaminated soil and/or groundwater. Gloves should be checked regularly for wear and tear and replaced when necessary).
- Steel-toed boots
- Safety glasses.

Additional PPE for areas of notable contamination should be assessed by Site Safety representatives, including:

- Dust masks, or other measures to mitigate against potential soil dust inhalation, for areas of notable soil contamination noted in **Section 3.2.3** and shown on **Figure F5**.
- Breathing protection and protection such as disposable coveralls for work near NAPL or former gasworks areas.

A first-aid kit, with eye wash bottle and manual should also be available in the work area for intrusive works.

VOC emissions, consisting of fuel hydrocarbon or methane vapours, may become present during excavation, stockpiling and remediation activities involving impacted soils. Vapour monitoring, for example by use of handheld multi-gas monitors, should be undertaken during works where vapour may be generated, with equipment procedures for operation and calibration and applicable action levels must be included in WHSPs.

4.6 Physical Barriers

At present, the Site surface consists of a mixture of:

- Intact concrete or asphalt covering, in:
  - The south, south-east and eastern areas around the Goods Shed, Red Square, the carpark area, and the former SeaRoad Shed Slab.
  - The central western area around 8A Evans Street.
  - The northern portion of the Site along the Escarpment
- Crushed concrete gravel or imported clean VENM over areas of previous excavation, including:
  - The south-west corner (crushed concrete from a former warehouse slab in the area)

- The centre of the Site (imported VENM).

The following is to be considered with regard to the management of potential human health risks at the Site:

- The Site surface should be maintained with hardstand or an earthen cap to prevent direct human access to soil. In the event that the existing hardstand is partly or wholly removed, and/or changes to the configuration and/or penetrations are made, the following would be required:
  - Further assessment to evaluate potential impact to future users.
  - Reinstatement of hardstand, or placement of an earthen cap.

  It is noted that confirmation of the design of all proposed hardstand or earthen cap areas (i.e. thickness and material type) with a Contaminated Land Auditor is required prior to placement.
- In the event that the existing hardstand is partly or wholly removed, and/or changes to the configuration and/or penetrations are made, the following minimum design barrier shall be installed, unless otherwise agreed to with a Contaminated Land Auditor. Note that consideration will need to be given to the intended use of the hardstand area during the design process to ensure the hardstand is suitable for the anticipated loads (e.g. light or heavy vehicles):
  - *Layer 1*: Orange mesh para-webbing (or similar) placed as an indicator barrier over exposed soils to alert Site users/ maintenance workers.
  - *Layer 2*: Sub-grade/ base material (minimum 0.6 m) certified as 'Fill Material' in accordance with Tasmanian EPA Bulletin 105 and be geotechnically suitable.
  - *Layer 3*: Surface covering such as concrete or asphalt at a thickness suitable for the intended use (e.g. light or heavy vehicles). Asphalt shall be a minimum 30 mm thickness to allow for longevity of the barrier.
- Any drains in future basement or subterranean structures must have a physical barrier (i.e., a grate or mesh) to prevent direct contact with any potential groundwater infiltration to drains.

Modifications of the land use and/or the configuration of the Site surface may result in a potential human health risk due to exposure to contamination in the subsurface. This includes (but is not limited to) the following:

- Construction of new buildings.
- Modification of existing buildings.
- Any subsurface excavation works.
- Modification of the existing surface profile (specifically with respect to excavation and/or levelling of soil).
- Modification of the existing surface coverings (e.g. replacing a concrete area with turf).

Section 4.12 provides further guidance with respect to conducting excavation works on the Site. It is critical that in the event that the existing physical barriers are modified or removed during any future works, then they must be reinstated to a minimum of the same standard/quality that exists at that location currently.

In the event that variation from the barrier requirements within this SEMP are required, the suitability of the proposed barriers should be confirmed with a Contaminated Land Auditor prior to implementation.

4.7 Establishment of Plants and Vegetation

Where possible, landscaped areas and gardens should be established in above ground planter boxes on hardstand and not directly over exposed soil.

Where gardens are proposed in-ground, if proposed planting consists of shallow rooted vegetation only, the following barrier system shall be installed as a minimum:

- *Layer 1*: Orange mesh para-webbing (or similar) placed as an indicator barrier over exposed soils to alert Site users.

- *Layer 2*: Earthen cover (minimum 0.6 m) certified as 'Fill Material' in accordance with Tasmanian EPA Bulletin 105.
- *Layer 3*: Surface coverage (comprising shallow rooted vegetation).

If establishment of deeper rooted vegetation, including the establishment of trees, garden and vegetation area design must conform to the designs attached as **Appendix H**, and meet the following requirements:

- Soil imported for in-ground planting must be Level 1 – Fill Material, as defined in Information Bulletin No 105 – Classification and Management of Contaminated Soil for Disposal (IB105) (EPA, 2018).
- No plants intended for consumption are to be included in any in-ground planting on the Site, and no plants grown in-ground should be consumed.
- The potential size of plant root structures should be considered when selecting species for cultivation on the Site. Planting structures should have sufficient volume for the plants to develop without requiring root structures to penetrate the earthen liners and extend beyond the clean-fill soil.
- The earthen liner and barrier layers included in planting designs are to be installed above the Site water table.
- In-ground planting is only to occur in open space use areas. No in-ground planting is to occur within Site buildings (i.e., within atriums, foyers, or arboretums).
- Trees, or any other deep-rooted plants, which are cultivated on the Site should be excavated and removed as soon as possible if any of the following occurs:
  - Death or significant rot/reduction in size;
  - Toppling/knocking over by wind or impact;
  - Any other event which whereby the original Site soil may be accessible to Site users
- In the event that plant removal occurs:
  - Removal of all root structures must be included.
  - If root structures have extended and pierced the earthen liner and/or indicator barrier layer, these must be repaired and restored as part of removal of the plant(s).

Any alternative planting arrangement must be reviewed by a suitably qualified and experienced environmental professional, and documented as unlikely to represent an unacceptable environmental risk to users of the Site or adjacent areas prior to installation.

4.8 Vapour Intrusion Protection

Known Site contamination or former uses have introduced contamination which may present a risk of vapour generation at hazardous levels.

For construction or other short to medium term intrusive Site modification or improvement projects, WHSPs must include a consideration of monitoring of vapour levels of work zone, with particular consideration of:

- Hydrocarbon and fuel vapours (including both concentrations harmful to health, and potential explosive concentrations) for work in the area of NAPL plumes (including solidified DNAPL plumes) or fuel/gasworks infrastructure.
- Hydrogen cyanide (HCN) gases in disturbance of the former gasworks area of the Site.
- Soil methane is unlikely to accumulate in open excavations or trenches, as dissipation from wind or natural air movement typically exceeds any accumulation which may occur from diffusion from soil impacts. However, potential methane accumulation in small or enclosed structures should be considered.

WHSPs should document monitoring requirements and identified action levels based on health or risk documentation for vapours during works, as discussed in **Section 4.4**.

In addition, as discussed in **Section 3.5**, vapour mitigation or protection systems for TRH/BTEXN and methane are considered required for any new structures within or extending beyond the boundaries of the Goods Shed and Yard, the Gateway, the Precinct South, the Precinct North, and the Promenade and Underground Carpark areas.

Future building and utility design in these areas, or any structures which include these areas in their footprint, must have gas protection systems in place as follows:

- Methane – The protection system must include the sufficient protection measures for CS3, as defined in *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020).

  Table 8 in EPA NSW (2020) provides required gas protection guidance values based on the land use. Based on the current proposed development of the Site, a gas protection guidance value of 2 is considered required (AECOM, 2026a).

- TRH/BTEXN – A vapour mitigation system that provides a protection level equivalent to that specified for CS3 is considered appropriate for VOCs (EPA NSW, 2020), including TRH/BTEXN, if it is:
  - Suitably resistant to Site-specific CoPC identified, TRH and BTEXN, including long-term durability.
  - Has at least one layer of redundancy, where each layer is capable of independently providing the protection required.
  - Has calculated vapour fluxes or venting rates (if a ventilation layer is used) which demonstrate no unacceptable risk to users of the building or structure, as described in EPA NSW (2020).

- Design and construction documentation must include:
  - Demonstrated compliance with the required gas protection guidance value.
  - A documented testing and verification method for vapour intrusion mitigation measures, with reference to Appendix 7 – Verification and construction quality assurance, of EPA NSW (2020).
  - Have documented procedures for ongoing maintenance and inspection of vapour protection systems, including post-construction monitoring of venting layers if used, and requirements for restoration of any vapour protection systems which are damaged or penetrated by future activities.

As noted in **Section 4.7**, inground plants (such as atrium vegetation) must not be established over gas protection systems, to prevent potential roots from penetrating protection layers.

Any design and/or installation of vapour protection measures will require independent oversight and sign-off by an Environmental Auditor, or other suitably qualified and independent verifier.

Scoring and description of potential vapour mitigation measures, taken from Table 9 of EPA NSW (2020), are provided on **Table 13** below, with further detail on each measure found in EPA NSW (2020). A required vapour protection guidance value may be met by a combination of measures but must equal or exceed the requirement.

Table 13 Gas Protection Guidance Values (EPA NSW, 2020)

Measure or System Element	Score	Comments
Venting and dilution measures		
Passive sub-floor ventilation with very good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 0.3 metres per second (m/s)[(a)]	2.5	The design of the venting layer (i.e. granular medium with inlet/outlet pipes versus open-void or modular drainage system)[(b)] must be considered when modelling steady-state concentrations
Passive sub-floor ventilation with good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 1 m/s and below 2.5% v/v at a wind speed of 0.3 m/s)[(a)]	1.5	If post-installation testing of passive ventilation indicates that it cannot meet this requirement, inlets and outlets must be upgraded. If this is unsuccessful, it will be necessary to retrofit an active system
Sub-floor ventilation with active abstraction or pressurisation	2.5	Not appropriate for NEPM HIL A residential settings because robust management systems, including alarms, must be in place to ensure long-term operation and maintenance. Achieving the full score requires a design with adequate redundancy and full coverage of the building footprint.
Ventilated car park (basement or undercroft)	4.0[(d)]	Assumes that the car park is vented to deal with exhaust fumes in accordance with BCA[(c)] requirements. The design of a car-park and the specifications of its ventilation system need to be considered in assigning an appropriate score of up to four.
Horizontal soil barriers beneath building footprint		
Horizontal clay or amended soil barriers designed to achieve defined permeability and diffusivity of the gases of concern placed, compacted and tested under appropriate engineering supervision	[(d)]	Requires appropriate engineering input and integration with the building design from the earliest possible stage. This must consider the effects of any proposed piling on the gas regime
Floor slabs		
Reinforced concrete ground-bearing floor slab or waffle pod slab	0.5	At a minimum, it is good practice to install ventilation in all foundation systems to relieve pressure. Breaches in floor slabs, such as joints, have to be effectively sealed against gas ingress to maintain performance
Reinforced concrete ground-bearing foundation raft slab with limited service penetrations cast into slab	1.0	
Reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints	1.5	
Fully tanked basement	2.0[(d)]	The design of a basement and the specifications of its ventilation system need to be considered in assigning an appropriate score. Fully tanked means designed to be waterproof under the range of groundwater conditions likely at the site, to the extent that supplementary internal drainage is not required

Measure or System Element	Score	Comments
Membranes		
Proprietary gas-resistant membrane with a gas transmission rate for the gases of concern on the site that is certified and appropriate to the overall design of the gas protection system. It should be installed by a specialist to an appropriate level of workmanship with documented internal construction quality control (CQC), including integrity testing (e.g. tracer gas or smoke testing), under independent construction quality assurance (CQA) carried out by a certified specialist[(e)] or appropriately qualified and experienced professional with independent verification of the entire process[(f)]	2.0	Membrane performance depends on the membrane material and thickness specified, design and quality of the installation, protection from and resistance to damage after installation, and the integrity of joints in membranes that require joints. Materials that offer some degree of self-sealing and repair are preferred. Long-term performance depends on the durability of the material, including its resistance to chemical degradation in the environment in which it is installed
Monitoring and detection (alarms)		
Intermittent monitoring using hand-held equipment	0.5	Monitoring and alarm systems are only valid as part of a combined gas protection system. Where fitted, permanent systems should be installed in the underfloor venting system but can also be provided in the occupied space as a back-up
Permanent monitoring system installed in the occupied space of the building	1.0	
Permanent monitoring system installed in the underfloor venting or dilution system	2.0	
Pathway intervention external to building footprint		
Vertical barrier	(g)	Required for residential and public buildings at CS 4 and above
Vertical venting systems (source depressurisation)	(g)	

Notes: *(a) Verified by post-construction monitoring; (b) See Appendix 6 of EPA NSW (2020); (c) Building Code of Australia; (d) Score depends on site-specific conditions and design; (e) For example, Geosynthetic Certification Institute – Inspectors Certification Program; (f) See Appendix 7 of EPA NSW (2020); (g) Score depends on site-specific conditions and design, but scores of 4.0+ should be achievable*

4.9 Exclusion Zones

Exclusion zones related to sensitive underground services are currently present on the Site and require controls and consideration in work planning. The known services with established exclusion zones are listed on **Table 14** below, and shown on **Figure F5**.

It is noted that other potential exclusion zones, or underground services which represent a risk if disturbed by intrusive works, may be present or installed by other parties in the future. Any intrusive works undertaken on the Site should consider the potential for underground services in work planning.

Table 14 Known Exclusion Zones

Exclusion Zone	Extent and Area	Requirements and Comments
Hobart Main Pipeline (Sewer) Asset owned by TasWater	3 m around the Hobart Main Pipeline, which passes through the central portion of the Site.	Approval from TasWater is required to undertake construction or groundwater disturbance activities within the exclusions zone, with requirements described in *Guidelines for Building near Sewer or Water Pipelines* (TasWater, 2017). It is noted that this sewer line is being realigned off-Site, and is expected to be removed as part of Site development.

Exclusion Zone	Extent and Area	Requirements and Comments
Telecommunication Cables Assets owned by Telstra Tasmania	2 m around the telecommunication cables in the Escarpment in the north-west area of the Site.	Any requirements to work near these assets should be confirmed with the asset owner prior to commencement. It is noted that these cables are likely to be removed as part of development of the Site, although it is not known if this has been explicitly proposed or discussed with the asset owner.
High voltage (HV) and low voltage (LV) power cables in a single conduit. Assets are owned by TasNetworks	3 m around the HV cable 0.5 m around the LV cable The cables are located on-Site, or have exclusion zones which extend onto the Site, in the south-west corner within the Gateway	Any requirements to work near these assets should be confirmed with the asset owner prior to commencement. It is noted that areas of potentially elevated contamination have been identified within these exclusion zones, and additional controls (below this table) are required for any activity in the exclusion zones, or if the cables are removed as part of future development.

It is noted that:

- Lead concentrations in soil within the sewer and telecommunication exclusion zones exceeds the Site derived Remediation Criteria (RC), listed in **Appendix G**, for intrusive maintenance workers, and potential exposure to lead in soil should be considered when planning intrusive work within the exclusion zones.

  In the event that these services are disconnected and/or removed from the Site:

  - Remediation of soil via excavation may be considered. Any such remediation would require validation by a suitability qualified and experienced environmental professional.
  - If lead impacted soil is not removed and validated, the records that these areas should be considered as having potentially elevated soil contamination (**Section 3.2.3**) should be maintained. Any subsurface services within these areas should be installed in clean soil corridors or protective shrouds to reduce potential exposure during future intrusive maintenance works.

- Potential NAPL and former gasworks waste, referred to as Tar Plumes A (in part), C and Tar Plume D and described in **Section 3.4**, has been identified within the exclusion zone around the power cables in the south-west corner of the Site.

  In the event that intrusive works are undertaken within the exclusion zone around these power cables:

  - PPE and monitoring requirements suitable for work near potential DNAPL should be incorporated in safety documentation and procedures. At a minimum, monitoring for volatile organic compounds (VOCs) and hydrogen cyanide (HCN) with appropriately maintained and calibrated monitoring equipment should be undertaken, with suitable action levels for any detectable concentrations of potentially hazardous vapour.
  - The high and low voltage cables are understood to be installed within a conduit of clean soil. Tar was not encountered at the base of the conduit during installation. In the event that maintenance on the cables is required, work should be limited to within this soil conduit and vertical excavation should be limited to the extent practicable.
  - If the conduits are removed or otherwise decommissioned and the exclusion zone removed, documentation of Tar Plumes C, D, and the portion of Tar Plume A not treated by ISS should be maintained in the SEMP and considered in planning intrusive work in those areas.

    A barrier layer should be maintained over the areas of potential impact as described in **Section 4.6**.

4.10 Chemical Exposure

The following CoPC have been identified in soil, groundwater, and soil vapour at concentrations above the adopted assessment criteria in past investigations and may pose a potential human health risk during future intrusive work:

- Heavy metals
- PAHs
- TRHs
- BTEXN
- ACM
- Methane
- NAPL, including solidified NAPL

A summary of the potential symptoms of exposure is provided in **Appendix D**. Potential exposure to these CoPC should be managed through the implementation of measures provided in a Site-specific WHSP (refer **Section 4.3**).

Other CoPC which may be present at the Site based on historical uses and information, but which have not been detected at potentially hazardous concentrations, are listed in **Section 3.1**.

4.11 Unexpected Finds

In the event that unexpected finds are encountered during intrusive works which have the potential to cause harm to human health or the environment, works shall cease and the area isolated. The Site supervisor and owner/occupier should then immediately be informed.

An unexpected find may include (but not be limited to):

- ACM (see **Section 3.6**)
- USTs
- Redundant pipework and abandoned services (as discussed in **Section 2.4**)
- Historic artifacts (Aboriginal and European) (see **Section 4.11.1**).
- Former gasworks infrastructure
- Stained, odorous, or discoloured soil
- Groundwater at a shallow depth than anticipated.

The material should be appropriately assessed by an experienced environmental or health and safety practitioner (depending on what the material is) and disposed/treated in a suitable manner with consideration to the guidance outlined in **Section 4.12**. Historic or artifact finds should be managed as described in **Section 4.11.1**

It should be noted that during previous Site investigations, redundant pipes and other abandoned services have been encountered which are not on any records and the origin and purpose of which remains unknown. There remains further potential for unidentified pipes to be discovered during subsurface works, and ACM has been detected in bituminous cladding of some pipelines previously removed from the Site. Underground service location surveys are to be completed prior to the commencement of subsurface works and due caution taken as part of any excavation.

Further to the above, if subsurface works are to be undertaken within the Gateway area, or in proximity to the former Hobart Gasworks, reference is made to recommendations provided in Workplace Standards Tasmania *Safety Alert No. 1 September 2010* with regard to working near historical gas infrastructure.

4.11.1 Protocol for Management of Unanticipated Archaeological Discoveries

The potential exists for unexpected Aboriginal and European artifacts to exist in Site soil. Portions of the Escarpment, Gateway and Promenade and Underground Carpark areas have been identified as a Place of Archaeological Significance in the *Sullivans Cove Planning Scheme.*

The following outlines the protocol for managing Unanticipated Historic (European) Archaeological Discoveries. Separate legislative and procedural requirements exist for Aboriginal heritage and these are documented in the Corporation's procedure *MPMS-MPDC-PC-ES-05-01 - Unanticipated Discovery Plan - Aboriginal Heritage*.

Archaeological investigations have taken place at Macquarie Point since 2008 through a series of test and controlled excavations, principally at the western end of the site. These works assist in understanding subsurface archaeological conditions and the potential of certain locations within Macquarie Point to contain archaeological features. Based on these insights, some inferred judgements have been made on:

- The potential, or likelihood for particular areas to contain subsurface archaeology; and
- The likely significance of such features or deposits.

Figure 3 shows the inferred areas archaeological sensitivity of the Site based on works completed to date (MPDC, 2024b), consisting of:

- High Sensitivity. High archaeological sensitivity is present within a single location of Macquarie Point in an area of the original ground surface with demonstrated or historically documented high levels of preservation. This area is highly sensitive both in terms of Aboriginal and early colonial archaeological potential.
- Moderate Sensitivity. Areas of moderate archaeological sensitivity include two places that are within or near to the original shoreline but may not have been heavily or moderately disturbed by twentieth century or late nineteenth century industrial development. These areas may be covered by fill or built upon by later development but there remains a reasonable probability that significant historical or Aboriginal materials are retained, although it is likely they are in a disturbed or secondary context. Any significant archaeological materials that are present may be intermittent or truncated. While twentieth century or late nineteenth century construction has left structural remnants that has not resulted in the total removal of the early soil profile.
- Area Cleared Through Excavation. The archaeological potential of these areas has been previously realised through past archaeological excavations.
- Low Sensitivity. These areas are distinguished by disturbances associated with twenty-first, twentieth century or late nineteenth centuries' industrial development. The pre-colonisation ground surface in this area may be entirely removed or stripped back to bedrock. These locations may also be the site of significant land reclamation. The potential for isolated pockets of redeposited archaeological material remains but is considered to be very small. There is a very low likelihood for Aboriginal cultural material to be present even in secondary contexts.
- Indeterminate or Nil Sensitivity. This rating of sensitivity reflects a lack of determination or a positive assessment of nil archaeological sensitivity across the broader areas of the site as documented in earlier reports and sensitivity mapping. It denominates areas for which detailed subsurface information is lacking but which have not been considered to contain any significant archaeological material. The inclusion of an area within this level of sensitivity rating is not intended as a definitive statement of its sensitivity but rather indicates that while previous sensitivity mapping may have considered the historical development of this area, there has been no assertion of archaeological potential.

The "Royal Engineers Building and Stone Post" (shown on **Figure 3** as 2 Davey Street 'Royal Engineers Building') and the Goods Shed are listed on the Tasmanian Heritage Register and require additional protection and consideration of heritage for development. The Goods Shed is proposed to be moved to the north of the Site, and no development of the Royal Engineers Building is proposed at this time. The former location of Lord's House adjacent to the Royal Engineers Building and the Rivulet

Diversion Tunnel (referred to elsewhere in this document and other reports as the Hobart Rivulet) are also of historic interest, but are not registered as heritage features.

Areas of Aboriginal sensitivity, where shell middens have been observed, are also known to be present in Regatta Point.

Figure 3 Areas of Inferred Archaeological Sensitivity (MPDC, 2024b)

However, it is highly likely that unanticipated archaeology will be encountered during excavation works because of the diversity and widespread nature of past development on the site and the limited insights available from historical research and excavations.

To account for such finds, project specifications for works must consider the potential for dealing with unanticipated discoveries. The Sullivans Cove Planning Scheme 1997 includes specific requirement as part of its requirements for Archaeological Sensitivity Reports, terming such protocols a ‘watching brief’.

Features may include but not be limited to the exposure of handmade clay bricks or sandstone blocks forming walls or surfaces, or artefacts such as fragments of ceramic, bottle glass, bone, shell or other items. Where such material is found, or where doubt exists, excavations within the area should cease pending attendance on site and receipt of advice from a qualified archaeologist, at which point, depending on the findings, it may also be necessary to involve Hobart City Council in discussions.

What if any further archaeological management is required will depend on the significance of the discovery. This will largely be a question of its thematic context; its potential to provide new and important information; and its condition. Management may vary from no further action, to recording of exposed features, to further archaeological monitoring, testing or controlled excavation in accordance with Parts 4 to 8 of the Tasmanian Heritage Council's *Practice Note 2: Managing Historical Archaeological Significance in the Works Application Process.*

4.12 Soil Management Plan

The management of soils at the Site must have regards to the provision of both the *Environmental Management and Pollution Control Act 1994* and IB105.

4.12.1 Excavated Material

In the event soil needs to be excavated, the contamination status of the soil must be determined and a waste classification assessment completed (discussed in **Section 4.12.4**).

If excavated materials are stored on-Site, they must be stockpiled in a designated area, or otherwise stored in soil drums, waste skip or other containment which prevents contact with Site surfaces or loss of soil via erosion, and must be labelled as contaminated, until the material is removed, reinstated, or otherwise disposed of.

The stockpiling area is to be on hardstand or high-density polyethylene (HDPE) sheeting. Stockpiles should be appropriately managed to prevent the loss of suspect soils as dust (via wind erosion), or stormwater runoff.

This may involve:

- Covering, or spraying the stockpiles to keep the soil damp to mitigate wind erosion.
- Construction of silt fences and other measures to capture and prevent runoff from the area.
- Establishment of exclusion zones or barriers to prevent access and contact with soil by unauthorised people.

Stockpiling for an extended period of time should be avoided in order to mitigate potential environmental impacts such as dust and odour generation, and stormwater and sediment run off. Exclusion zones or barriers should be maintained around excavations to prevent access by unauthorised people who may fall into excavations or come into contact with the soil.

Soils with potentially high levels of contamination encountered during excavation work must be separated and stockpiled from other non-odorous, visibly clean soils, and assessed by a suitably experienced environmental practitioner. Soils which should be separated in this way may be identified by one or more of the following attributes:

- Containing coke, ash, coal tar, ACM fragments, or other visually evident contamination
- Highly odorous (i.e. putrescible, aromatic or hydrocarbon odours)
- Visibly stained (i.e. hydrocarbon staining or other)
- Soil which appears to have been in contact with groundwater
- Soil excavated from the areas of notable soil impacts as noted in **Section 3.2.3**.

4.12.2 Dust Management

This section is applicable to works associated with subsurface excavation and soil movement. It is expected that normal operation of the Site, or intended future uses, will not require the implementation of dust and odour controls.

The following measures that can be undertaken to assist with mitigating issues associated with dust and odours should be considered when planning soil excavation or movement on the Site:

- Minimise movement of vehicles on exposed surface areas
- Minimise excavation and movement of soils
- Dampen down vehicle tracks with water or undertake wheel washing
- Trucks transporting soil around and off-Site should have their loads covered with tarpaulins (or similar) to prevent the emission of dust and/or odour
- Dampen down exposed soil in excavations, or in stockpiles, to minimise dust generation
- Dampen down exposed soil, stockpile, or loads, with an environmentally appropriate odour suppressant solution
- Avoid excavating soil on windy days, due to the increased likelihood of dust and odour generation and transport
- Cover exposed soil (i.e. stockpiles) with netting, matting or plastic sheeting if necessary, to minimise generation of dust and odours.

4.12.3 Acid Sulfate Soil

This section is applicable to works associated with subsurface excavation and movement of soil at or near the water table, where greater than 100 m^3 in volume of soil will be disturbed or potentially exposed to atmospheric oxygen.

PASS located in saturated materials at or near the water table has the potential to oxidise and form Actual Acid Sulfate Soil (AASS) if disturbed or exposed to oxygen. The extent and characteristics of PASS detected at the Site are described in *Acid Sulfate Soil Investigations* (AECOM, 2025d), which requires:

- Future activities at Macquarie Point should identify all activities which have the potential to disturb or expose (i.e., dewater) PASS at the Site, and:
  - The SEMP and CEMPs should include overarching management obligations for disturbance of ASS and/or water table drawdown via dewatering.
  - A scope specific Acid Sulfate Soil Management Plan (ASSMP) and Dewatering Management Plan (DWMP) should be developed for each discrete works package involving civil and general earthworks activities, water table drawdown via dewatering, and any other significant soil disturbance activities or changes to natural groundwater and surface water systems.

    These documents should be prepared by those undertaking works which may disturb PASS, and must include:
    - Estimated volumes and action criteria for PASS which may be disturbed by the proposed works.
    - Procedures for the handling of disturbed PASS, including verification of neutralisation, groundwater generated by dewatering, and monitoring of Site environmental conditions in the vicinity of PASS disturbances.
    - Contingency measures which are specific, measurable, and attainable, and can be implemented in a timely manner in the event that action criteria or trigger values are exceeded.
- Future structures and infrastructure at the Site should consider the potential effects of sulfides and possible acidification in design and selection of materials, and adopt appropriate mitigation measures to prevent degradation of materials overtime.
- Any groundwater, or run-off which may have come into contact with PASS, should be considered as potentially contaminated. pH and the potential to acidify should be considered in assessment any such water prior to disposal

4.12.4 Characterisation for On-Site Reuse/ Off-Site Disposal

Tasmanian EPA Information Bulletin No. 105, *Classification and Management of Contaminated Soil for Disposal* (IB105) (EPA, 2018) provides guidance with regard to the classification of contaminated soil for disposal purposes. Two categories of Fill Material were introduced by amendment of the *Environmental Management and Pollution Control Act 1994* (the EMPCA) and the *Environmental Management and Pollution Control (Waste Management) Regulations 2020* in 2021, and clarified by *Clean fill Type 1 and type 2 – Declaration of pollutant levels* (EPA, 2022).

Soil at the Site excavated and removed from the Site as part of remediation work between 2015 and 2024 has typically been characterised as Level 2 – Low Level Contaminated Soil due to the presence of:

- Metals (arsenic, cadmium, chromium (total), copper, lead, mercury, nickel, tin, zinc)
- TPH (>C10-C36)
- PAHs

It is noted that total concentrations of PAHs (generally benzo(a)pyrene and Sum of PAHs) and lead in excess of the Level 2 criteria have been detected in Site soil. However, Section 2 of IB105 states that "*Generally, where a leachable concentration is prescribed in Table 2* [of IB105] *that value takes precedence over the total concentration and is used as the sole determinant of the final classification for disposal…*"

Leachate concentrations of benzo(a)pyrene, benzo(a)pyrene toxicity equivalence quotient (TEF), and lead have typically been reported below the Level 2 criteria. However, total concentrations of these CoPC have been, and should be for future soil, considered when determining disposal scenarios.

Based on analytical results available for soil which remains *in situ* at the Site, it is expected that remaining soil will have similar characteristics. Small areas of other possible characterisations may exist, consisting of:

- Level 1 – Fill Material, which has been identified on-Site in:
  - Areas where clean fill has been imported and no contaminating activities have occurred, such as bedding sand beneath recent slabs.
  - Natural rock (dolerite bedrock) which has been excavated and crushed.
- Level 3 – Contaminated Soil, which has been identified on-Site in:
  - Areas of elevated hydrocarbon impact where bulk fuel storage has previously occurred, such as proximity to known LNAPL plumes.
  - Areas of elevated metals concentration in fill material.
  - Areas of leachable PAHs or tar traces in the former gasworks area in the southwest corner of the Site (the Gateway).

Due to the heterogeneous nature of soil at the Site, excavated soil or other materials from the Site must be stockpiled (or stored within a skip/drums) and appropriately characterised for on-Site reuse or off-Site disposal by a suitable qualified environmental practitioner on a case by case basis.

It is noted that in accordance with IB105, on-Site remediation, treatment and/or reuse is the preferred approach to the management of contaminated soil.

A recommended approach for characterising excavated materials is provided in the following sections.

4.12.4.1 Soil Assessment and Sampling

Any assessment of soil, including any sampling program to determine acceptable on-Site reuse or off-Site disposal scenarios, should be planned and undertaken by a suitability qualified and experienced environmental practitioner.

Any such assessment should consider the history of the source area and potential sources of contamination, and any previous investigations or available analytical data, in order to identify CoPC in the soil to be assessed. Additional sampling, if required, should be conducted in line with the guidelines

and practices in the ASC NEPM and other guidance or commonly accepted reference methodologies, and should include quality assurance and quality control sampling such as intra- and inter-duplicate samples and analytical blanks.

Soil should be sampled at a suitable rate for assessment and identification of contaminants. IB105 defines 1 sample per 25 m^3 for waste classification, but statistical assessment methodologies, such the approach provided in *IWRG702 - Industrial Waste Resource Guidelines: Soil Sampling for Waste Soils* (IWRG702) (EPA Victoria, 2024) may be appropriate for larger volumes with EPA approval.

4.12.4.2 On-Site Reuse

To assess the suitability for excavated materials to be reused on Site, it is recommended that soil data be screened against the Site derived Remediation Criteria (RC) developed by AECOM (refer AECOM, 2016, 2025a) and listed in **Appendix G**. The RC are based on generic assumptions regarding future land use including:

- An engineered break layer will be present at the ground surface to mitigate the potential for future Site users (with the exception of Maintenance Workers) to have direct contact with soils or groundwater.
- Groundwater extraction will not be undertaken except for investigative or remediation purposes.
- A SEMP (this document) will be in place in the future to maintain/manage the surface cover. The SEMP is likely to be included as part of the Site suitability statement provided by the Site Environmental Auditor.
- Adjacent off-Site land uses include open space, commercial/industrial and residential areas. As these potential land uses have been considered on the Site, the derived RC are considered to also be protective of potential exposures to off-Site receptors (e.g. via groundwater migration beyond the Site boundary).
- It is considered that potential exposure to workers undertaking remediation and/or development activities can effectively be mitigated through the implementation of an appropriate Construction Environmental Management Plan. The CEMP will be prepared during the planning stage for any future remediation and/or development activities.

Soil should be analysed for, at a minimum:

- Heavy Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, vanadium, and zinc)
- TPH
- BTEX
- PAH
- Cyanide
- Phenolic compounds.

In addition:

- At least 30% of samples should be analysed for a full suite of the compounds listed in IB105, with the exception of tributyltin, which has not been detected or historically used on Site.
- If it is suspected that other contaminants may be present (e.g. asbestos), these should also be included in the analytical suite.
- If >100 m^3 of soil has been excavated from below or within 1 m of the water table, it should be managed as PASS as described in **Section 4.12.3**. Soil should only be considered for reuse if neutralisation of any potential acidification has been confirmed by laboratory analysis, typically by either chromium reducible sulfate (CRS) or suspension peroxide oxidation and combined acidity sulfate (SPOCAS) analysis.

Where compounds are reported below the interim RC, soils may be reused on-Site and covered with an impervious barrier (i.e. placement of physical hardstand). In cases where compounds are reported above the interim RC, an appraisal as to whether the material is suitable for on-Site reuse (with

consideration to the implementation of additional management controls) should be undertaken by an appropriately experienced environmental practitioner.

4.12.4.3 Off-Site Disposal

If off-Site disposal of excavated material is planned, stockpiles or waste in soil drums must be sampled and analysed for waste characterisation purposes prior to removal from Site in accordance with IB105.

Material should be sampled at a rate of 1 sample per 25 m^3 (or three samples as a minimum) and analysed for compounds listed on Table 2 of IB105. Alternative sampling suites and/or density may be accepted by EPA and waste disposal facilities, but any change from the sample suites and sample density should be determined by a suitably qualified environmental practitioner.

If >100 m^3 of soil has been excavated from below or within 1 m of the water table, it should be managed as PASS as described in **Section 4.12.3**, and neutralisation should be confirmed by laboratory analysis prior to any off-Site disposal.

Table 15 below provides an overview of soil disposal options with reference to IB105.

Table 15 IB105 – Waste Classification Summary

EPA Classification	Disposal/ Treatment Options	Requirements
Level 4 (Contaminated Soil for Remediation)	• On-Site remediation • Off-Site remediation • Storage pending availability of treatment	• No direct disposal to landfill • EPA Environmental Approval and transport certificates must be used • Vehicles must hold EPA permit (unless exemption issued)
Level 3 (Contaminated Soil)	• On-Site remediation • Off-Site remediation • Licensed landfill	• Disposal to licensed facility • EPA Environmental Approval and transport certificate system must be used • Vehicles must hold EPA permit (unless exemption issued)
Level 2 (Low Level Contaminated Soil)	• On-Site remediation • Off-Site remediation • Licensed landfill	• Disposal to licensed landfill • EPA Environmental Approval and transport certificate system must be used • Vehicles must hold EPA permit (unless exemption issued)
Level 1 (Fill Material)	• Unrestricted	• Disposal should not adversely impact the environment or human health

A Waste Management Plan (as detailed in Section 5.2 of IB105) must be prepared and submitted to EPA for approval for disposal of any material which is classified as *Level 2 (Low Level Contaminated Soil)* or above.

Soils and excavated materials classified as *Level 4 (Contaminated Soil for Remediation)* must be remediated (either on-Site or off-Site) and are typically unable to be disposed directly to landfill without treatment.

Any proposed disposal site must be legally able to accept the quantities and contaminant profile of any material proposed for off-Site disposal.

4.12.5 Imported Material

Any materials imported to the Site for use as fill will be required to meet the environmental and geotechnical requirements specified for the particular end use. Material should comply with the

requirements for reuse as defined in IB105 and should be assessed and below the site specific RC as defined in **Appendix G**.

Compaction of backfill should be applied such that the reinstated areas will not settle.

4.12.6 Surface Reinstatement and Barrier Restoration

Where hardstand has been removed to facilitate excavation activities, it is recommended that the surface be reinstated with like materials (i.e. concrete with concrete), or with a physical barrier which fulfils the requirements described in **Section 4.6**.

4.12.7 Material Tracking

A record of excavated soil and stockpile movements, including, but not limited to, the location of materials excavated, quantities, descriptions of materials encountered (including observations of potential contamination), laboratory test certificates, disposal location, and tip dockets, should be maintained by the Site owner or occupier for any work involving the import, excavation, or other movement of soil at the Site. This tracker should be kept with Site records for future reference.

The form of tracking may be determined by those managing or conducting the works, however an example materials tracking register is attached as **Appendix E**.

4.13 Groundwater Quality Management Plan

A Site-specific Groundwater Quality Management Plan (GQMP) is attached as **Appendix F**, and must be implemented at the Site in order to allow:

- Maintenance of knowledge on the condition of Site groundwater elevation, flow direction, and chemical characteristics and record any changes which may arise over time or as Site condition changes.
- Assess if unacceptable risks to on- and off-Site human and ecological receptors may be presented by changes in groundwater conditions, and to identify what additional assessment, mitigation, or remediation actions are required.

The GQMP includes:

- A summary of the regulatory framework applicable to the assessment and management of groundwater at the Site.
- Data Quality Objectives (DQOs) for groundwater monitoring events (GMEs) at the Site.
- Methodologies for ongoing monitoring and sampling of groundwater.
- Key groundwater risks.
- Trigger levels and contingencies.

The GQMP should be reviewed and updated at the same frequency and conditions as the SEMP (**Section 5.4**), or as otherwise identified within the GQMP. Ongoing groundwater monitoring at the Site within the GQMP may only cease with Environmental Auditor verification of the final GME report which recommends cessation of groundwater monitoring.

4.14 Noise Control

Works with heavy plant or other equipment which has the potential to cause noise above background levels should be conducted in accordance with the most recent version of *MPMS-MPDC-FW-MP-04-02 - Construction Noise & Vibration Management Framework*, or have otherwise documented procedures and methodologies which comply with the *Environmental Management and Pollution Control (Noise) Regulations 2016*.

Noise and vibration controls should consider and include:

- Receptors on- and off-Site who may be affected by noise and vibration.

- Acceptable levels of noise and vibration generation, including Noise Management Levels and alarm levels
- Potential sources of noise and vibration, and allowable hours of operation
- Mitigation and monitoring procedures

5.0 Implementation

The SEMP is an active document, which needs to be considered by all parties/stakeholders who may plan or undertake works which come into contact with Site soil or groundwater or access confined spaces where groundwater or soil vapour infiltration may occur. Any parties carrying out such works at the Site shall satisfy themselves that suitable safety and environmental controls have been implemented as part of their proposed works program.

Should any activities by the Site owner or occupier, or with their consent, need to occur on the Site that is not currently covered in the SEMP, then the SEMP should be updated to include these activities. Alternatively, as stated in **Section 4.1**, a CEMP may be required which specifically addresses the proposed tasks and how the works shall comply with the general requirements of the SEMP.

5.1 Site Inspection

Visual inspections of the Site should be undertaken by the Site owner or occupier (or nominated representative) annually to assess the surface condition of the Site. Where excavations have taken place, and excavations have been backfilled, the surface is to be reinstated with an impervious barrier (i.e. placement of physical hardstand).

If significant works are undertaken, or breaches or damages to surface protections are detected, inspection of the affected area should be undertaken at the time of works, and at the completion of modifications of the area, or repairs to damaged surface coverings.

Where this has not been undertaken, corrective actions will be required to reduce the risk to an acceptable level to such an extent that it no longer presents an unacceptable risk to human health or the environment.

A register of the completion of visual inspections and documentation associated with works completed subsequent to inspections identifying the need for corrective actions should be maintained by the Site owner or occupier, as noted in **Section 5.5**.

The register of inspections should include (but not be limited to) the following:

- Time and date of the inspection and/or incident
- Details of any visual indications of changes to surface conditions at the Site
- Details regarding the cause (suspected or known) of the breach
- Details and documentation associated with works undertaken in the reinstatement of surface condition
- Details of any systems or procedures implemented to prevent similar breaches or deteriorations in the future.

5.2 Incident Management

All environmental incidents should be recorded, and if an incident or potential incident is likely to cause significant impacts to people or the environment, the Site owner or occupier should be immediately notified.

Environmental incidents, accidents or mishaps include:

- An incident or actual environmental impact.
- A near miss, where an incident has occurred, but no environmental impact occurred.
- Observations of potentially hazardous or unsafe situations.

Records shall be kept by the Site owner or occupier of any environmental incidents, hazardous situations, unusual events and the corrective action taken. A representative of the Site owner or occupier should investigate the cause of any emergency so that necessary changes in work practices can be made to prevent the incident recurring.

5.3 Corrective Actions

In the event that Site conditions result in an accidental or unintentional risk to human health or the environment without implementation of appropriate exposure minimisation measures, isolation of the affected area should be undertaken and steps taken by the most suitable and effective means to prevent exposure to Site personnel or the environment.

Following this, the SEMP should undergo a review of all procedures to minimise the potential for future exposure of impacted material. Corrective actions should be completed in a manner and timing as directed by the Site owner or occupier.

Following the incident or accident, a documented review of the incident should be undertaken by the Site owner or occupier (or their nominated representative). The review should be tasked with identifying the cause of the incident and providing recommendations on alternative procedures or systems to be implemented at the Site and/or within the SEMP to prevent/minimise the likelihood of the incident reoccurring.

5.4 Document Revision

A review of the SEMP should be undertaken by the Site owner/occupier:

- Every three years, based on the range of 1 to 5 years provided in *Environmental Management Plan Guidelines* (DCCEEW, 2024).
- If significant changes in Site use or environmental condition (i.e., a chemical release) occur.
- If significant changes to environmental legislation occur
- Within three months of any design variance being reviewed and accepted by a suitably qualified and experienced Contaminated Land Auditor prior to construction (**Section 1.2**).

Reviews should consider the following, and identify if any update or revision of the SEMP is required:

- Any non-compliances with the SEMP that have not been rectified
- Means of improving environmental compliance
- Changes legislation or guidelines that impact any part of the SEMP or use of the Site
- Proposed changes in the way the areas of the Site are used or any changes in the surrounding land use which may impact upon exposure pathways.
- Any design variances (i.e., proposed designs which did not comply with the wording of the SEMP) which have been reviewed and verified as not introducing any unmanaged or unacceptable environmental risks by a suitably qualified and experienced Contaminated Land Auditor (see **Section 1.2**).

Any changes or updates to the SEMP should be recorded in **Appendix N**. The Site owner/occupier (or their designated delegate) must communicate any changes and provide the most recent version of the SEMP to any contractors or other workers who are undertaking Site activities which may come into contact with soil or groundwater.

5.5 Record Keeping

The Site owner or occupier will be responsible for keeping documents relating to the implementation of the SEMP, including (but not limited to):

- Documentation generated by the activities in **Section 5.1** to **5.3**, including records of Site inspections, environmental incidents, and corrective actions.
- The most recent specific procedures which are referenced in this SEMP, or any subsequent replacements, consisting of:
  - *MPMS-MPDC-PC-ES-05-01 - Unanticipated Discovery Plan - Aboriginal Heritage*
  - *MPMS-MPDC-FW-MP-04-02 - Construction Noise & Vibration Management Framework*

  - *MPMS-IMP-MP-WH-04-01 – Asbestos Management Plan*
  - *MPMS-ELG-RG-WH-04-01 – Site Asbestos Register*
- The outcomes of additional environmental assessments or modifications in the future Site uses.
- Any design variances (i.e., proposed designs which did not comply with the wording of the SEMP which have been reviewed and verified as not introducing any unmanaged or unacceptable environmental risks by a suitably qualified and experienced Contaminated Land Auditor (see **Section 1.2**).
- A SEMP maintenance register (including superseded versions of the SEMP), Site inspection documents, permits and approvals for environmental work, and training records of people who have been inducted onto the SEMP.
- Documentation of the following:
  - Materials tracking and disposal
  - Unexpected finds
  - Environmental incidents which occur on Site
  - Any other environmental investigations or records, such as records of annual GMEs conducted under the GQMP (**Appendix F**).

The SEMP and any records of environmental activities must be provided by the previous Site owner to the new owner in the event of any land sale or transfer, which changes control of all or a portion of the Site.

6.0 References

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7.0 Limitations

AECOM Australia Pty Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of the Macquarie Point Development Corporation and only those third parties who have been authorised in writing by AECOM to rely on this Report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract titled *Macquarie Point Development Project – Proposal for Report Updates – Acid Sulfate Soil and SEMP* dated 19 September 2025.

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report is dated 10-Apr-2026, and is based on the information reviewed and referenced in the Report text at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This Report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the site.

Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

Appendix A

Figures

List of Attached Figures

Figure F1 Site Location

Figure F2 Site Layout and Proposed Development

Figure F3 Current and Proposed Final Surface Elevations

Figure F4 Current Groundwater Wells and Soil Vapour Bore Locations

Figure F5 Subsurface Features

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LAST MODIFIED PK 15 JAN 2024

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LEGEND

- Regatta Grounds Boundary
- Macquarie Point Site Boundary

SITE LOCATION

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure

F1

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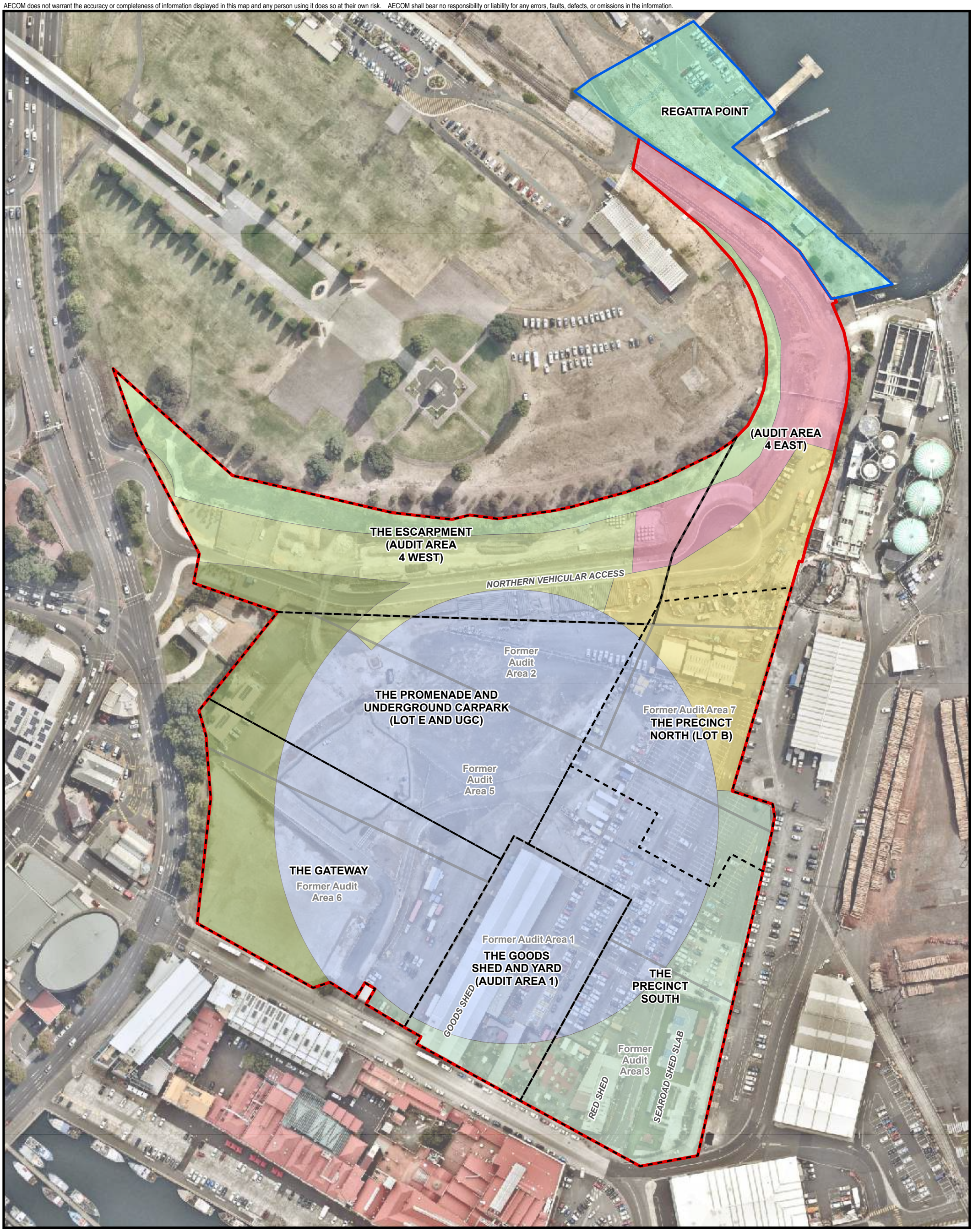

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Legend

- Regatta Point Boundary
- Assessment Area
- Former Audit Areas
- Site Boundary

Proposed Future Land Use

- Aboriginal Culturally Informed Zone
- Residential Development and Public Foreshore Zone
- Paved area and extension to the Aboriginal Culturally Informed Zone
- Multipurpose Stadium and Associated Concourse Zone
- Complementary Integrated Mixed Use Zone
- Royal Engineers Building and Land
- Antarctic Facilities Zone
- Transport Corridor
- Vegetated Area

SITE SETTING AND LAYOUT

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure
F2

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REGATTA POINT

THE ESCARPMENT (AUDIT AREA 4 WEST)

(AUDIT AREA 4 EAST)

Final level - 4.8 mAHD

Final level - 1.7 mAHD

THE ROYAL ENGINEERS BUILDING AND LAND

THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC) (PART AUDIT AREAS 2 AND 5)

Final level - 3.0 mAHD

THE PRECINCT NORTH (LOT B) (AUDIT AREA 7 AND PART AUDIT AREAS 2,4 AND 5)

THE GATEWAY (AUDIT AREA 6 AND PART AUDIT AREA 5)

Final level - 3.3 mAHD

THE GOODS SHED AND YARD (AUDIT AREA 1)

THE PRECINCT SOUTH (AUDIT AREA 3 AND PART AUDIT AREA 5)

Final level - 2.9 mAHD

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LAST MODIFIED PK 31 Jul 2025

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DATUM GDA 1994, PROJECTION MGA ZONE 55

0 25 50 100
metres

1:1,800 (when printed at A3)

Legend

- Regatta Point Boundary
- Current Assessment Area Boundary
- Site Boundary

Final Surface Level

- Final level - 1.7 mAHD
- Final level - 2.9 mAHD
- Final level - 3.0 mAHD
- Final level - 3.3 mAHD
- Final level - 4.8 mAHD

CURRENT AND PROPOSED FINAL SURFACE ELEVATIONS

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure
F3

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\07\Excavation_Level\FX_2.mxd)

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DATUM GDA 1994, PROJECTION MGA ZONE 55

0 30 60 120
metres

1:2,000 (when printed at A3)

Legend

- 2025 Groundwater Well
- Existing Groundwater Well
- 2025 Soil Vapour Bore
- Existing Soil Vapour Bore
- Reinstated and Resurveyed Existing Well
- TasPorts Well
- Assessment Area Boundary
- Site Boundary

CURRENT GROUNDWATER WELLS AND SOIL VAPOUR BORE LOCATIONS

Macquarie Point Development Corporation

Site Environment Management Plant

Macquarie Point, Hobart, TAS

Figure
F4

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\07\Geotech\Soil_GW_SV_2025\Soil_GW_SV_2025.aprx)

A3 size

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N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 25 50 100

metres

1:1,800 (when printed at A3)

Legend

- Assessment Area
- Regatta Point Boundary
- Site Boundary
- Sea Wall
- Sealed Pipe
- Potential Buried Railway
- Engineer's Jetty (Buried)
- HV Conduit
- LV Conduit
- City of Hobart Services
- Stormwater pipeline
- Sewer (Main Hobart Pipeline)
- Former Sewer pipeline
- Naval oil pipeline
- Water pipeline
- Diesel Pipeline (Remaining)
- Oil Line (Remaining)
- Fuel Line (Remaining)
- Telecommunication Cables
- Lead impacted soil on Site boundary
- Petroleum impacted soil on Site boundary
- Buried and capped ACM
- Previous UST Location
- Lead impacted soil to be excavated as part of development
- Lead impacted soil may be present at base of excavation following development excavation

SUBSURFACE FEATURES

Macquarie Point Development Corporation

Site Environment Management Plan

Macquarie Point, Hobart, TAS

Figure F5

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\09\Precinct_South_CUTEP\F4_A3P_Subsurface_Features.mxd)

A3 size

Appendix B

SEMP Distribution and Sample Induction Register

Site Owners/Occupiers - SEMP Distribution List

Date	Revision	Area of Site	Owner / Occupier	Contact Name	Contact No.
15-Oct-2021	A	Whole Site	Macquarie Point Development Corporation	Greg Cooper	0400 165 638
22-Oct-2021	0				
17-Nov-2021	1				
18-Dec-2024	2				
30-Sep-2025	3				

SEMP Induction Form

Date	Name	Company	Position/ Responsibility	Contact No.	Signature

Appendix C

Area Specific Contamination Fact Sheets

Macquarie Point Site Environment Management Plan

Area Specific Contamination Fact Sheets

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1.0 Goods Shed and Yard Contamination Summary

Historical activities undertaken within The Goods Shed and Yard area have resulted in the presence of residual soil and groundwater contamination. Multiple phases of soil, groundwater and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil and groundwater impacts in this area of the Site.

No further remediation of the Goods Shed and Yard is planned or considered required at this time.

1.1 Identified Soil Impacts

Fill has been identified beneath the Goods Shed and Yard area from the surface to depths of 7 – 10 m below ground level (bgl). Field observations indicated that fill material is heterogeneous comprising silts, sands with dolerite gravels and cobbles with occasional rubble, glass, metal fragments, coal, coke and ash. A slight hydrocarbon odour was noted at two sampling locations (BH36 and MW127), and a slight hydrocarbon sheen was also noted during the drilling of the soil bore for groundwater well MW127.

The field observations and the presence of Chemicals of Potential Concern (CoPC) above the adopted soil investigation (Tier 1) criteria are likely to have occurred as a result of the placement of fill material associated with the former Hobart Gasworks, or potentially from impacted fill material imported to the site for land reclamation.

Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH) / Total Recoverable Hydrocarbons (TRH) and select metals were reported in soil above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs):

- Residential, Recreation/ Open Space or Commercial/ Industrial Land Uses
- Maintenance of Modified and Highly Modified Ecosystems.

Table 1 below provides a range of concentrations of CoPC (or general CoPC groups) identified within the Goods Shed and Yard area that have been reported above the adopted Tier 1 criteria.

Table 1 Summary of Soil Analytical Results – The Goods Shed and Yard

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Lead	<5	1,640
Nickel	<2	77
Copper	<5	248
Zinc	6	2,820
TRH (C_{10}-C_{40})	<50	10,500
Benzene	<0.1	0.8
Total PAHs	<0.5	2,310

1.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Goods Shed and Yard area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at locations K14, L18, L13, M13 and M14. As a result, there is potential for Intrusive Maintenance workers within the Promenade and Underground Carpark area to come in contact with these soils.

However, based on the overall statistical assessment of shallow lead impacts in this area conducted against the Maintenance Workers Site Derived RC, remediation of these impacts is not considered as required (AECOM, 2021a). It is further noted that these locations will be excavated and removed as part of Site development.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m bgl (i.e. below or in deeper soil next to the Underground Carpark) must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP

1.1.2 Asbestos

Whilst asbestos has not been identified in soil during previous environmental investigations, there is potential that Asbestos Containing Material (ACM) may be encountered during intrusive works or require management as part of building refurbishment activities within the Goods Shed and Yard area.

Asbestos has been noted within the Goods Shed building.

1.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for wells located within the Goods Shed and Yard area since January 2015.

Over this timeframe, groundwater samples have had concentrations reported of a combination of arsenic, cobalt, iron, manganese, zinc, ammonia, sodium, chloride, TDS and sulphate, above the adopted Tier 1 assessment criteria for groundwater PEVs.

Table 2 below provides a range of CoPC concentrations (or general CoPC groups) identified within The Goods Shed and Yard area that have been reported above the adopted Tier 1 criteria.

Table 2 Summary of Groundwater Analytical Results – the Goods Shed and Yard

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Arsenic	<0.001	0.021
Cobalt	<0.001	0.012
Iron	0.46	34
Manganese	0.004	2.48
Zinc	<0.005	0.23
Ammonia	<0.001	26
Total Dissolved Solids (TDS)	38	3,650
Sodium	<1	930
Chloride	3	4,400
Sulphate	<1	930

2.0 The Escarpment (Audit Area 4 West) and Audit Area 4 East Contamination Summary

Historical activities undertaken within the Escarpment and the Audit Area 4 East areas have resulted in residual soil and groundwater contamination. Multiple phases of soil and groundwater investigations have been undertaken to assess the nature and extent of contamination.

The following sections provide an overview of identified soil and groundwater impacts at these areas of the Site. It is noted that remediation of soil impacts in the Escarpment area was conducted in late 2019 and early 2020 as reported in *Audit Area 4 – Remediation Validation* (AECOM, 2020b).

No further remediation of the Escarpment is planned or considered required at this time. However, further remediation and Auditor approval is required for Audit Area 4 East prior to future development.

2.1 Identified Soil Impacts

In the Escarpment and Audit Area 4 East areas, fill material consists of crushed stone/ballast, silt and clayey gravels with occasional rubble, brick and wood fragments.

Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH) / Total Recoverable Hydrocarbons (TRH) and select metals were reported in soil above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs):

- Residential, Recreation/ Open Space or Commercial/ Industrial Land Uses
- Maintenance of Modified and Highly Modified Ecosystems.

Table 3 below provides the range of concentrations of Chemicals of Potential Concern (CoPC) (or general CoPC groups) identified within the Escarpment and Audit Area 4 East areas that have been reported above the adopted Tier 1 investigation criteria.

Table 3 Summary of Soil Analytical Results – the Escarpment and Audit Area 4 East

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Lead	<5	1,070
Nickel	3	62
Arsenic	<5	552
Copper	12	828
Zinc	16	1,220
TPH (C_{16}-C_{34})	<100	4,170
TPH (C_{10}-C_{16})	<50	5,680
TPH (C_{10}-C_{16}) (minus Naphthalene)	<50	5,670
TPH (C_6-C_{10}) (less BTEX[1])	<10	53
Benzo(a)pyrene	<0.5	46.4
Total PAHs	<0.5	464
Naphthalene	<0.5	17
Dibenz(a,h)anthracene	<0.5	7.1
Indeno(1,2,3-c,d)pyrene	<0.5	24.3

Note: 1. BTEX – benzene, toluene, ethylbenzene and xylenes

2.1.1 Lead Impacted Soil in Telecommunications Cable Exclusion Zone (the Escarpment)

During remediation works in the Escarpment, a lead concentration of 1,600 mg/kg was reported in soil validation sample CB-EX-41, collected from the boundary of the 2 m buffer zone surrounding the major telecommunications cable in the former Concrete Batching Plant area of the Escarpment. The location of the lead detection is shown on **Plate 1** below.

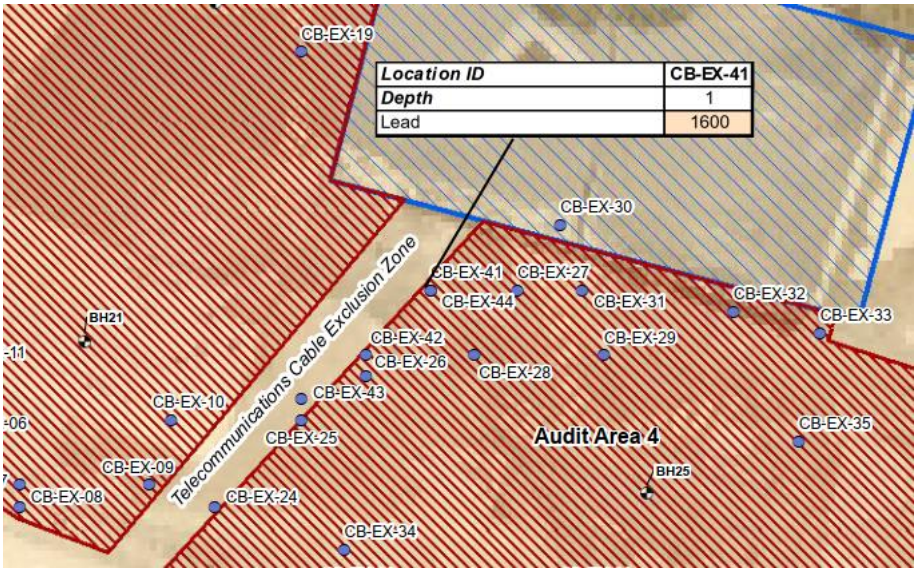

Plate 1 Location of lead in soil detection in telecommunication cable exclusion zone

Due to the risk of damage to the cable from excavations in this area, the asset owner (Telstra) did not give approval for excavation of soil in the exclusion zone. The impact was assessed as localised and not typical of the material in the exclusion zone in the Remediation Validation report (AECOM, 2020b), and soil present within the exclusion zone has been isolated from clean fill using a 200 µm plastic liner (shown on **Plate 2** below).

Plate 2 The Escarpment - Liner on the Western Boundary of the Telecommunications Cable

Future works in this area should consider the potential for lead impacts to be present if this soil is to be disturbed.

2.1.2 Asbestos in Audit Area 4 East

On 9 July 2020, contractors (Pitt & Sherry Pty Ltd) working for the Macquarie Point Development Corporation detected fragments of Asbestos Containing Material (ACM) in the embankment within Audit Area 4 East adjacent to the boundary with the Escarpment. The following was noted with regard to these fragments:

- The ACM encountered consisted of fragments of corrugated roofing material between 5 to 300 mm in size.
- ACM was typically encountered 400 – 600 mm below the ground surface.

All encountered ACM and surrounding soil were removed when encountered and the area was assessed by an occupational hygienist to be free of visual ACM. The hygienist indicated that the number of ACM fragments present appeared to increase in the northwest of the area cleared and may be present in the adjacent embankment in that direction.

The location where ACM was detected, and the potential area to the northwest, has been added to the Site Asbestos Register, and both areas are shown on **Plate 3** below.

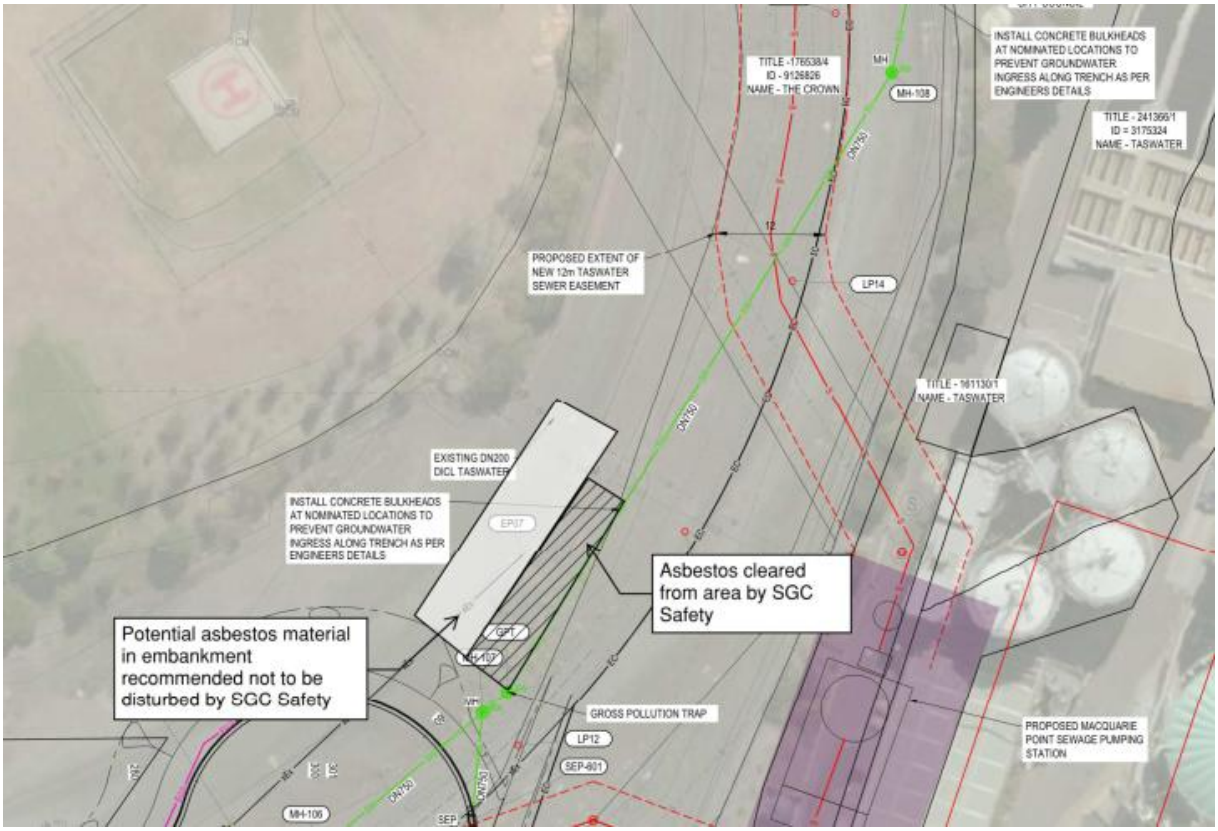

Plate 3 Audit Area 4 East - Area of ACM Encountered

2.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for wells located within these areas since February 2015.

Over this timeframe, groundwater samples have reported concentrations of a combination of aluminium, iron, manganese, arsenic, boron, copper, vanadium, zinc, phosphorus, ammonia, total dissolved solids (TDS), chloride, sodium, BTEXN, TRH and PAHs above the adopted Tier 1 assessment criteria for select groundwater PEVs.

Table 4 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Escarpment and Audit Area 4 East that have been reported above the adopted Tier 1 criteria.

Table 4 Summary of Groundwater Analytical Results – the Escarpment and Audit Area 4 East

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Aluminium (Filtered)	1.38	1.38
Iron (Filtered)	<0.05	6.22
Manganese (Filtered)	<0.001	5.1
Arsenic (Filtered)	0.001	0.019
Copper (Filtered)	<0.001	0.03
Vanadium (Filtered)	<0.01	0.18
Zinc (Filtered)	<0.005	0.143
Phosphorus	1.2	1.2
Ammonia as N	<0.01	3.84
Total Dissolved Solids (TDS)	460	9010
Chloride	10	8890
Sodium	30	6300
Benzene	<0.001	0.003
Naphthalene	<0.001	0.332
Dibenzofuran	<0.005	0.015
pH (pH units)	7.21	11.1
TPH C10 - C36 (Sum of total)	<0.05	1.57
TPH >C10 - C40 (Sum of total)	<0.1	1.55
TPH >C_{10}-C_{16} minus Naphthalene (F2)	<0.05	1.59
Anthracene	<0.001	0.007
Fluoranthene	<0.001	0.007
Phenanthrene	<0.001	0.035
PFAS		

3.0 The Promenade and Underground Carpark Contamination Summary

Historical activities undertaken within the Promenade and Underground Carpark area have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, light non-aqueous phase liquid (LNAPL) and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil, groundwater, LNAPL and soil vapour impacts at the Promenade and Underground Carpark area.

Remnant infrastructure associated with a former rail Roundhouse may be present in the central area of the Promenade and Underground Carpark.

Soil, groundwater and LNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – Audit Areas 2 and 7 and Pipeline Removal* (AECOM, 2021d) and the *Goods Shed Remediation Validation Report* (AECOM, 2021e). The *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c) report contains a detailed assessment LNAPL remediation conducted.

No further remediation of the Promenade and Underground Carpark is planned or considered required at this time.

3.1 Identified Soil Impacts

Within the Promenade and Underground Carpark area and the surrounding buffer zone, fill material typically consisted of sand and gravel with occasional anthropogenic material including coal, coke, slag, ceramics, glass, metal fragments, wire, timber/wood, bone, rubber and general building rubble including brick, concrete and pipes.

Concentrations of a combination of Chemicals of Potential Concern (CoPC) including Polycyclic Aromatic Hydrocarbons (PAHs) [naphthalene, benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, sum of PAHs], Total Recoverable Hydrocarbons (TRHs) [TRH >C_{10}-C_{16}, TRH >C_{16}-C_{34}, TRH >C_{34}-C_{40}, aliphatic TRH >C_{10}-C_{12}, aromatic TRH >C_{10}-C_{12}, aliphatic TRH >C_{12}-C_{16}, aromatic TRH >C_{12}-C_{16}, TRH C_6-C_{10} (minus BTEX) (F1), TRH >C_{10}-C_{16} (minus Naphthalene) (F2)] and metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc) in soil were reported above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs) and Site Derived Remediation Criteria (RC):

- Human Health – Direct Contact – Residential (low, and medium/high density), Recreation/ Open Space, and Commercial/ Industrial land uses.
- Human Health – Vapour Intrusion – Residential and Commercial/ Industrial land uses.
- Maintenance of Modified and Highly Modified Ecosystems.
- Aesthetics.
- Remediation Criteria – Residential (slab-on-grade with unknown construction or multi-storey building, low rise slab-on-grade, and building with basement), Commercial (slab-on-grade with unknown construction or multi-storey building, and working within a basement) and Maintenance Workers.

Table 5 below provides the range of CoPC concentrations (or general CoPC groups) identified within the Promenade and Underground Carpark area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 5 Summary of Soil Analytical Results – the Promenade and Underground Carpark

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Arsenic	<2	576
Cadmium	<0.4	29
Chromium	<2	314
Copper	<5	2,280
Lead	<5	20,100
Nickel	3	86
Zinc	8	55,70
TRH >C10-C16	<50	15,500
TRH >C16-C34	<100	15,500
TRH >C34-C40	<100	2,920
Aliphatic TRH >C10-C12	<10	504
Aromatic TRH >C10-C12	<10	114
Aliphatic TRH >C12-C16	<10	2,790
Aromatic TRH >C12-C16	<10	1,170
TRH C6-C10 (minus BTEX) (F1)	<10	114
TRH >C10-C16 (minus Naphthalene) (F2)	<50	15,500
Naphthalene	<0.5	39.7
Benzo(a)pyrene	<0.05	156
Benz(a)anthracene	<0.5	157
Benzo(b)fluoranthene	0.9	4.6
Benzo(k)fluoranthene	<0.5	64.7
Dibenz(a,h)anthracene	<0.5	20
Indeno(1,2,3-cd)pyrene	<0.5	66.2
Sum of PAHs	<0.5	1,810

3.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Promenade and Underground Carpark area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at locations J06, J08, J10, J12, I13, H10, H12, H12, G11, G13 and F11. As a result, there is potential for Intrusive Maintenance workers within the Promenade and Underground Carpark area to come in contact with these soils. These locations will

be excavated and removed as part of the Site development, however elevated lead may be present at the base of the excavation at I13 and G13.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m below the current Site level must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP.

3.1.2 Asbestos

Anecdotal information indicates that pits and service trenches in the southern portion of the Promenade and Underground Carpark area were backfilled with building rubble including asbestos. No bulk asbestos or Asbestos Containing Material (ACM) has been encountered in investigations to date, however minor ACM has been encountered as seven isolated fragments. Under current and proposed future development, while the Site is maintained with hardstand or an engineered break, potential ACM within the soil does not have a complete source-pathway-receptor linkage to Site users. However, the potential for ACM to be present should be considered in future works which may disturb soil in this area and managed as discussed in the Site Environment Management Plan (SEMP).

3.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Promenade and Underground Carpark area since January 2015.

Since 2015, groundwater samples have reported concentrations of a combination of CoPC including total dissolved solids (TDS), metals (arsenic, copper, iron, lead, manganese, zinc), inorganics (ammonia, sodium, boron), TRH [TRH C_{10}-C_{36} fraction (sum), TRH >C_{10}-C_{40} fraction (sum), TRH C_{10}-C_{16} fraction (sum) (minus naphthalene)] and PAHs [naphthalene, benz(a)anthracene, benzo(a)pyrene, anthracene, phenanthrene, fluoranthene] above the following adopted Tier 1 assessment criteria for groundwater PEVs and Site Derived RC:

- Drinking water (health and aesthetics)
- Recreation (primary and secondary contact)
- Maintenance of Ecosystems (90% ecosystem protection level)
- Irrigation
- Vapour Intrusion (from groundwater)
- Remediation Criteria – Residential (unknown construction or multi-storey building)

Table 6 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Promenade and Underground Carpark area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 6 Summary of Groundwater Analytical Results – the Promenade and Underground Carpark

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Total Dissolved Solids	40	5,420
Arsenic	<0.001	0.032
Copper	<0.001	0.011
Iron	<0.05	6.72
Lead	<0.001	0.017
Manganese	0.002	5.47

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Zinc	<0.001	0.063
Ammonia (as N)	<0.01	8.43
Sodium	3.7	363
Boron	<0.05	0.78
TRH C10-C36 fraction (sum)	<0.050	4.05
TRH >C10-C40 fraction (sum)	<0.100	3.95
TRH C10-C16 fraction (minus naphthalene) [F2]	<0.050	2.01
Naphthalene	<0.001	0.0015
Benz(a)anthracene	<0.001	0.0014
Benzo(a)pyrene	<0.0005	0.0011
Anthracene	<0.001	0.0054
Phenanthrene	<0.001	0.016
Fluoranthene	<0.001	0.0069

3.3 Identified LNAPL Impacts

Environmental investigations completed on the Site to date have historically identified three Light Non-Aqueous Phase Liquid (LNAPL) plumes in or adjacent to the Promenade and Underground Carpark area, referred to as LNAPL Plume A1, LNAPL Plume A2 and LNAPL Plume A3.

The LNAPL in these plumes is understood to comprise predominantly diesel fuel, as well as fuel oils associated with diesel engine operation (e.g. lubricants, engine oils). The probable source of LNAPL is historic locomotive refuelling activities during operation the Roundhouse Refuelling Area.

No measurable LNAPL was present in any wells in the vicinity of these plumes when last gauged in June 2025, although indicators of LNAPL, including sheen, odours, and small volumes of LNAPL when developing wells in the vicinity were observed. Measurable LNAPL was last detected in LNAPL Plumes A1 and A2 in November 2019, and in LNAPL Plume A3 in July 2017, although no monitoring was conducted on the plumes between 2019 and 2025 due to Site activities.

A detailed assessment of LNAPL impacts and remediation conducted at the Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c), and was reviewed in *Soil, Groundwater and Soil Vapour Investigation 2025* (AECOM, 2025c). Both these reports concluded that:

- Further recovery of LNAPL is considered to be impractical.
- The LNAPL plumes are sufficiently stable.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a SEMP or similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

On this basis, further LNAPL remediation is not practicable or required. However, restoration of groundwater PEVs is not practicable, and groundwater management will be required as discussed in the main body of the SEMP.

3.4 Identified Soil Vapour Impacts

Soil vapour monitoring events have been conducted across the Site between 2015 and 2019, including at soil vapour wells within and immediately adjacent to the Promenade and Underground Carpark area, at locations where concentrations of Volatile Organic Compounds (VOCs) and Semi-VOCs (SVOCs) in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected, or in the vicinity of the LNAPL plumes to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Assessment of potential vapour intrusion risks associated with the LNAPL plumes undertaken in *Soil Vapour and Indoor Air Investigations 2019* (AECOM, 2021b) surmised that soil vapour impacts associated with the LNAPL plumes do not present an unacceptable risk to the planned future uses of the Promenade and Underground Carpark area.

Soil vapour investigations identified that methane exists in potentially hazardous concentrations in the subsurface within the Promenade and Underground Carpark area (at SV12, SV27S and SV27D) as well as the surrounding area (at SV14 and SV16). The risk from soil methane in the area assessed has been calculated as CS2 – Low Risk, as defined by *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020), and appropriate mitigation measures should be included in future building design in this area or when conducting works in potentially enclosed spaces, such as pits, trenches or conduits, in these areas.

It is noted that if the Underground Carpark is ventilated in accordance with Building Code of Australia (BCA) requirements to deal with exhaust fumes, it should also provide sufficient protection from methane infiltration as per EPA NSW, 2020. If the Underground Carpark is not designed and constructed to BCA standards, methane protection measures should be advised by a qualified environmental practitioner and approved by a Contaminated Land Auditor.

4.0 The Precinct North Contamination Summary

Historical activities undertaken within the Precinct North area have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, light non-aqueous phase liquid (LNAPL) and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil, groundwater, LNAPL and soil vapour impacts at the Precinct North area.

Soil, groundwater and LNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – Audit Areas 2 and 7 and Pipeline Removal* (AECOM, 2021d) and the *Goods Shed Remediation Validation Report* (AECOM, 2021e). The *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c) report contains a detailed assessment LNAPL remediation conducted.

No further remediation of the Precinct North is planned or considered required at this time.

4.1 Identified Soil Impacts

Subsurface investigations have identified that the Precinct North area is underlain by fill material extending up to 8.2 m below ground level (bgl). Fill material is described as silty sand with dolerite gravels and cobbles with a range of anthropogenic materials including rubble, glass and metal fragments, coal, coke, ash, brick, rubber, timber, wires and fabric. Following remediation and soil excavation in 2020 (AECOM, 2021d), portions of the Precinct North area have been backfilled with fill material and crushed dolerite sourced from either other sections of the Site or imported Virgin Excavated Natural Material (VENM). Underlying the fill material is natural sands, clays, gravels and dolerite bedrock.

During historic land reclamation activities undertaken across the broader Site, sea walls were constructed consisting of a combination of timber and stone. A sea wall is understood to run approximately parallel to the eastern boundary of the Precinct North area.

Concentrations of a combination of Chemicals of Potential Concern (CoPC) including Polycyclic Aromatic Hydrocarbons [PAHs] (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, 7,12-dimethylbenz(a)anthracene, indeno(1,2,3-cd)pyrene, Sum of PAHs), Total Recoverable Hydrocarbons [TRH] (aliphatic C_{10}-C_{12}, aliphatic C_{12}-C_{16}, aromatic C_{10}-C_{12}, aromatic C_{12}-C_{16}, C_6-C_{10}, C_{10}-C_{16}, C_{16}-C_{34}, C_{34}-C_{40}), naphthalene, and heavy metals (arsenic, copper, lead, nickel, zinc) in soil were reported above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs) and Site Derived Remediation Criteria (RC):

- Human Health – Direct Contact – Residential (low, and medium/high density), Recreation/ Open Space, and Commercial/ Industrial land uses.
- Human Health – Vapour Intrusion – Residential and Commercial/ Industrial land uses.
- Maintenance of Modified and Highly Modified Ecosystems.
- Aesthetics.
- Remediation Criteria – Residential (slab-on-grade with unknown construction or multi-storey building, low rise slab-on-grade, and building with basement), Commercial (slab-on-grade with unknown construction or multi-storey building, and working within a basement) and Maintenance Workers.
- Remediation Criteria - Potential Future Residential, Commercial/Light Industrial Workers or Intrusive Maintenance Workers

Table 7 below provides the range of CoPC concentrations (or general CoPC groups) identified within the Precinct North area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 7 Summary of Soil Analytical Results – The Precinct North

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Arsenic	<2	184
Copper	<5	1,800
Lead	<5	1,340
Nickel	3	68
Zinc	8	10,200
TRH C_6-C_{10} (minus BTEX[1])	<10	152
TRH >C_{10}-C_{16} (minus Naphthalene)	<50	17,995
TRH >C_{10}-C_{16}	<50	18,000
TRH >C_{16}-C_{34}	<100	16,000
TRH >C_{34}-C_{40}	<100	3,310
Aliphatic TRH >C_{10}-C_{12}	<50	1,420
Aromatic TRH >C_{10}-C_{12}	<50	140
Aliphatic TRH >C_{12}-C_{16}	<50	6,590
Aromatic TRH >C_{12}-C_{16}	<50	2,540
Naphthalene	<0.5	184
Benzo(a)pyrene	<0.5	141
Benz(a)anthracene	<0.5	148
Benzo(b)fluoranthene	2.1	128
Benzo(k)fluoranthene	<0.5	68.9
Chrysene	<0.5	140
Dibenz(a,h)anthracene	<0.5	18.7
7,12-dimethylbenz(a)anthracene	<0.5	3.8
Indeno(1,2,3-cd)pyrene	<0.5	59.2
Sum of PAHs	<0.5	2,330

Note: 1. BTEX – benzene, toluene, ethylbenzene and xylenes

4.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Precinct North area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at K06, L08, M09 and N10. As a result, there is potential for Intrusive Maintenance workers within the Precinct North area to come in contact with these soils. These locations will be excavated and removed as part of the Site development, however elevated lead may be present at the base of excavation at N10.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m bgl (i.e. below or in deeper soil next to the Underground Carpark) must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP.

4.1.2 Boundary Impacts

Soil samples collected at seven locations on the eastern boundary of the Precinct North area reported exceedances of Site Derived RC for proposed future uses:

- Two locations (OL-EX-288/1.5 and OL-EX-59/0.9) reported exceedances of the RC for Future Commercial Workers for Total Petroleum Hydrocarbons (TPH) C_{10}-C_{16} (minus Naphthalene).
- Five locations (OL-EX-75/0.5, OL-EX77/1.0, OL-EX-79/0.2, OL-EX-293/1.15, OL-EX-294/1.05) reported exceedances of the RC for Future Intrusive Maintenance Workers for lead.

These samples do not represent an unacceptable risk for future uses of the area as the impacted areas are limited and delineated by samples within 5 m from within the excavation boundary or base, and impacted soils which had the potential to extend onto the Site were excavated and removed during remediation works in 2020 (AECOM, 2021d). These areas should be considered when conducting works along the Site boundary in these areas.

4.1.3 Hobart Main Sewer Soils

During remediation works in 2020 (AECOM, 2021d), excavation of impacted soils was limited by the presence of the Main Hobart Pipeline, a sewer line which runs through the Precinct North area. The owner of the sewer, TasWater, required an exclusion zone for excavation which did not allow excavation to depths of greater than 1 m below ground level (bgl) within 3 m of the sewer location.

Soil was excavated to a depth of 1 m bgl in this exclusion zone. However, lead concentrations in excess of the RC for Future Intrusive Maintenance Workers for lead were detected in the soil within the exclusion zone and should be considered and appropriate controls put in place for future works in this area.

4.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Precinct North area since January 2015.

Since 2015, groundwater samples have reported concentrations of a combination of CoPC including: total dissolved solids (TDS), metals (arsenic, boron, copper, iron, lead, manganese, zinc), inorganics (ammonia, chloride, cyanide, sodium), TRH (C_{10}-C_{16}, C_{10}-C_{36}, C_{10}-C_{40}), PAHs (naphthalene, benz(a)anthracene, benzo(a)pyrene, anthracene, phenanthrene, fluoranthene, 2,4-dimethylphenol, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene) and E. Coli above the following adopted Tier 1 assessment criteria for groundwater PEVs and Site Derived RC:

- Drinking water (health and aesthetics)
- Recreation (primary and secondary contact)
- Maintenance of Ecosystems (90% ecosystem protection level)
- Irrigation
- Buildings and Structures
- Vapour Intrusion (from groundwater)
- Remediation Criteria – Residential (unknown construction or multi-storey building)

Table 8 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Precinct North area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 8 Summary of Groundwater Analytical Results – the Precinct North

CoPC	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)
Total Dissolved Solids	240	1,690
Arsenic	<0.001	0.009
Boron	0.2	0.69
Copper	<0.001	0.011
Iron	15.5 (one sample only)	
Lead	<0.001	0.013
Manganese	0.026	2.46
Zinc	<0.005	0.134
Ammonia (as N)	<0.01	22.1
Chloride	11	664
Cyanide	<0.004	0.29
Sodium	8	547
TRH C10-C36 fraction (sum)	<0.05	12.6
TRH >C10-C40 fraction (sum)	<0.1	12.2
TRH C10-C16 fraction (minus naphthalene)	<0.1	6.19
Naphthalene	<0.005	0.232
Benz(a)anthracene	<0.001	0.095
Benzo(a)pyrene	<0.001	0.0985
Anthracene	<0.001	0.142
Phenanthrene	<0.001	0.317
Fluoranthene	<0.001	0.254
2,4-Dimethylphenol	<0.001	0.0062
Benzo(k)fluoranthene	<0.001	0.0346
Chrysene	<0.001	0.0974
Dibenz(a,h)anthracene	<0.001	0.0114
Indeno(1,2,3-cd)pyrene	<0.001	0.0434
Pyrene	<0.001	0.228

4.3 Identified LNAPL Impacts

Environmental investigations completed on the Site to date have historically identified three LNAPL plumes in or up groundwater gradient of the Precinct North area, referred to as LNAPL Plume A1, LNAPL Plume A2 and LNAPL Plume A3.

No measurable LNAPL was present in any wells in the vicinity of these plumes when last gauged in June 2025, although indicators of LNAPL, including sheen, odours, and small volumes of LNAPL when developing wells in the vicinity were observed. Measurable LNAPL was last detected in LNAPL Plumes A1 and A2 in November 2019, and in LNAPL Plume A3 in July 2017, although no monitoring was conducted on the plumes between 2019 and 2025 due to Site activities.

A detailed assessment of LNAPL impacts and remediation conducted at the Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c), and was reviewed in *Soil, Groundwater and Soil Vapour Investigation 2025* (AECOM, 2025c). Both these reports concluded that:

- Further recovery of LNAPL is considered to be impractical.
- The LNAPL plumes are sufficiently stable.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a Site Environment Management Plan (SEMP) or similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

On this basis, further LNAPL remediation is not practicable or required. However, restoration of groundwater PEVs is not practicable, and groundwater management will be required as discussed in the main body of the SEMP.

4.4 Identified Soil Vapour Impacts

Soil vapour monitoring events have been conducted across the Site between 2015 and 2019, including at soil vapour wells within and immediately adjacent to the Precinct North area, at locations where concentrations of Volatile Organic Compounds (VOCs) and Semi-VOCs (SVOCs) in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected, or in the vicinity of the LNAPL plumes to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Assessment of potential vapour intrusion risks associated with the LNAPL plumes undertaken in *Soil Vapour and Indoor Air Investigations 2019* (AECOM, 2021b) surmised that soil vapour impacts associated with the LNAPL plumes do not present an unacceptable risk to the planned future uses of the Precinct North area.

Soil vapour investigations identified methane exists in potentially hazardous concentrations in the subsurface within the Precinct North area (at SV14, SV16, SV17 and SV18). The risk from soil methane in the area assessed has been calculated as CS2 – Low Risk, as defined by *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA NSW, 2020), and appropriate mitigation measures should be included in future building design in this area or when conducting works in potentially enclosed spaces, such as pits, trenches or conduits, in these areas.

5.0 The Precinct South Contamination Summary

Historical activities undertaken within Precinct South have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, light non-aqueous phase liquid (LNAPL) and soil vapour investigations have been undertaken to assess the nature and extent of contamination. The following sections provide an overview of identified soil, groundwater, LNAPL and soil vapour impacts at the Promenade and Underground Carpark area.

Soil, groundwater and LNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – Audit Areas 2 and 7 and Pipeline Removal* (AECOM, 2021d), the *Goods Shed Remediation Validation Report* (AECOM, 2021e) and the *Precinct South Remediation Validation Report* (AECOM, 2024d). The *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c) report contains a detailed assessment LNAPL remediation conducted.

No further remediation of the Precinct South is planned or considered required at this time.

5.1 Identified Soil Impacts

Subsurface investigations have identified that the Precinct South is underlain by fill material extending up to 12 m below ground level (bgl). Fill material is described as silty sand with dolerite gravels and cobbles with a range of anthropogenic materials including rubble, glass and metal fragments, coal, coke, ash, brick, rubber, timber, wires and fabric. Following remediation and soil excavation in 2020 and 2023, portions of the Precinct South have been backfilled with fill material and crushed dolerite sourced from either other sections of the Site or imported Virgin Excavated Natural Material (VENM). Underlying the fill material is natural sands, clays, gravels and dolerite bedrock.

During historic land reclamation activities undertaken across the broader Site, sea walls were constructed consisting of a combination of timber and stone. A sea wall is understood to run approximately parallel to the eastern boundary of the Precinct South. Buried rail lines may be present in the eastern and southern portions of the Precinct South.

Concentrations of a combination of Chemicals of Potential Concern (CoPC) including metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), cyanide (total), TRH, PAHs, MAHs, and PFAS in soil were reported above the adopted Tier 1 criteria for the following Protected Environmental Values (PEVs) and Site Derived Remediation Criteria (RC):

- Human Health – Direct Contact – Residential (low, and medium/high density), Recreation/ Open Space, and Commercial/ Industrial land uses.
- Human Health – Vapour Intrusion – Residential and Commercial/ Industrial land uses.
- Maintenance of Modified and Highly Modified Ecosystems.
- Aesthetics.
- Remediation Criteria –Commercial (slab-on-grade with unknown construction or multi-storey building, and working within a basement) and Maintenance Workers. It is noted that residential use is not proposed in the Precinct South and soil results were not assessed against residential use RC in the DSI and CUTEP report (AECOM, 2026b).

Table 9 below provides the range of CoPC concentrations (or general CoPC groups) identified within the Precinct South that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 9 Summary of Soil Analytical Results – The Precinct South

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Arsenic	<2	374
Cadmium	<0.4	28
Chromium	<2	866

CoPC	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Copper	<5	1,400
Lead	<5	8,000
Nickel	<2	160
Zinc	<5	13,000
Cyanide (total)	<1	1,040
TRH C_6-C_{10} (minus BTEX[1])	<10	847
TRH >C_{10}-C_{16} (minus Naphthalene)	<50	6,910
TRH >C_{16}-C_{34}	<100	20,700
TRH >C_{34}-C_{40}	<50	3,550
Aliphatic TRH >C_8-C_{10}	<5	918
Aliphatic TRH >C_{10}-C_{12}	<50	636
Aromatic TRH >C_{10}-C_{12}	<50	204
Aliphatic TRH >C_{12}-C_{16}	<50	2,440
Aromatic TRH >C_{12}-C_{16}	<50	1,910
Naphthalene	<0.005	273
Benzo(a)pyrene	<0.005	449
Benzo(a)pyrene Toxic Equivalency Quotient (TEQ) (Limit of Reporting)	1.2	639
Sum of PAHs	<0.5	7,800
PFOS	<0.0005	0.0132

Note: 1. BTEX – benzene, toluene, ethylbenzene and xylenes

5.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Precinct South area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl at location M12 and BH67 (shown on **Figure F5**). As a result, there is potential for Intrusive Maintenance workers within the Precinct North area to come in contact with these soils.

Based on the overall statistical assessment of shallow lead impacts in this area conducted against the Maintenance Workers Site Derived RC, remediation of these impacts is not considered as required (AECOM, 2026b). Additional PPE, such as dust masks, and procedural controls to minimise any potential inhalation or ingestion of soil with elevated lead impacts during construction or intrusive works. It is further noted that the majority of these locations will be excavated and removed as part of the Site development.

Following Site development, any services or conduits that will be installed within soil at a depth of >2.0 m bgl (i.e. below or in deeper soil next to the Underground Carpark) must be installed in protective shrouds or in trenches/corridors of clean fill to prevent contact with Site soil.

Maintenance Workers should use appropriate PPE (i.e. dust masks and gloves) to reduce potential exposure to lead in soil. Soil management requirements are discussed in the main body of the SEMP

5.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Precinct South area since January 2015.

Since 2015, groundwater samples have reported concentrations of a combination of CoPC including: total dissolved solids (TDS), metals (arsenic, boron, copper, iron, lead, manganese, zinc), inorganics (ammonia, chloride, cyanide, sodium), TRH (C_{10}-C_{16}, C_{10}-C_{36}, C_{10}-C_{40}), PAHs (naphthalene, benz(a)anthracene, benzo(a)pyrene, anthracene, phenanthrene, fluoranthene, 2,4-dimethylphenol, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene) and E. Coli above the following adopted Tier 1 assessment criteria for groundwater PEVs.

- Drinking water (health and aesthetics)
- Recreation (primary and secondary contact)
- Maintenance of Ecosystems (90% ecosystem protection level)
- Irrigation
- Buildings and Structures
- Vapour Intrusion (from groundwater).

No exceedances of Site derived RC have been detected in groundwater.

Table 10 below provides a range of CoPC concentrations (or general CoPC groups) identified within the Precinct South area that have been reported above the adopted Tier 1 criteria and Site Derived RC.

Table 10 Summary of Groundwater Analytical Results – the Precinct South

CoPC	Unit	Minimum Concentration	Maximum Concentration
Total Dissolved Solids	mg/L	150	28,000
Arsenic	mg/L	<0.001	0.064
Aluminium	mg/L	<0.01	0.32
Boron	mg/L	<0.001	1.71
Cadmium	mg/L	<0.0001	0.0002
Chromium	mg/L	<0.001	0.127
Iron	mg/L	0.04	455
Lead	mg/L	<0.001	0.157
Manganese	mg/L	0.198	6.35
Zinc	mg/L	<0.001	7.29
Ammonia (as N)	mg/L	0.71	60
Total nitrogen (as N)	mg/L	6	47.8
Chloride	mg/L	4	14,100
Sodium	mg/L	12	3,420
Sulphate (as SO_4)	mg/L	<1	1,510
Calcium	mg/L	19	3,070

CoPC	Unit	Minimum Concentration	Maximum Concentration
Cyanide (total)	µg/L	<4	260
Phosphorus	mg/L	<0.01	1.7
E.coli	mg/L	<1	1,700
TRH C_6-C_{10} (minus BTEX)	µg/L	<20	3,1000
TRH C_{10}-C_{16} fraction (minus naphthalene)	µg/L	<50	4,530
TRH >C_{10}-C_{40} fraction (sum)	µg/L	<100	8,240
Aliphatic TRH >C_8-C_{10}	µg/L	<20	1,040
Aliphatic TRH >C_{12}-C_{16}	µg/L	<20	1,640
Benzene	µg/L	<0.5	7
Ethylbenzene	µg/L	<1	4
Naphthalene	µg/L	<1	57
n-propylbenzene	µg/L	<5	3,033
Benz(a)anthracene	µg/L	<1	63
Benzo(a)pyrene	µg/L	<0.3	42
Anthracene	µg/L	<1	135
Phenanthrene	µg/L	<1	336
Fluoranthene	µg/L	<1	174
1-methylnaphthalene	µg/L	<2	237
Chrysene	µg/L	<1	64
Indeno(1,2,3-cd)pyrene	µg/L	<1	5
Pyrene	µg/L	<1	191
PFOS	µg/L	<0.001	0.38
Methane	µg/L	3,270	24,000

5.3 Identified LNAPL Impacts

Environmental investigations completed on the Site to date have historically identified one LNAPL plume within the Precinct South, referred to as LNAPL Plume B, and three LNAPL plumes up groundwater gradient of the Precinct South, referred to as LNAPL Plume A1, LNAPL Plume A2 and LNAPL Plume A3.

Measurable LNAPL has not been detected in LNAPL Plumes A1 and A2 since November 2019, and in LNAPL Plume A3 since July 2017, although it is noted that these plumes were not monitored between

2019 and 2025 due to other Site activities in the area. LNAPL was present in LNAPL Plume B in June 2025 (AECOM, 2025c), consisting of:

- 20-50 mm in MW3
- 20-42 mm in PW02
- 62-81 mm in S8

LNAPL globules were also noted on the interface probe when gauging well MW154, and limited LNAPL (4-70 mm) has been intermittently detected in MW5 in December 2023 and February 2024.

A detailed assessment of LNAPL impacts and remediation conducted at the Site has been reported in the *Assessment of LNAPL Remediation End-Points* (AECOM, 2021c), and was reviewed in *Soil, Groundwater and Soil Vapour Investigation 2025* (AECOM, 2025c). Both these reports concluded that:

- Further recovery of LNAPL is considered to be impractical.
- The LNAPL plumes are sufficiently stable.
- Based on the current development plan for the Site, no unacceptable risks to current or future human or ecological receptors from LNAPL appears to be present, assuming that a Site Environment Management Plan (SEMP) or similar is implemented in order to minimise and manage potential risks for any interactions between groundwater, LNAPL and future Site users.

On this basis, further LNAPL remediation is not practicable or required. However, restoration of groundwater PEVs is not practicable, and groundwater management will be required as discussed in the main body of the SEMP.

5.4 Identified Soil Vapour Impacts

Soil vapour monitoring events have been conducted across the Site between 2015 and 2025, including at soil vapour wells within and immediately adjacent to the Precinct South area, at locations where concentrations of Volatile Organic Compounds (VOCs) and Semi-VOCs (SVOCs) in soil or groundwater were in excess of the Tier 1 vapour intrusion criteria selected, or in the vicinity of the LNAPL plumes to enable assessment of potential risks posed by soil vapour to potential future users of this area.

Potential soil vapour from TRH, BTEXN and methane may be generated within the Precinct South and requires mitigations as discussed in the main body of the SEMP.

Appendix D

Summary of CoPC

Summary of Chemicals of Potential Concern

The following information has been compiled from the June 1997 National Institute of Occupational Health and Safety (NIOSH) *Pocket Guide to Chemical Hazards*, 1998 American Conference of Governmental Industrial Hygienists (ACGIH) *Guide to Occupational Exposure Values, Agency for Toxic Substances & Disease Registry* (ATSDR), the Australia Government *Asbestos Safety and Eradication Agency*, and representative material safety data sheets (MSDS).

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are formed as a result of the incomplete burning of organic material. The most common health effects associated with PAHs are linked to its carcinogenic effects. The primary route of exposure to PAHs during this project is contact with contaminated soils which can lead to entry through ingestion, inhalation (dust) or open wounds. This necessitates the use of appropriate protective clothing and proper decontamination procedures.

Total Petroleum Hydrocarbons (TPH)

TPH is a term used to describe several hundred chemical compounds that originate from crude oil. The compounds in various TPH fractions can affect the body in different ways. Health effects include central nervous system depression, irritation of the throat, skin, eyes, and stomach, breathing difficulties, in addition to impacts on blood, immune system, liver, spleen, kidneys, developing foetus, and lungs. The primary route of exposure to TPH during this project will be through handling tar impacted material. Appropriate PPE must be worn at all times while handling TPH contaminated material.

Phenolic Compounds

Phenolic compounds, also known as phenols, are a wide range of chemical compounds characterised by one or more hydroxyl groups bonded directly to an aromatic hydrocarbon ring. Phenolic compounds naturally occur in biological processes (typically by plants and micro-organisms) in small quantities, but can be generated in higher quantities by industrial processes such as manufacturing of drugs, resins, dyes, fertilisers, explosives, paint removers, textiles, and coke.

Phenolic compounds may have a diverse range of exposure indicators, but typically cause irritation in the nose, throat, eyes, and skin. Acute exposure to phenol (the simplest and most commonly used phenolic compound) causes an increased respiration rate, followed by a decreased respiration rate, decreased body temperature, cyanosis, muscular weakness, weak or occasionally rapid pulse, coma, and/or death. Chronic exposure to phenol is typified by systemic problems. These include vertigo, digestive difficulties, skin eruptions, nervous problems and headaches. Death may occur when liver or kidney problems become severe.

Phenolic compounds will enter the body by breathing, through the skin or by ingestion.

Benzene, Toluene, Ethyl-benzene, and Xylenes (BTEX)

These chemicals are often found in products such as paints and coatings, and are constituents of petroleum products, particularly gasoline, jet fuels, kerosene. All of the BTEX chemicals can produce neurological impairment, and exposure to benzene can additionally cause haematological effects including aplastic anaemia and acute myelogenous leukemia. The primary route of exposure to BTEX during this project is the inhalation of vapours. This necessitates the use of appropriate protective clothing including respiratory equipment where necessary.

Chlorinated Solvents

Chlorinated solvents are a large family of chemical compounds that contain chlorine, for example, carbon tetrachloride, trichloroethylene (TCE), or methylene chloride. They are used for a wide variety of commercial and industrial purposes, including degreasers, cleaning solutions, paint thinners, pesticides,

resins, glues, and a host of other mixing and thinning solutions. Exposures can lead to short-term or long-term health effects, depending on the manner by which they entered your body and the amount of exposure. Short-term side effects may include dizziness, fatigue, headaches, and/or skin rashes. Long-term side effects may include chronic skin problems, and/or damage to the nervous system, kidneys, or liver. Some chlorinated solvents are also known to cause cancer, in both humans and animals.

Workers can be exposed to chlorinated solvents through the absorption of solvents, through inhalation and skin contact.

Heavy Metals

Large amounts of heavy metals may cause acute or chronic toxicity (poisoning). Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Heavy metals may enter the human body through ingestion, inhalation, or absorption through the skin. Appropriate protective equipment must be worn and proper decontamination procedures must be adhered to.

Total Dissolved Solids (TDS)

TDS consist of inorganic salts and small amounts of organic matter that are dissolved in water. **TDS** comprise sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate, nitrite and phosphates. No health effects have been associated specifically with or directly attributable to high TDS concentrations, although the health effects of individual components of TDS must be considered separately. Indirectly, high TDS water, being less palatable, might discourage consumers from drinking tap water, leading to use of potentially less healthy water (from alternative sources, natural or manufactured) and/or other less healthy drinks.

Sodium

Sodium is a natural component of water and essential to human life. The guideline value for sodium in drinking water is based on aesthetic considerations (taste threshold); while high sodium may be likely to give water a salty taste, it is unlikely to present a health concern. When consumed, sodium is readily absorbed by the body. It is present in all body tissues and fluids and its concentration is maintained by the kidney. High concentrations give rise to the sensation of thirst. Excessive sodium intake, usually via diet, can aggravate chronic congestive heart failure and increase blood pressure. Reduced sodium intake can reduce the blood pressure of some individuals with hypertension.

Asbestos Containing Material (ACM)

Asbestos is a naturally occurring mineral fibre which is strong, flexible, and can insulate from heat and electricity. Because of these properties, historically asbestos has been commonly used in the construction of homes and buildings and is understood to have been used in roofing material as bonded asbestos at Macquarie Point. It can be encountered as friable (generally crumbling material with potential to generate fibres) or non-friable (bonded). Asbestos is a known carcinogen and exposure to asbestos fibres can lead to a number of diseases, including pleural disease, asbestosis, lung cancers, and mesothelioma. In the event that potential asbestos containing material (ACM) is encountered in soils during intrusive works, all activities are to cease immediately in the work area. A suitably experienced occupational hygienist should be consulted to provide advice regarding the removal and management of ACM in soils prior to works re-commencing.

Methane

Methane is a colourless, odourless and highly flammable gas. It can be produced in soil from the decay under anoxic (low oxygen) conditions of carbon containing materials, including nature materials such as plant or animal matter, or from carbon impacts such as TPH.

Low levels of methane are not expected to cause adverse health effects. Higher concentrations can reduce oxygen levels in the air and lead to mood changes, slurred speech, vision problems, memory loss, nausea, vomiting, facial flushing and headaches. In severe cases, low oxygen levels can lead to

changes in breathing and heart rate, balance problems, unconsciousness and, if over a long period, death.

Methane is also potentially flammable in higher concentrations. If present in soil, methane has the potential to pool in confined spaces

Per- and Poly-fluoroalkyl Substances (PAHs)

PFAS are manufactured chemicals that have been used for more than 50 years. PFAS makes products non-stick, oil- and water-repellent, and fire, weather- and stain-resistant, and has been used in a range of consumer products, such as carpets, clothes, food packaging and paper, and have also been used in firefighting foams, pesticides and stain repellents.

PFAS encapsulates a broad recognised range of compounds which can have different chemical, environmental and biological properties. However, PFAS are typically soluble, very stable and tend to resist degradation, and may bioaccumulate in humans or ecological receptors.

PFAS is widespread and it is likely that most people in Australia have low levels of different PFAS in their bodies following exposure to everyday household objects, primarily through inhalation, ingestion, or skin contact.

There is currently limited evidence of human disease or other clinically significant harm from PFAS exposure. Some studies have found association between people exposed to specific PFAS chemicals and increased cholesterol or uric acid levels in the blood, reduced kidney function, altered indicators of immunological function, altered levels of thyroid and sex hormones, lower birth weights, later ages for starting menstruations/earlier menopause, and increased risk of testicular/kidney cancer.

It is noted that the noted associations have not been determined as direct health causes at this time.

Appendix E

Materials Tracking Register

Materials Tracking Register

Name / Representative	
Company /Organisation	
Description of Works	
Page No. of	

Table 1 Materials Tracking Register

Date	Origin[1]	Approximate Volume (m^3)	Sampled (Y/N)	Destination[2]	Description and Comments[3]

Notes: 1. Include a description of the location where the soil was excavated and a grid location (where possible); 2. This may be off-Site disposal, placement in stockpile, re-use on the Site. Provide a description of the location where soils are to be re-used and/or stored, including a grid location (where possible), and records of any approvals such as EPA Environmental Approvals for off-Site disposal; 3. Include soil type (including waste classification), any odours or other indicators of contamination and sampling undertaken; 4. Table provided above is an example of a soil materials tracking register for simple earthworks. Large scale earthworks may require a different tracking system; 5. The completed form should be returned to the Site Manager (or delegate) and retained on file for reference.

Appendix F

Groundwater Quality Management Plan

Prepared for
Macquarie Point Development Corporation
ABN: 92 657 409 841

Groundwater Quality Management Plan

Macquarie Point

16-Feb-2026
Macquarie Point Development Project

Groundwater Quality Management Plan

Macquarie Point

Client: Macquarie Point Development Corporation

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1.0 Introduction

1.1 General

The Macquarie Point Development Corporation (MPDC; the Corporation) has engaged the services of AECOM Australia Pty Ltd (AECOM) in the role of Project Remediation Consultant to assist with the development, implementation and ongoing oversight of a remediation strategy for the Macquarie Point site in Hobart, Tasmania (the Site). The Site location is presented on **Figure F1**, and layout on **Figure F2**.

This Groundwater Quality Management Plan (GQMP) has been prepared to document the requirements for ongoing groundwater monitoring and management at the Site.

1.2 Purpose and Objectives

The overall purpose of the GQMP is to document the requirements and provide a framework for ongoing groundwater monitoring at and adjacent to the Site, in order to allow identification of any changes in groundwater condition which may affect the risk status associated with groundwater within or emanating from the Site.

To meet this purpose, the objectives of the actions to be undertaken under this GQMP are to allow:

- Maintenance of knowledge on the condition of Site groundwater elevation, flow direction, and chemical characteristics and record any changes which may arise over time or as Site condition changes.
- Assess if unacceptable risks to on- and off-Site human and ecological receptors may be presented by changes, and to identify what additional assessment, mitigation, or remediation actions are required.

This GQMP forms part of, and should be read in conjunction with, the Site Environment Management Plan (SEMP) (AECOM, 2026). The SEMP documents:

- Stakeholder roles and responsibilities
- Relevant Site setting information
- Ongoing environmental management requirements.

If as part of future revisions, the GQMP is separated from the SEMP or the Site is sub-divided and separate GQMPs are developed for sub-areas, the information from the SEMP and any changes which have occurred must be incorporated into the new or updated GQMP.

The GQMP includes the following to support the SEMP and overall management of environmental impacts at the Site:

- A summary of the regulatory framework applicable to the assessment and management of groundwater at the Site.
- Data Quality Objectives (DQOs) for groundwater monitoring events (GMEs) at the Site.
- Methodologies for ongoing monitoring and sampling of groundwater.
- Key groundwater risks
- Trigger levels and contingencies.

1.3 Use of Groundwater at the Site

Groundwater at the Site has impacts and contamination from historic industrial land use, and should not be extracted or used for any purpose other than:

- Environmental monitoring, assessment, or remediation.

- Short-term removal during development or construction of the Site (i.e., removal of groundwater in slurry from pile installation, removal of groundwater which has entered excavations)
- Groundwater drainage measures for structures, which meet the requirements described in Section 4.4 of the SEMP.

Any groundwater extracted at the Site should be considered as potentially contaminated, and removed by a licensed waste contractor, or alternatively treated and disposed to sewer under a Site-specific Trade Waste Agreement (subject to regulatory approval). The potential for dissolved methane in groundwater to degas and enter surrounding air should be considered in any handling of Site groundwater.

2.0 Regulatory Framework

2.1 Environmental Management and Pollution Control Act 1994

The *Environmental Management and Pollution Control Act 1994* (the EMPCA) forms the basis of environmental legislation in Tasmania.

Any activities undertaken must comply with the EMPCA.

2.2 State Policy on Water Quality Management 1997

The *State Policy on Water Quality Management 1997* (the SPoWQM) was issued:

To achieve the sustainable management of Tasmania's surface water and groundwater resources by protecting or enhancing their qualities while allowing for sustainable development in accordance with the objectives of Tasmania's Resource Management and Planning System.

The SPoWQM defines Protected Environmental Values (PEVs) for Tasmanian groundwater, which have been assessed for the Site in **Section 4.1**.

2.3 Macquarie Point Development Corporation Act 2012 and the Site Environmental Audit

In 2015, the *Macquarie Point Development Corporation Act 2012* (the Act) was amended to enable the accreditation of an environmental auditor under Tasmanian legislation. The amended Act enables the Director of the Tasmanian Environment Protection Authority (EPA) to accredit an auditor. Mr David Lam of Tetra Tech Coffey has been appointed as the Environmental Auditor for the Site and has been accredited as an auditor recognised by the amended Act.

Where there is limited, or a lack of, suitable guidance in Tasmania for the audit, the amended Act allows for the Auditor to defer to other suitable interstate guidance. In this instance, the guidelines supporting the Victorian EPA Environmental Audit Framework have been adopted, as it is the home state of the appointed Auditor.

It is noted that Victorian legislation which defines the Audit process was updated and superseded by the *Environment Protection Act 2017* (the EP Act), which came into effect on 1 July 2021, and contains significant changes to Audit methodology and terminology under the Victorian framework. Under Section 478 of the EP Act, existing Audits where an Auditor has been engaged prior to 1 July 2021, and the Audit has not been completed by 1 July 2021, can be conducted under either the EP Act or the previous framework defined in the *Environment Protection Act 1970*. To maintain continuity with the portions of the Audit already completed, the Site Audit is currently continuing under the previous framework and terminology.

The role of the Auditor is to review the progression of investigation, and remedial planning and execution works at the Site. It is understood that the Auditor shall ensure that the works are carried out in compliance with local Tasmanian legislation and guidelines with consideration given to the requirements of the Victorian EPA Environmental Audit Framework.

The ultimate outcome of the Environmental Audit is to obtain a Site Suitability Statement as part of a Contaminated Land Audit Report for each area of the Site. Each Site Suitability Statement contains, or is expected to contain, requirements for implementation of the SEMP which this GQMP forms part of.

2.4 State Policies and Projects (Macquarie Point Precinct) Order 2025

The Tasmanian Government Department of State Growth announced in September 2022 that the Site is the preferred location for a mixed-use precinct, including a multipurpose stadium. Details of the proposed development of the Site were released in the Precinct Plan (MPDC, 2024).

The proposed development of a multipurpose stadium at the Site was classified as a Project of State Significance (PoSS) by the Governor of Tasmania on 16 October 2024, and *State Policies and Projects (Macquarie Point Precinct) Order 2025*, (the Order) was introduced to Tasmanian State Parliament in October 2025. The Order was approved by the Tasmanian House of Assembly on 13 November 2025

and by the Tasmanian Legislative Council on 4 December 2025 and provides conditions and approval for development of the Multipurpose Stadium at the Site.

Schedule 5 of the Order provides general environmental conditions for development of the Site. The conditions in the Schedule, and in the Order in general, are consistent with the *Macquarie Point Development Corporation Act 2012*, and in general require completion of a Site Suitability Statement for each area of the Site prior to development of that specific area.

No changes to the Environmental Audit of the Site, or the overall process and requirements for issue of Site Suitability Statements, arise from the Order. The Order does require that Site Suitability Statements be issued and implemented for each area of the Site where development is to occur.

3.0 Data Quality Objectives

Guidance regarding the development of Data Quality Objectives (DQOs) has been referenced from the following primary documents:

- National Environment Protection Council, *National Environment Protection* (*Assessment of Site Contamination*) Measure 1999, *Schedule B2: Guideline on Site Characterisation* (as amended May 2013) [ASC NEPM].
- New South Wales Environment Protection Authority (NSW EPA) *Contaminated Land Guidelines: Sampling Design Part 1 – Application* (EPA NSW, 2022).
- United States Environmental Protection Agency (US EPA), *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4) (US EPA, 2006).

The process of establishing appropriate DQOs is defined by the seven-step planning approach presented in the ASC NEPM and summarised in **Table 1** below.

Table 1 Data Quality Objectives

Step	Data Quality Objective Step Summary
1	***State the Problem*** – Summarise the problem that will require new environmental data, identify the resources available to resolve the problem and develop a conceptual site model (CSM) based on available information prior to the commencement of the site investigation.
2	***Identify the Goal of the Study*** – Identify the decisions that need to be made and the new environmental data required to support the identified decisions. Develop a decision statement linking the principal project objective(s) to the possible actions that will address the problem.
3	***Identify Information Inputs*** – Identify the information needed to support any decision and whether new environmental data will be needed.
4	***Define the Boundaries of the Study*** – Specify the spatial and temporal aspects of the environmental media that the data must represent to support decision(s).
5	***Develop the Analytical Approach*** – Define the parameter of interest, specify the action level, and integrate information from Steps 1–4 into a single statement that gives a logical basis for choosing between alternative actions.
6	***Specify Performance or Acceptance Criteria*** – Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data.
7	***Develop the Plan for Obtaining Data*** – Identify the most resource-effective sampling and analysis design for generating the data that is required to satisfy the DQOs.

The GQMP scope and methodology have been designed to meet the nominated DQOs. Discussion regarding the approach to be adopted, relative to the seven steps presented in **Table 1,** is provided in the following sections.

3.1 Step 1 – State the Problem

At completion of the Environmental Audit, the Site must be considered suitable for the proposed use. However, Site development or changes in the future may change groundwater conditions and the risk profile of groundwater contamination. Groundwater conditions must be monitored and assessed during and following development to allow identification of any changes in condition which may alter the level of risk assessed from groundwater impacts.

This GQMP has been developed to document the approach to the ongoing monitoring and assessment of groundwater quality at the Site, in order to identify if changes in groundwater conditions occur in the

future which may represent potential risks to users of the Site or adjacent land or water bodies. Preparation, maintenance, and implementation of the GQMP is a requirement of the SEMP (AECOM, 2026), and of the Site Suitability Statements issued for the Site.

3.2 Step 2 – Identify the Goal of the Study

The decision identification component of the DQO process represents the key issues that need to be considered to resolve the problems identified in Step 1. These include:

- Is groundwater elevation and flow consistent with historical conditions and with the assumptions which form part of assessment of the risk profile for groundwater at the Site?
- Are analyte concentrations within surface water and groundwater above background levels?
- Do the concentrations identified exceed the relevant criteria and do they indicate a change in risk or the potential for an unmanaged risk at the Site, which required action?
- Are the contaminants identified consistent with the understanding of the Site history?
- Is the investigation approach scientifically suitable and defensible and is it consistent with relevant guidelines?
- Are any of the trigger conditions met and are further actions required?

Overall, the decision making statement for this GQMP is:

- *Potential risks from Site groundwater must be monitored and sufficient information gathered to assess and monitor potential risks. If changes occur which introduce unacceptable risks, a process to enable implementation of suitable management measures is required.*

3.3 Step 3 – Identify the Information Inputs

To allow assessment of the data against the decision goals listed in **Section 3.2**, various inputs will be considered as follows:

- Field observations of aesthetic impacts or potential contamination (e.g., odours and phase separated hydrocarbons [light non-aqueous phase liquids; LNAPL]) and of groundwater elevation and inferred flow directions.
- Laboratory analysis of representative groundwater samples.
- Planned and implemented changes to the Site and surrounding areas, such as development activities, land use, and any other features of note relating to groundwater.
- Anecdotal information and previous investigation data (where available)

3.4 Step 4 – Define the Boundaries of the Study

The spatial boundaries (geographical limits) and lateral extent for data collection and decision making for the investigations are defined and illustrated by the Site boundaries and off-Site groundwater monitoring wells shown on **Figure F3**.

The vertical extent works will be limited the maximum depth of groundwater wells listed on **Table T1**.

The temporal bound of each study will be the period of groundwater sampling, with reference to historic Site groundwater data collected between 2015 and 2025.

3.5 Step 5 – Develop the Analytical Approach (or Decision Rule)

Data collected via implementation of the GQMP must be sufficiently representative of the media sampled to satisfy the purpose and inform the conclusions and recommendations of each GME, and further develop the CSM.

The following analytical approach will be undertaken:

- The scope of each GME will be developed with consideration of previous investigations, recommendations, data gaps, and overall Site knowledge (refer to **Section 6.1**).
- All samples will be collected by suitably qualified/experienced field scientists.
- All samples will be analysed for the target chemicals of potential concern (CoPC), which will be identified prior to each GME. Analysis must be conducted by analytical laboratories, which have current accreditation from the National Association of Testing Authorities (NATA) for the analysis requested.
- All sample analysis results will be compared to the adopted criteria (refer to **Section 4.0**).
- Field and laboratory quality assurance/quality control (QA/QC) sampling requirements will be identified prior to each GME.
- Data quality indicators (DQIs) (**Section 4.4**) will be used to validate the data quality.

The decision rules will be:

- If comparison of groundwater data to the relevant screening criteria (outlined in **Section 4.0**) identifies exceedances, increasing concentration trends, or data gaps or discrepancies from the proposed sampling plan, the contamination impacts will be subject to further investigation, assessment, remediation, or management; otherwise, environmental conditions will be deemed suitable for the proposed future uses and environmental values associated with the Site based on the available data.
- If the GME results suggest potential unacceptable risk, or if there remains insufficient information, recommendations shall be made on further assessment, management, or remediation measures.
- If the QA/QC data meets the Data Quality Indicators (DQIs) adopted (outlined in **Section 4.4.1**) to assess the precision and accuracy of the data, the data will be considered to be suitable for interpretive use. Data that fail to meet the DQIs will be assessed for their significance, then if required, managed using corrective actions (where possible) such as re-analysis of suspect samples, re-analysis of data and/or procedures, acceptance of data with acknowledged limitations/bias, or the data may be discarded.

3.6 Step 6 – Specify Performance or Acceptance Criteria

A decision error in the context of the decision rule presented in Step 5 would lead to either underestimation or overestimation of the potential risks associated with a particular analyte. Decision errors may include:

- Limitations in available Site history information
- Constraints associated with the ability to access certain areas of the Site, or off-Site locations
- Errors in the sampling plan
- Collection of samples that are not representative of the subject media
- Analytical errors
- Data not representative of Site conditions.

It is intended that the findings of the groundwater quality monitoring will provide sufficient information to inform decision making regarding potential risks, for example:

- Data will be reviewed and outliers within data sets will be identified and discussed in the context of Site characterisation for potential risks to human health and the environment
- If the criteria are not exceeded and the potential risk is considered acceptably low, an appropriate risk close out statement will be used
- If the criteria are exceeded, appropriate further assessment and contingency actions will be identified to further evaluate and, if necessary, manage the potential risk.

The quality of the data collected will be assessed on a range of factors including:

- Documentation and data completeness
- Reference to relevant guidance documents
- Consistency of methodology
- Data quality including comparability, representativeness, precision, and accuracy for data collection and analysis.

Assessment criteria for groundwater DQIs are listed in **Section 4.4**.

3.7 Step 7 – Develop the Plan for Obtaining Data

This GQMP has been developed to document the plan to obtain the required data, in order to meet the data quality objectives of this investigation identified in Steps 1 to 6 above.

The scope of works will be carried out to a level of accuracy and confidence consistent with the requirements of the ASC NEPM.

4.0 Environmental Values and Assessment Criteria

4.1 Protected Environmental Values

An appraisal of PEVs of groundwater has been undertaken with reference to the SPoWQM.

Table 1 from the SPoWQM (presented on **Plate 1** below) identifies PEVs for groundwater which are possible to be achieved on the basis of the groundwater total dissolved solids (TDS) concentrations.

Table 1 Environmental Values and Uses of Groundwater Classified by the Level of Total Dissolved Solids (mg/L)

Category TDS (mg/L)	A Less than 1000	B 1000-3500	C 3500-13000	D greater than 13000
Protected Environmental Value				
Drinking Water (1)	*			
Irrigation	*	*		
Industry	*	*	*	
Stock	*	*	*	
Ecosystem Protection	*	*	*	*

"*" Denotes an environmental value which can be achieved given the level of dissolved solids

(1) Where groundwaters have TDS levels below 500 mg/L, TDS levels should be maintained below these levels wherever practicable.

Plate 1 SPoWQM Table 1 - Environmental Values and Uses of Groundwater Classified by the Levels of TDS (mg/L)

Based on the reported TDS concentrations during previous groundwater investigations, Site groundwater is considered to be representative of Category A in accordance with the SPoWQM. For the purposes of ongoing assessment, all PEVs should be considered.

In addition, recreation (primary and secondary contact), aesthetics, buildings and structures, and human health (vapour intrusion) have been included as PEVs for groundwater at the Site.

4.2 Tier 1 Assessment Criteria

Groundwater assessment criteria have been identified for each groundwater PEV considered relevant for the Site, as discussed in **Section 4.1**, using the reference documents provided in **Table 2** below.

Adopted criteria values for specific CoPC are provided in **Appendix C**.

The Tier 1 assessment criteria have been derived to initially screen and identify precluded PEVs. The risk-based Remediation Criteria (the RC) presented in **Section 4.3** have been derived on a Site-specific basis for assessment of risks to the human health from groundwater impacts.

Table 2 Adopted Tier 1 Screening Criteria - Groundwater

Protected Environmental Value	Adopted Assessment Criteria	Rationale
Drinking Water	• NHMRC Australian Drinking Water Guidelines (amended 2018) Aesthetics • NHMRC Australian Drinking Water Guidelines (amended 2018) Human Health • PFAS NEMP (2025) Where no high reliability NHMRC guideline values are available, screening values have been adopted from the following sources: • WHO (2017) Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First Addendum • US EPA RSLs (2020) Tap Water Quality • Health Canada (2020) • NZMH (2018) Drinking Water Standards	• Whilst it is noted that groundwater at the Site is unlikely to be extracted for drinking water purposes, this PEV has been conservatively considered for the purposes of groundwater assessment.
Irrigation	• ANZECC (2000) Short Term Trigger Values (STV) for Irrigation Water	• STV have been adopted on the basis of the surrounding land use, where ongoing irrigation of plants and garden beds is unlikely to occur. STV can be tolerated for up to 20 years of irrigation.
Industry	• Due to the wide and varied potential industrial uses of groundwater, water quality requirements for use in industrial processes are assessed on an industry-specific basis.	• Groundwater at the Site is unlikely to be used for industrial purposes. In the absence of any standard or reliable criteria to apply for this PEV without a specific planned industrial use, this PEV has not been considered.
Stock	• ANZECC (2000) Livestock Drinking Water Quality	• Based on the Site setting, it is unlikely that groundwater would be used for stock watering purposes. However, for the purpose of assessing this PEV, the ANZECC (2000) guidance has been adopted.

Protected Environmental Value	Adopted Assessment Criteria	Rationale
Ecosystem Protection	• ANZG (2018) 90% level of ecosystem protection (marine water) • PFAS NEMP (2025) Interim Marine 95% (slightly to moderately disturbed) level of ecosystem protection (interim marine) Where no high reliability guideline values are available in ANZG (2018), screening values have been adopted from the following sources: • ANZG (2018) low to moderate reliability trigger values (marine) • ANZG (2018) 90% level of ecosystem protection (marine water) draft guidelines released for public comment on 29 June 2020 • US EPA (2013) Ambient Water Quality Criteria (chronic – Marine) • US EPA (2006a) Region 3 Mid-Atlantic Biological Technical Assistance Group (BTAG) Screening Benchmarks (marine) • RIVM (2001) Dutch Intervention Values (DIV) for TPH • There are currently no relevant Australian guidelines for TRH in groundwater. Therefore, for the purpose of this assessment, the Netherlands Ministry of Housing - DIV (2000) for Mineral Oil has been adopted	• The nearest surface water ecosystems that may receive groundwater discharge, i.e. River Derwent and Sullivans Cove, would be characterised as a moderately to highly disturbed (i.e. active port area) marine environment according to the ANZECC (2000) definitions. As such, the assessment criteria based on 90% level of ecosystem protection (marine) have been adopted, with the exception of identified bioaccumulative CoPC where the 95% level of ecosystem protection (interim marine) has been conservatively adopted, consisting of: - PFAS - Mercury - PAHs (anthracene, phenanthrene, fluoranthene, and benzo(a)pyrene).
Recreation (Primary Contact)	• NHMRC (2008) Guidelines for Managing Risk in Recreational Water • PFAS NEMP (2025)	• NHMRC (2008) recommends applying Australian Drinking Water Guidelines - *Health* (NHMRC, 2018), adjusted for a 10 fold decrease in ingestion of water.
Recreation (Secondary contact)		• Primary Contact Recreation criteria have been conservatively adopted to assess secondary contact.
Aesthetics	• NHMRC Australian Drinking Water Guidelines (amended 2018) Aesthetic	• This may relate to aesthetic issues associated with the presence of objectionable odours, colours, taints, visible floating material, foam, oil or grease or ‘dirty’ water.

Protected Environmental Value	Adopted Assessment Criteria	Rationale
Buildings and Structures	• AS 2159 – 2009	• Building and structures have been assessed on the basis of concrete piles in a mild exposure classification scenario in high permeability soils. • In addition to a pH of 5.5, sulphate and chloride concentrations of 1,000 mg/L and 6,000 mg/L respectively have been adopted to assess potential impacts to concrete piles.
Human Health - Vapour Intrusion	CRC CARE (2011) Groundwater HSLs for vapour intrusion including: • Residential - HSL A/B (sand, depth to groundwater 2.0 – <4.0 m bgl) • Recreation/ Open Space - HSL C (sand, depth to groundwater 2.0 – <4.0 m bgl) • Commercial/ Industrial - HSL D (sand, depth to groundwater 2.0 – <4.0 m bgl) • Intrusive Maintenance Worker- HSL: (sand, depth to groundwater 2.0 – <4.0 m bgl) The British Geological Survey (BSG) (UKRI, 2024) value for assessing risk of methane intrusion from groundwater.	• Groundwater HSLs for vapour intrusion for TRH fractions have been developed based on typical petroleum mixtures and consider the solubility limits of petroleum mixtures. HSLs cannot be applied to non-petroleum sources such as pure solvents or gasworks wastes, where solubility limits are much higher. The HSL (infinite) values presented in Appendix F of CRC CARE, 2011 have been adopted in accordance with CRC CARE guidance. The theoretical solubility of the pure compound in water was used instead to identify vapour limiting HSLs (i.e. chemicals where a vapour inhalation risk was calculated to be only present at concentrations exceeding the theoretical solubility). Whilst it is noted that petroleum products do exist at the Site, given the varying types of hydrocarbon impact (i.e. gasworks, diesel, and petrol) the HSL infinite values have been adopted as a conservative approach. • HSLs associated with depths to groundwater of between 2.0 and <4.0 m bgl in sand lithology were selected to assess groundwater analytical results as the Tier 1 criteria have been conducted as an initial screening only. The Site specific remediation criteria (**Section 4.3**) are considered protective of groundwater at 1 m bgl, based sensitivity analysis (AECOM, 2025a). • The BSG methane criteria assumes all methane in water will outgas to form an explosive atmosphere.

Notes: *NHMRC – National Health and Medical Research Council; PFAS – Per- and Polyfluoroalkyl Substances; NEMP – National Environmental Management Plan; WHO – World Health Organisation; US EPA – United States Environmental Protection Agency; RSL – Regional Screening Level; NZHM – New Zealand Health Ministry; ANZECC – Australian and New Zealand Environment and Conservation Council; STV – Short Term Trigger Value; ANZG – Australian and New Zealand Guidelines; BTAG – Biological Technical Assistance Group; RIVM – Rijksinstituut voor Volksgezondheid en Milieu; TRH – Total Recoverable Hydrocarbons; CRC CARE – Cooperative Research Council for Contamination Assessment and Remediation of the Environment; BSG – British Geological Survey; HSL – Health Screening Level*

4.3 Site Specific Remediation Criteria

Site Specific Remediation Criteria (RC), to inform remediation and management works required at the Site, for the protection of human health were initially derived in 2016 (AECOM, 2016), and reviewed updated in 2025 (AECOM, 2025a). The RC adopted for groundwater are presented in **Appendix C**.

The RC consider the following scenarios and land uses which are considered applicable to the currently proposed future development based on the review of RC (AECOM, 2025d)*:*

- High density residential development (slab-on-grade buildings and buildings with a communal basement car park)
- Recreation / open space
- Multi-storey car park
- Commercial/light industrial (slab-on-grade buildings and working within a basement car park).

It is noted that residential development is now only proposed in Regatta Point. However, high density residential land use is known to occur off-Site and hydraulically down-gradient along Evans Street to the south of the Site, and the potential exists for groundwater migration from the Site to reach this area. As such, the RC protective of residential use should be applied to groundwater data from the Site in assessment of off-Site risks.

Potential risks to ecological receptors were not considered in the RC and were separately assessed (AECOM, 2020), and reviewed in 2025 (AECOM, 2025b) noting that the only potential ecological receptors identified for the Site are off-Site aquatic receptors via groundwater migrations.

The risk-based Site RC are derived based on generic, conservative exposure assumptions protective of on-Site and off-Site human health under the above-mentioned potential future land use conditions at the Site, and incorporated the following key assumptions:

- NAPL impacts at the Site will be remediated to the extent practicable and therefore risks associated with exposure to NAPL, and volatile contaminants derived from NAPL were not considered in the derivation of the RC.
- Intrusive maintenance work at up to 1 m below ground level (bgl) may be undertaken in all land uses.
- An engineered break layer will be present at the ground surface to mitigate the potential for future Site users (with the exception of maintenance workers) to have direct contact with soils.
- A reticulated water supply will be available, based on the urban setting of the Site, and abstraction of groundwater for any purposes other than remediation or monitoring, or temporary extraction during construction, will not be required. Potential exposure to contaminants in groundwater during any construction, remediation, or monitoring will be managed by task specific safety documentation informed by the SEMP.
- Groundwater will be 1 m or more below the final surface of the Site.
- A SEMP will be prepared and put in place to maintain/manage surface cover. It is noted that this GQMP has been prepared as an attachment to the SEMP.
- With regard to basements:
    - Use of any future basements is assumed to be limited to car parking. If basements are constructed for other purposes, a risk assessment specific to the intended use should be conducted.
    - Where basements are associated with future residential or commercial buildings, it is assumed that these will be communal areas for multiple properties, for example, as part of a strata scheme that is managed by a body corporate. Private basements will therefore not be associated with individual residences.
    - Where there is access to a basement car park, it is assumed that any groundwater seepage collects in floor drains and a physical barrier is present, and therefore, groundwater will not be

directly contacted by basement users, with the exception of maintenance workers. It is assumed that individual tenants will not be involved in the maintenance of any associated services, including drainage pumps or sumps.

- For potential future multi-storey car park users, the most sensitive receptor in this scenario would be considered to be a parking attendant present at the Site for a typical eight hour working day. It is considered that RC derived for potential future commercial/light industrial workers (working within a basement) would be protective of all other basement users. This includes multi-storey car park users and residential tenants who access basement car parks and are likely to have lower frequency and duration of exposure, therefore the multi-storey car park users scenario is not evaluated separately in this assessment.
- Adjacent off-Site land uses include open space, commercial/industrial, and residential areas. As these potential land uses have been considered on-Site, the derived RC are considered to also be protective of potential exposures to off-Site receptors (e.g. via groundwater migration beyond the Site boundary), as:
  - Extractive groundwater use is not known to occur within 2 km of the Site, based on review of registered groundwater bores undertaken in 2024, and the urban setting and reticulated water supply indicate that groundwater extraction and use is unlikely to occur.
  - No basements are known to be present in the surrounding off-Site buildings, and are considered unlikely due to the additional costs which would be required for basement construction, based on shallow groundwater elevation, hydraulically downgradient of the Site.
- It is considered that potential exposure to workers undertaking remediation and/or development activities can effectively be mitigated through the implementation of an appropriate Construction Environmental Management Plan (CEMP). The CEMP should be prepared during the planning stage for any future remediation and/or development activities.
- A separate assessment of the potential risks to on-Site visitors was not undertaken as it was considered that the chronic exposure duration assessment of commercial/light industrial workers or residents is sufficiently protective of the shorter exposure duration visitor scenario.

These assumptions, including controls and requirements for future development, are currently documented as requirements of the SEMP (AECOM, 2026), and should be maintained in future SEMPs. Additional assessment of risks to users, and potentially further remediation, would be required in the event of any proposed development or Site use which does not conform to these assumptions.

4.4 Quality Assurance / Quality Control

A QA/QC program has been developed to ensure that data collected is sufficiently accurate, precise and reproducible for the purposes of the assessment program. The objective of the QA/QC program is to provide an assessment of the reliability of the data presented for interpretation. **Table 3** below summarises the QA/QC for investigations conducted as part of implementation of the GQMP.

Table 3 Aspects of the QA/QC Program

Aspect	Description
Use of Experienced Personnel	Field work will be undertaken by trained personnel with previous experience in contaminated site assessment. Field personnel will be familiar with: • Field sampling techniques • Task- and Site-specific health and safety protocols.
Field Methodology	Field activities will be conducted in accordance with the AECOM standard procedures provided in **Appendix D**.
Equipment Calibration	Where applicable, field equipment will be calibrated daily prior to use in the field. Certificates of calibration in accordance with manufacturer requirements will be provided from equipment suppliers as part of hire/procurement.

Aspect	Description
Record Keeping	Date, field personnel details, observations and findings of field activities including (but not limited to) general Site conditions (including weather), groundwater level and water quality measurements, groundwater sampling, and equipment calibration details will be recorded on project-specific data sheets.
Sample Collection	Non-dedicated sampling equipment (e.g. groundwater sampling pump, water level meter and water quality meter) will be decontaminated prior to mobilisation to Site and between sampling locations. Dedicated sampling equipment (e.g. tubing and sample containers) will be used for the collection of groundwater and QA/QC samples.
Duplicates	Field duplicate (inter and intra-laboratory) samples will be collected at a rate of one each for every 20 primary samples, for each sample media, with the exception of field duplicates of PFAS samples, which will be collected at a rate of one every 10 primary samples, in accordance with the PFAS NEMP (HEPA, 2025).
Sample Labelling	A unique sample identification number will be used for each sample to specify the sample origin (monitoring well number and date).
Chain of Custody	Standard Chain of Custody (CoC) procedures will be adopted for sample transfers. CoC documentation includes sample numbers; date of sampling/ collection; analyses required; and release and receipt of parties accepting sample custody.
Sample Storage	Samples will be collected in appropriate sample containers supplied by the analytical laboratory. Where required, sample containers will be prepared with preservation solutions based on the analyte of interest. Samples will be placed in cool storage prior to transfer to the laboratory.
Decontamination	All non-dedicated field equipment used in the sampling process will be subject to appropriate decontamination procedures, generally consisting of a non-phosphate and non-PFAS containing detergent solution wash followed by a deionised, distilled, or clean water rinse. The decontamination procedures will be performed prior to first use onsite and between each sampling location.

The quality of the data collected will be assessed on a range of factors including:

- Documentation and data completeness
- Reference to relevant guidance documents
- Consistency of methodology
- Data quality including comparability, representativeness, and accuracy for data collection and analysis.

4.4.1 Data Quality Indicators

The Data Quality Indicators (DQIs) to be adopted to assess the precision and accuracy of the data include:

- Assessment of the reproducibility of the data by calculation of the Relative Percent Difference (RPD) for laboratory and field duplicate samples. This will provide an indication of the precision of the data. The RPD is calculated from the absolute difference between results of the duplicate pair divided by the mean value of the duplicate pair as presented below:

  RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

  Where: D1 = primary sample analysis

D2 = duplicate sample analysis

- Assessment of the analytical results for laboratory quality control samples. This will provide an indication of the accuracy of the data.
- Collection of rinsate blanks (at a rate of one per day of sampling) to provide an indication of accuracy related to potential for cross contamination of samples during sampling.
- Collection of field blanks (at a rate of one per day of sampling) to assess ambient conditions during sampling. Field blanks will be kept on hold unless rinsate results report detections above the laboratory limit of reporting (LOR).
- Analysis of trip blanks (at a rate of one per esky) to provide an indication of accuracy related to potential for cross contamination of samples during transport.

Assessment criteria for data quality indicators for sampling undertaken during the investigations implemented as part of this GQMP are listed below in **Table 4**.

Table 4 Acceptance Criteria for Data Quality Indicators

Data Quality Indicator	Acceptance Criteria
Rinsate blanks	Less than the laboratory LOR
Intra and inter laboratory field duplicates (1) (3)	Relative percent difference (RPD) less than 30%
Laboratory duplicates (2) (3) (4)	RPDs less than: - 20% for high level laboratory duplicates (i.e., >20 x LOR) - 50% for medium level laboratory duplicates (i.e., 10 to 20 x LOR)
Matrix spikes (5) (6) (7)	Recoveries between 70-130%
Method blanks (7)	Less than the laboratory LOR
Trip blanks	Less than the laboratory LOR
Laboratory control samples (7) (8)	Recoveries between 70-130%.
Surrogate spikes	See Note 6

Notes:

1. *Potential exceptions may occur where the analyte concentrations are close to the LOR. The 30% RPD is obtained from the NEPM, Schedule B3, where it is advised that when an RPD exceeds 30% then a review should be conducted to ascertain the cause.*
2. *If the results are close to the LOR, then higher results will be accepted.*
3. *Assumes that samples are homogeneous and the background analyte level is less than 20% of the spike level (refer to USEPA Method 8000B). Note that there is no requirement for matrix spikes to pass as certain matrices may preclude recovery of spiked compounds. In this case data will be accepted if the laboratory control sample (LCS) data meets the acceptance criteria.*
4. *Laboratory duplicates taken 1 per 10 samples.*
5. *80% of the compounds tested must fall within the control limits. Control limits are dynamic and vary for individual tests as per USEPA Method 8000B.*
6. *Recoveries for surrogates are test dependent and are based on USEPA Method SW846. Control limits are dynamic and vary for individual tests but are within the criteria described in USEPA Method SW846.*
7. *Taken 1 per batch or 1 per 20 samples (whichever is smaller).*
8. *Recoveries for surrogates are test dependent and are based on USEPA Method SW846. Control limits are dynamic and vary for tests but are within the criteria described in USEPA Method SW846.*

4.4.2 Corrective Actions

Analytical data that fail to meet the predetermined DQIs and acceptable limits of accuracy and precision will be managed using one or more of the following corrective actions (where possible) on a case-by-case basis:

- Assess significance of DQI failure to consider whether further actions are necessary
- Reanalyse suspect samples, provided sample or extract is within holding time
- Evaluate and amend sampling and/or analytical procedures
- Resampling and reanalysis
- Accept the data as an estimate with an acknowledged level of bias and imprecision
- Discard the data.

In the event that data of questionable reliability are used, restrictions and limitations associated with the use of such data will be clearly identified. Failure to meet the DQIs will be reported and the significance to the outcome of the sampling and investigation works will be assessed.

5.0 Groundwater Conceptual Site Model

The ASC NEPM states that a CSM is an essential part of all site contamination assessments. A CSM provides a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors, and a framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future.

The development of a CSM is a dynamic and iterative process, where all information and data from each stage of an assessment is integrated to refine the CSM and inform subsequent decisions on whether further investigation or management is necessary.

Sections 5.1 to **5.4** below present the current CSM for groundwater at the Site, based on current Site knowledge of contamination as summarised in Section 3 of the SEMP.

The CSM should be reviewed as part of GME reporting (see **Section 6.8**). Proposed development of the Site, in particular the lowering of the Site and management of shallow groundwater in the north-east section of the proposed Stadium (**Section 6.4.4**) has the potential to alter groundwater flow and may affect NAPL and dissolved phase contaminant mobility, or expose and allow the oxidation of PASS.

5.1 Sources of Contamination

Based on current identified Site contamination and impacts (see Section 3 of the SEMP), the sources of contamination in groundwater listed in **Table 5** below are considered to have the potential to represent potential risks to receptors:

Table 5 Groundwater Potential Sources of Contamination

#	Type	Description
1	Dissolved phase contaminants	Concentrations of the following CoPC have been detected in groundwater above one or more of the adopted Tier 1 criteria for assessment of PEVs (see **Section 4.0**): • TDS • TPH - C_{10}-C_{36} / TRH - C_{10}-C_{40} • Benzene, naphthalene • PAHs – anthracene, benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, dibenzofuran, phenanthrene, fluoranthene, 2.4-dimethylphenol • Metals – aluminium, arsenic, boron, cobalt, copper, iron, lead, manganese, vanadium, zinc • Ammonia (as N), chloride, sodium, phosphorus, sulphate, cyanide • PFAS – PFOS • Methane • E. Coli and pH[1] In particular: • TRH/TPH and other hydrocarbon related contaminants (such as benzene, naphthalene and PAHs) are generally in the vicinity of LNAPL plumes and the former gasworks area in the south-west of the Site, but have been detected in groundwater in other areas. • PFOS above Tier 1 criteria has been detected in the south-east corner of the Site in one well (MW16), although detects above LOR but below criteria have been detected in wells on the north and north-east side of the Site. • Methane in groundwater is widespread, but generally in areas where land reclamation has occurred and buried, saturated natural soils are present, and may represent a risk if volatilised methane accumulates in enclosed spaces or structures.

[1] While E. Coli and pH are not “chemicals” of potential concern, they have been treated as such in assessment.

#	Type	Description
2	NAPL	NAPL has been detected as: • LNAPL in four plumes: - LNAPL Plumes A1, A2 and A3 in the central portion of the Site. - LNAPL Plume B in the south-east corner of the Site, and inferred to be co-sourced and extend off-Site to the east. LNAPL was remediated by Total Fluids Extraction (TFE) between 2015 and 2017. • DNAPL in four plumes in the former gasworks area in the south-east area of the Site. DNAPL was remediated via *in situ* solidification (ISS) in two areas in 2024. NAPL may represent a risk if directly contact with receptors occurs, or if secondary contact occurs via NAPL-derived dissolved phase or vapours. NAPL is not currently considered mobile (see Section 3.4 of the SEMP), but potential mobilisation due to groundwater disturbance should be considered in assessment.
3	PASS	PASS has been detected in natural soils (sands/silts) at the Site, generally in saturated soil below the water table, but also in some pockets of unoxidised material in unsaturated fill. While PASS is not considered a "contaminant" arising from human activities, but is instead a natural condition of soils at the Site, management of PASS is considered to form part of the overall management of the environmental condition of groundwater. If disturbed or dewatered, PASS has the potential to acidify and lower groundwater pH, which may directly impact receptors, or mobilise other contamination, especially metals.

Notes: *CoPC – Chemical of Potential Concern; TDS – Total Dissolved Solids; TPH – Total Petroleum Hydrocarbons; TRH – Total Recoverable Hydrocarbons; PAH – Polycyclic Aromatic Hydrocarbon; PFAS – Per- and Polyfluoroalkyl Substances; PFOS - Perfluorooctane Sulfonic Acid; E. coli - Escherichia Coli; NAPL – Non-Aqueous Phase Liquid; LNAPL – Light NAPL; DNAPL – Dense NAPL; TFE – Total Fluids Extraction; PASS – Potential Acid Sulfate Soil.*

5.2 Potential Receptors

Based on the current and proposed future uses of the Site, the receptors listed in **Table 6** below are considered to have the potential to come into contact with groundwater within or discharging from the Site.

Table 6 Potential Receptors of Groundwater

#	Type	Description
1	Human health – Residents (off-Site only), commercial/industrial workers and visitors at the Site or adjacent properties	• Residents of land to the south or west of the Site, which is zoned to allow a mix of residential and commercial uses. Apartments (first floor and above) are located along Evans Street, south of the Site. • Commercial or industrial workers at the Site or adjacent businesses such as shops and offices to the south and west, or the TasPorts facility to the east. • Visitors to residences, businesses, or open spaces at the Site or adjacent properties It is assumed that potential receptors in this category will not be undertaking intrusive works or activities.
2	Intrusive Maintenance and Construction Workers (On- and Off-Site)	• Workers undertaking intrusive maintenance (such as accessing sub-surface pipes or utility conduits) or construction activities.
3	Recreational users of nearby waterways (Off-Site only)	• Boating, fishing or other recreational uses of Sullivan's Cove or the River Derwent.

#	Type	Description
4	Ecological Receptors (Off-Site only)	• No ecological receptors (terrestrial or aquatic) are present on-Site or proposed as part of future development. Potential plants and vegetation on-Site will be managed as described in Section 4.7 of the SEMP to limit groundwater interaction. • No terrestrial ecosystems have been identified off-Site or are considered likely. • Aquatic ecosystems (assessed as “high disturbed”) are present in Sullivans Cove and the River Derwent.

5.3 Potential Pathways

Table 7 below lists the identified pathways whereby sources of contamination may come into contact with receptors.

Table 7 Potential Receptors of Groundwater

#	Type	Description
1	Direct contact	Ingestion, washing, or other direct contact with groundwater/ NAPL (either on-Site or which has migrated off-Site), or with surface water which Site groundwater has discharged to.
2	Vapour inhalation or accumulation	Inhalation of groundwater derived vapour, or accumulation of non-toxic vapour which represents an explosion risk (methane) in enclosed structures.

Risks associated with groundwater may be present on-Site, or off-Site where groundwater with contamination has migrated beyond the Site boundaries.

As noted in Section 2.5.3 of the SEMP, Site groundwater elevation contours generally followed the pattern of topographic elevation across the Site, indicating a relatively steep up-gradient flow direction to the south-east, prior to flattening out to a very gentle gradient across the central and south-eastern down-gradient areas. Groundwater flow direction followed the steep north-easterly slope towards Regatta Point further around the headland to the far north of the Site.

Groundwater is inferred to have southeast and southerly components of flow in the main area of the Site, with some westerly flow along the eastern boundary with TasPorts land which may be due to a buried seawall in this area, and northeasterly towards Regatta Point. The inferred ultimate discharge points of Site groundwater are the River Derwent and Sullivans Cove.

5.4 Source-Pathway-Receptor Assessment

An exposure pathway describes the course a chemical or physical agent takes from its source to an exposed individual or ecological receptor. In order for a receptor to be exposed to a chemical contaminant from a site, a complete exposure pathway must exist, which generally includes the following elements:

- A source and mechanism of chemical release
- A retention or transport medium (or paths where chemicals are transferred between media)
- A point of potential human or ecological contact with the contaminated medium
- An exposure route (i.e., inhalation, ingestion or dermal contact for the entity) at the point of exposure.

In cases where one or more of the above elements is missing, the exposure pathway is considered to be incomplete. Such circumstances are not considered to pose a risk of harm to receptors. **Table 8** below provides assessment on the status of source-pathway-receptor (SPR) linkages for groundwater at Macquarie Point.

The following assumptions have been made when considering SPR linkages:

- This GQMP and the SEMP will be implemented and maintained at the Site, including the following controls related to groundwater:
  - On-Site Groundwater use will be limited, as required in **Section 1.3**, to:
    - Environmental monitoring, assessment, or remediation;
    - Short-term removal during construction;
    - Groundwater drainage systems for structures.
  - Groundwater drainage and vapour intrusion protection (as required in Sections 4.4 and 4.8 of the SEMP) will be installed and maintained as part of future structures where required.
  - Safety documentation and procedures (such as Construction Environmental Management Plans [CEMPs], Work Health and Safety Plans [WHSPs], and/or task specific Job Safety Analysis [JSAs] or Safe Work Method Statements [SWMSs]) will be prepared and implemented for all intrusive works at the Site, as required in Section 4.3 of the SEMP.
  - Work planning will consider and identify potential disturbance of PASS, and preparation of a suitable Acid Sulfate Soil Management Plan (ASSMP), which may include a Dewatering Management Plan (DWMP), as required in Section 4.12.3 of the SEMP.
  - Potential risks and assumptions about use relating to groundwater will be communicated to adjacent landowners and properties, as required in **Section 6.8**.
- Due to the developed urban nature of the area and available reticulated water supply, groundwater (whether on-Site or in adjacent areas) will not be extracted for drinking, irrigation, recreational, or industrial purposes.

Table 8 Groundwater Source-Pathway-Receptor Linkage Assessment

Exposure Pathway	Residents (off-Site only), commercial/industrial workers and visitors		Intrusive Maintenance or Construction Workers		Recreational Users of Surface Water	Aquatic Ecosystems
	On-Site	Off-Site	On-Site	Off-Site	Off-Site	Off-Site
Incidental ingestion of contaminated groundwater	×(a)	×(a)	✓(d)	✓(d)	✓ (e)	✓(f)
Dermal contact with contaminated groundwater	×(a)	×(a)	✓(d)	✓(d)	✓ (e)	✓(f)
Inhalation of contaminated groundwater-derived vapours in indoor air	×(b)	×(b)	✓ (d)	✓ (d)	N/A	N/A
Accumulation of non-toxic groundwater-derived vapours (methane) to potentially hazardous levels in enclosed spaces.	×(b)	✓(b)	✓(d)	✓(d)	N/A	N/A
Inhalation of contaminated groundwater-derived vapours in outdoor air	✓ (c)	×(c)	✓(d)	× (c)	×(c)	N/A
Ingestion of contaminated groundwater used as potable water supply	×(a)	×(a)	×(a)	×(a)	×(a)	✓ (f)
Inhalation of contaminated groundwater vapours during irrigation/showering	×(a)	×(a)	×(a)	×(a)	×(a)	N/A
Ingestion of vegetables, plants or animals fed by contaminated groundwater	×(a)	×(a)	×(a)	×(a)	✓(f)	✓ (f)

Notes: × : incomplete pathway; ✓: potentially complete pathway; N/A : Not applicable

a) No on-Site or down-gradient off-Site bores used for agricultural / domestic purposes have been identified in previous investigations. The current SEMP restricts the use of Site groundwater to monitoring or remediation purposes or for dewatering (temporary or on-going), and based on the land use off-Site and downgradient, and the reticulated water supply available, use or handling of groundwater off-Site as potable water, or for irrigation, showering, stock watering, or other uses by humans, is considered unlikely.

b) On-Site development includes design and verification of vapour protection systems to prevent hazardous vapour intrusion, including consideration of potential vapour management for long-term drainage systems. No concentrations of CoPC which are considered to represent a potentially hazardous concentration of groundwater-derived vapours in indoor spaces have been detected in groundwater emanating from the Site, with the exception of methane, which is considered co-sourced from off-Site conditions (buried sea- and river-bed) and not sourced from the Site in off-Site areas.

c) No concentrations of CoPC which are considered to represent a potentially hazardous concentration of groundwater-derived vapours in outdoor spaces have been detected in groundwater within or emanating from the Site.

d) Risks to on-Site intrusive maintenance or construction workers will be managed by safety and environmental management documents as required by the SEMP. As part of implementation of the GQMP, off-Site landowners/controllers will be informed of potential risks to inform their own safety planning and management.

e) Potential surface water which may be subject to recreational use (the River Derwent and Sullivans Cove) are between 130 to 270 m from the Site boundary, and it is assessed that attenuation is likely to reduce CoPC concentrations below adopted criteria across these distances.

f) No potential impacts to off-Site ecological receptors are considered likely (see **Section 6.4.5**), which would include animals (i.e., fish) potentially consumed by off-Site recreational users of surface water.

6.0 Groundwater Monitoring Events

6.1 Scope Development and Schedule

In order to monitor the groundwater at and adjacent to the Site, and meet the purpose and objectives of the GQMP, as described in **Section 1.2**, Site-wide GMEs should be conducted at a minimum initial frequency of annually. The first GME is scheduled to occur in June 2026, noting that scheduling may be affected by Site development activities.

Each GME should be conducted with consideration of the following information:

- The environmental investigations which informed Site Suitability Statements / Contaminated Land Audit Reports, the SEMP, and the overall state of knowledge related to Site groundwater contamination.
- The key potential risk areas described in **Section 6.4** below.
- Any changes in Site condition or use, such as development, land use, and activities on neighbouring sites.
- Results and recommendations of previous GMEs.
- Any other recommendations, requirements, or data gaps relating to groundwater conditions which have been identified as part of other investigations or Site activities.

Sections 6.2 to **6.8** provide an initial scope and methodology for GMEs, with proposed groundwater wells to be gauged and selected analytical suites provided on **Table T2**. Groundwater well locations and proposed monitoring actions are shown on **Figure F5**.

Any modification of this scope for future GMEs must be justified as described in **Section 7.0**.

6.2 Well Maintenance and Repair

Groundwater wells at the Site are to be maintained in a functional condition. The following inspections will be made as part of the each GME:

- Inspect condition of concrete pad for signs of damage
- Inspect gatic cover or metal stickup cover for signs of damage
- Inspect well cap to assess if it is appropriately sealed.

Should any of the inspections identify damage to a well which could allow surface water ingress, cross-contamination of groundwater and/or to inhibit future use, work to repair the well will be undertaken.

Gatic covers are to be maintained to prevent the ingress of surface water and gatic bolts are to be replaced when showing signs of wear or damage.

The integrity of the groundwater wells should be maintained so far as reasonably practicable during normal operations or any Site development work. If wells cannot be located during sampling or gauging events, appropriate measures, such as use of a metal detector or engagement of a licensed surveyor to locate the recorded co-ordinates of a well, should be undertaken.

If a lost well cannot be relocated, a damaged well cannot be repaired and used for ongoing monitoring, or removal of groundwater well is required for the purpose of Site development:

- The groundwater well network should be assessed to determine if a replacement is required and is practicable, noting that as Site development progresses direct replacement may not be possible, or if remaining wells can be used to provide suitable information for monitoring groundwater condition.

  Replacement should be conducted as part of any other larger scale maintenance activities as discussed below.
- If the groundwater well location is known and a groundwater well is to be removed from the monitoring network (due to damage or no longer being required), the groundwater well must be

decommissioned in accordance with National Uniform Drillers Licensing Committee (NUDLC) Minimum Construction Requirements for Water Bores in Australia, Fourth Edition (2020) decommissioning requirements.

Minor maintenance requirements (such as replacing missing bolts) will be undertaken immediately during GMEs. Larger scale maintenance requirements (such as gatic replacement, redevelopment if excess siltation has occurred, or well replacement if required) will be scheduled for completion prior to, or during, the following GME.

Any new groundwater well, or groundwater well which has had the maintenance or repair activities undertaken that affects the well casing elevation, a licensed surveyor will be engaged to re-survey the top of casing location with reference to Map Grid of Australia (MGA) Zone 55) and elevation with reference to the Australian Height Datum (AHD).

A summary of groundwater well maintenance requirements completed or identified during each GME must be documented in the report described in **Section 6.8**.

6.3 Groundwater Gauging and Sampling Methodology

AECOM SOPs for development, low-flow sampling, and gauging of groundwater wells are attached as **Appendix D**. GME activities should be conducted with reference to and in accordance with these documents, or with suitable procedures which have been developed in accordance with the following documents:

- *AS NZS 5667.1.1998 – Water Quality Sampling – Part 1 Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*
- *AS NZS 5667.11,1998 – Water quality - Sampling guidance on sampling of groundwaters*
- *EPA Victoria Publication 669.1: Groundwater sampling guidelines* (EPA Victoria, 2022)
- *The Per- and Polyfluoroalkyl Substances National Environmental Management* Plan (the PFAS NEMP) (HEPA, 2025)
- The ASC NEPM

If the above documents are updated or superseded in the future, any groundwater sampling methodologies should be formulated or updated with reference to the most recent relevant guidelines.

During GMEs:

- A gauging round should be conducted prior to sampling. The gauging round should be completed in as short a time as practicable (ideally within one day).

  During gauging, the concentration of Volatile Organic Compounds (VOCs) and potential flammable compounds in each wellhead should be recorded using an appropriately calibrated photo-ionisation detector (PID) and Lower Explosive Limit (LEL) detector.

  The time at which each well is gauged should be recorded and potential tidal influence considered when assessing data.

- Sampling of each groundwater should be conducted once the gauging round is complete for all wells. Groundwater sampling should:
  - Include collection of field groundwater parameters with an appropriately calibrated water quality meter. Parameters which should be recorded include:
    - Physical appearance and characteristics of groundwater, such as colour, turbidity, and odour.
    - Field pH
    - Electrical Conductivity (EC)
    - Temperature
    - Oxygen Reduction Potential (ORP)

  - Dissolved Oxygen (DO)
- Be undertaken using low-flow methodologies for consistency with previous GMEs and historical data, unless justification for an alternative methodology, including assessment of potential differences which may arise in groundwater results, is provided.

6.4 Potential Elevated Risk Areas

Groundwater at the Site has impacts from a number of historic industrial land uses on- and off-Site, as discussed in the SEMP. The following areas have been identified in previous investigations as having detected contamination, Site characteristics, or proposed development which may introduce elevated groundwater risks.

6.4.1 Non-Aqueous Phase Liquid Areas

NAPL has been detected at the Site as both Light Non-Aqueous Phase Liquid (LNAPL) and Dense NAPL (DNAPL), as described in Section 3.4 of the SEMP.

Where practicable, GMEs should include gauging and sampling of wells within and hydraulically up-, down- and cross-gradient of NAPL areas. **Table 9** below presents existing groundwater wells which are within or immediately adjacent to inferred NAPL areas, with groundwater well locations shown on **Figure F3**.

For the purpose of the initial GME scope presented on **Table T2**, all groundwater wells on **Table 9** are included in the gauging scope, and collection and analysis of groundwater is included for all wells which are screened across the shallow aquifer.

However, collection and analysis of groundwater samples is not considered required from MW123B, MW126B, MW128B, MW129, MW131_GHD, MW136_GHD. Each of these wells are screened below the water table for assessment of the deeper aquifer, and are either in a nested bore, or <5 m, from a groundwater wells screened in the shallower aquifer which is included in the sampling scope for the GME. As the Site has a single continuous aquifer, and any contamination to the deeper portions of the aquifer would have to pass through shallower groundwater in order to reach receptors, collection and analysis of groundwater from the shallower screened wells is considered suitable for assessment and monitoring of groundwater condition.

Table 9 NAPL Monitoring Wells

NAPL Area	Groundwater Well Location			
	Within inferred plume extent	Up-gradient	Down-gradient	Cross-gradient
LNAPL Plume A1	MW183	MW103A	MW182, MW191	MW177, MW187, MW184
LNAPL Plume A2	MW185	MW191, MW184,	MW187, MW146, RN4, MW176, MW175	MW186, MW36
LNAPL Plume A3	MW187	MW182, MW177, MW183	MW155, MW146, RN4,	MW185
LNAPL Plume B	MW3, PW02, S8, PC13[1]	MW164, MW6[2], MW188	MW5[2], MW135_GHD[1], MW136_GHD[1,3], MW16, MW126A, MW126B[3], MW154[2], MW60, MW193, MW134_GHD[1]	-

NAPL Area	Groundwater Well Location			
	Within inferred plume extent	Up-gradient	Down-gradient	Cross-gradient
Tar Plume A	-	MW128A, MW128B	MW196, MW123A, MW123B[3], MW130_GHD, MW131_GHD[3], MW132_GHD	-
Tar Plume B	-	MW196, MW198	MW100, MW129[3] MW197, MW133_GHD, RS6	MW132_GHD
Tar Plume C	-	MW101	MW128A, MW128B[3], MW196	MW102
Tar Plume D	-	-	MW101, MW102, MW198	MW121

Notes: *1. Off-Site well on third party land with limited access granted; 2. LNAPL has been historically detected in this well; 3. Groundwater wells screened below the water table to assess the deeper portion of the aquifer.*

6.4.2 Per- and Polyfluoroalkyl Substances (PFAS)

While no direct record of PFAS usage or storage on the Site exists, PFAS has been identified as a CoPC arising from bulk fuel storage.

PFAS analysis has been conducted on samples collected from 33 groundwater wells across the Site between 2015 and 2025.

PFAS has not been reported above the laboratory LOR in the following 21 groundwater wells when included in laboratory analysis: MW101, MW123A, MW123B, MW124A, MW124B, MW25A, MW125B, MW126B, MW127A, MW127B, MW128A, MW128B, MW129, NR2*, R2*, R3*, RN2, RS6, S4*, S9*, TW03. Wells marked with a * have been lost or destroyed.

PFAS has been detected above LOR in 14 wells, as summarised on **Table 10** below. It is noted that other PFAS congeners have also been detected in the wells listed on **Table 10**, but do not have adopted criteria. 6:2 Fluorotelomer sulfonic acid (FTS) has only been included as no other PFAS has been detected in RN4.

Table 10 Detectable PFAS in Groundwater

Well	Date	Detectable PFAS (µg/L)				Comment(s)
		PFHxS	PFOS	PFOA	6:2 FTS	
Ecosystem Protection		NC	0.13	220	NC	
Drinking Water		0.07	0.07	0.2	NC	
MW16	19 Jul 2016	<0.02	0.09	0.02	<0.05	MW16 in the south-east corner of the Site, cross/down-hydraulic gradient of LNAPL Plume B. Hydraulic contours and groundwater elevations in surrounding wells indicate that groundwater at this well may be coming from the north and west (on-Site) and from the east (off-Site), and is likely to be discharging in a southerly direction.
	18 Jul 2017	0.04	0.38	0.06	<0.05	
	23 Jun 2025	0.01	0.30	0.02	<0.05	

Well	Date	Detectable PFAS (µg/L)				Comment(s)
		PFHxS	PFOS	PFOA	6:2 FTS	
Ecosystem Protection		NC	0.13	220	NC	
Drinking Water		0.07	0.07	0.2	NC	
BG1	21Jul 2016	0.04	<0.01	0.01	<0.05	BG1 is upgradient / background and detection in this well may indicate an off-Site source.
	18 Jul 2017	<0.02	<0.01	<0.01	<0.05	
	17 Jun 2025	0.007	0.014	0.013	<0.005	
MW6	19 Jul 2016	<0.02	<0.01	<0.01	<0.05	MW6 is located in the south-east corner of the Site, on the eastern boundary with adjacent TasPorts property and up- to cross-gradient of LNAPL Plume B.
	18 Jul 2019	<0.02	<0.01	<0.01	<0.05	
	23 Jun 2025	0.003	0.012	0.005	<0.005	
MW60	19 Jul 2016	<0.02	<0.01	0.01	<0.05	MW126A is located in the south-east corner of the Site, near the inferred discharge point of groundwater from the Site and down-gradient of LNAPL Plume B.
	18 Jul 2017	<0.02	<0.01	0.02	<0.05	
	24 Jun 2025	0.005	0.006	0.015	<0.005	
MW120	18 Aug 2015	-	<0.02	<0.02	<0.1	MW120 was located in the north-west corner of the Site, and is an upgradient / background well and detection in this well may indicate an off-Site source. This well was lost/destroyed and has been replaced by MW120A.
	02 Feb 2016	-	<0.01	<0.01	<0.1	
	21 Jul 2016	<0.02	0.02	<0.01	<0.05	
MW120A	25 Jun 2025	0.004	0.024	0.006	<0.005	This well was installed to replace MW120 in 2025.
MW121	19 Aug 2015	-	<0.02	<0.02	<0.1	MW121 is located in the north-west portion of the Site, and is an upgradient / background location and detection in this well may indicate an off-Site source.
	21 Jul 2016	<0.02	0.02	0.03	<0.05	
	18 Jul 2017	<0.02	0.03	<0.01	<0.05	
	18 Jun 2025	0.001	0.019	0.004	<0.005	

Well	Date	Detectable PFAS (µg/L)				Comment(s)
		PFHxS	PFOS	PFOA	6:2 FTS	
Ecosystem Protection		NC	0.13	220	NC	
Drinking Water		0.07	0.07	0.2	NC	
MW126A	02 Feb 2016	-	<0.01	<0.01	<0.1	MW126A is located in the south-east corner of the Site, near the inferred discharge point of groundwater from the Site.
	19 Jul 2016	<0.02	<0.01	<0.01	<0.05	
	18 Jul 2017	<0.02	<0.01	<0.01	<0.05	
	24 Jun 2025	0.005	0.004	0.007	<0.005	
MW188	24 Jun 2025	0.001	<0.001	0.002	<0.005	MW188 was installed in 2025 in a roadway east of the Red Shed in the south-east corner of the Site.
MW193	24 Jun 2025	<0.001	0.002	0.003	<0.005	MW188 was installed in 2025 in a roadway east of the Red Shed on the southern boundary in the south-east corner of the Site.
MW194	17 Jun 2025	0.004	0.017	0.015	<0.005	MW194 was installed in 2025 adjacent to BG1 on the northern Site boundary Site, and is considered to represent groundwater entering the Site.
RN2	19 Jul 2016	<0.02	<0.01	<0.01	0.13	RN2 is on the Site boundary, and hydraulic contours indicate that water at this location is likely to represent groundwater entering the Site from the east.
	19 Jul 2017	<0.02	<0.01	<0.01	<0.05	

Notes: *NC - No criteria; PFHxS - Perfluorohexane sulfonic acid; PFOS - Perfluorooctane sulfonic acid; PFOA - Perfluorooctanoic acid; FTS - Fluorotelomer sulfonic acid.*

Exceedances of adopted the criteria for drinking water and protection of marine ecosystems (95% species protection level) have been detected in one well, MW16 in the south-east corner of the Site. **Table 11** below lists wells in the vicinity of MW16.

Table 11 Wells in the vicinity of MW16

Groundwater Well ID	Inferred Hydraulic Direction[1]	PFAS Detected above LOR in Well Previously?
MW154	Up-gradient	Not analysed
S8	Up-gradient	Not analysed (LNAPL in well)
MW60	Cross- to down-gradient	Yes
MW126A	Cross- to down-gradient	Yes
MW134_GHD	Down-gradient	Not analysed. Off-Site well with limited access granted by third party landowner
MW135_GHD	Cross- to up-gradient	Not analysed. Off-Site well with limited access granted by third party landowner

Groundwater Well ID	Inferred Hydraulic Direction[1]	PFAS Detected above LOR in Well Previously?
MW136_GHD	Cross- to up-gradient	Not analysed. Off-Site well with limited access granted by third party landowner
PC12	Cross- to down-gradient	Not analysed. Off-Site well with limited access granted by third party landowner
MW193	Cross-gradient	Yes
MW151	Down-gradient	Not analysed

Notes: 1. Inferring groundwater flow direction is complex in the vicinity of MW16, as groundwater elevation is relatively flat and a seawall has been identified

For the purpose of the initial GME scope presented on **Table T2**, all groundwater wells on **Table 10** and **Table 11** have been included in the gauging scope, and selected for PFAS analysis.

6.4.3 Potential Acid Sulfate Soil (PASS)

If disturbed by excavation or dewatering, PASS located beneath the Site has the potential to oxidise and acidify. Any such disturbance requires an Acid Sulfate Soil Management Plan (ASSMP) as described in the SEMP, which may include requirements for ongoing monitoring of groundwater.

However, any such requirements will be specific to the area and extent of disturbance, and should be documented in the ASSMP or DWMP and implemented outside of the SEMP and GQMP.

6.4.4 Groundwater Elevation Relative to Buildings and Structures

As described in **Section 4.3**, the Site Specific RC include an assumption that groundwater will be greater than 1 m below building slabs.

As part of the proposed design, lowering of the Site surface elevation and construction of buildings is proposed and an area (shown on **Figure F4**) has been identified where groundwater may be present within 1 m of the base of the proposed structures (and above the base in some areas). Design and construction in this area must include protection against groundwater or groundwater-derived vapour entering buildings, as required by Section 4.4 of the SEMP, and it is understood that this is currently proposed to be achieved by a combination of a drainage layer and vapour barrier.

Any future changes in design shown on **Figure F4**, which may affect the distance between groundwater and the base of building slabs, should be considered for implications to the GQMP.

The timeframe for when construction of this layer will occur is not yet specified, but is anticipated to occur in 2027/2028, with initial excavation occurring in 2026. Groundwater monitoring during and after construction must assess if groundwater is being lowered and is not a risk of reaching the surface.

For the purpose of the initial GME scope presented on **Table T2**, gauging of all groundwater wells has been included.

6.4.5 Potential Impacts to Off-Site Ecological Receptors

A Site-wide assessment of potential off-Site impacts to ecological receptors, namely the River Derwent and Sullivans Cove was conducted in 2019/2020 and is reported in the *Assessment of Potential Off-Site Ecological Impacts* (AECOM, 2020). *Assessment of Potential Off-Site Ecological Impacts – 2025 Addendum* (AECOM, 2025b) was prepared in 2025 in order to incorporate additional data collected since initial issue of this assessment on the Site's environmental condition.

The objective of the *Assessment of Potential Off-Site Ecological Impacts* was to assess the potential risk posed to off-Site aquatic receptors with respect to the nature and extent of contaminant discharge *via* groundwater from contaminant sources at the Site.

Based on the outcomes of the weight-of evidence assessment conducted in this assessment, and the review and addendum prepared in 2025, it is unlikely that the Chemicals of Potential Ecological Concern (CoPEC) concentrations in groundwater beneath the Site are presenting a potentially

unacceptable risk to off-Site aquatic ecological receptors (if present) at the inferred points of discharge on the basis that:

- The assessed adjacent aquatic habitats are artificial, of low ecological value and considered to be 'highly disturbed' environments. A sensitivity analysis demonstrated that the overall risk conclusions would not materially change if the condition of the off-Site receiving environment was improved over time to become consistent with a 'slightly-moderately disturbed' habitat, for which a higher level of species protection would be desirable.
- The following chemicals have been identified as CoPEC at the Site, based on reported concentrations in one or more groundwater samples exceeding the adopted Tier 1 criteria:
  - Metals (aluminium, cadmium, copper, lead, manganese, vanadium, zinc)
  - Ammonia (as N), free cyanide, total phosphorus, and pH[2]
  - TRH >C10-C40 fraction (sum)
  - Monoaromatic hydrocarbons (benzene, ethylbenzene, o-xylene, m&p-xylene, 1,2,4-trimethylbenzene)
  - Polycyclic aromatic hydrocarbons (naphthalene, anthracene, phenanthrene, fluoranthene, benzo(a)pyrene)
  - 2,4-dimethylphenol
  - PFOS

  It is noted that cadmium and PFOS were not identified as CoPEC in the initial assessment (AECOM, 2020), but were identified and considered in the 2025 update (AECOM, 2025b).
- Concentrations of CoPEC were reported below adopted screening levels near Sullivans Cove and the River Derwent, were likely to attenuate further prior to discharge into these areas, or were associated with background conditions. Concentrations of CoPEC did not increase significantly (>20%) compared between 2020 and 2025, and no new exceedances of adopted ecological criteria were detected, with the exception of:
  - Elevated concentrations of cadmium, copper, lead, and zinc were observed in groundwater collected from MW180, a new groundwater well installed at Regatta Point in 2024 and screened across historical fill.

    Concentrations in excess of adopted criteria were inconsistent across the two sampling events conducted to date.
  - 2,4-Dimethylphenol: Elevated concentrations were observed at
    - MW132_GHD, located on Evans Street to the south of the Site in December 2022.

      Remediation of gasworks impacts in the Gateway was conducted in 2025 and, combined with natural attenuation processes, concentrations are expected to decline over time. During the most recent GME (June 2025) concentrations of 2,4-dimethylphenol were below the laboratory LOR in MW132_GHD.
    - MW120A, located in the north-west corner of the Site in June 2025.

      MW120A is one of the most hydraulically up-gradient wells on the Site and is located close to where groundwater is inferred to enter the Site. Concentrations in this groundwater wells are unlikely to be representative of groundwater discharging from the Site.
- Hydrocarbon fingerprinting of an LNAPL sample collected from within Plume B suggests that the LNAPL is dominantly composed of weathered diesel and lube oil. No new sources of LNAPL were identified. The plume is considered stable and no significant TRH-signature is evident downgradient near the receiving environment at Sullivans Cove.

[2] While pH is not a chemical, it has been treated as one for the purpose of assessment of ecological risks.

- Disturbance of PASS in Site soil without appropriate management could lead to acidification and increased mobilisation of metals, and increase the potential risk to off-Site aquatic ecological receptors. However, implementation of an ASSMP in accordance with the SEMP is expected to mitigate this risk.
- A mixing zone indicating estuarine/saline water interaction noted near Sullivans Cove is likely to result in the reduction of groundwater concentrations of key CoPEC prior to the point of discharge into the receiving environments.
- The Hobart Rivulet (which passes north of the Escarpment, through Audit Area 4 East, and south of Regatta Point) has concrete walls are understood to be below the groundwater level beneath the Site and may act as a barrier to groundwater flow in the direction of the point of discharge to River Derwent.
- Groundwater is inferred to predominately discharge through cracks and protrusions in the seawalls. No obvious groundwater seepage through the concrete seawall was noted near Sullivans Cove or the River Derwent during low tide inspections as part of the initial 2020 assessment, and no development or modification of seawalls is known to have occurred since then.

In summary, the *Assessment of Potential Off-Site Ecological Impacts* considered multiple lines of evidence to assess the potential risk posed to off-Site aquatic ecological receptors (i.e. marine ecosystems within the River Derwent and Sullivans Cove) with respect to the nature and extent of contaminant discharge via groundwater from contaminant sources at the Site.

Based on the outcomes of AECOM (2020), including the review conducted as part of AECOM (2025b), it is considered that groundwater emanating from the Site boundary is unlikely to pose an unacceptable risk to off-Site aquatic ecological receptors at Sullivans Cove and the River Derwent.

GMEs must include:

- Gauging and groundwater sampling at groundwater wells located (at a minimum) on the Site boundary where groundwater may be discharging from the Site towards aquatic ecological receptors (Sullivans Cove and the River Derwent).
- Analysis of the following to improve understanding of ecological risks:
  - Cadmium, copper, lead, and zinc in MW180
  - 2,4-dimethylphenol in MW120A and MW132_GHD.

6.5 Sample Analytical Suites

6.5.1 General Suite

Previous groundwater investigations have generally assessed samples for the following analytical suites, which is considered suitable to refresh Site groundwater data and allow assessment of potential risks to receptors:

- Total Petroleum Hydrocarbons (TPH) C6-C40
- Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene (BTEXN)
- Phenols
- Metals (aluminium, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, manganese and zinc)
- Cations/Anions (calcium, magnesium, sodium, chloride, sulfate, alkalinity and ionic balance)
- Acidity
- Cyanide (total, free and weak acid dissolvable [WAD])
- Ammonia
- Methane

- Total dissolved solids

The general suite should be undertaken for all groundwater samples collected as part of the GME, unless otherwise justified as part of review of groundwater data following the GME.

6.5.2 Per- and Poly-Fluoroalkyl Substances (PFAS)

PFAS analysis should be conducted on groundwater collected from wells which have previously had detectable concentrations of PFAS, and satellite wells in the vicinity of MW16, which has reported concentrations of PFOS in excess of adopted criteria, as described in **Section 6.5.2**.

6.5.3 Laboratory Limits of Reporting

Laboratory analytical suites must be selected with suitable LORs to allow assessment against the adopted criteria. Current criteria are presented in **Appendix C**, but LORs must consider any changes in criteria which arise as a result of future investigations and assessments, reference sources, or other actions which lead to changes in adopted criteria.

6.6 Waste Management

All wastewater, such as extracted groundwater and equipment wash water, is to be collected within temporary storage containers such as jerry cans or waste drums.

All solid waste products derived during each sampling event (for example filters, tubing, bladders and gloves) are to be disposed of in prescribed waste bins.

Wastewater and solid wastes are to be disposed of as potentially contaminated waste at the conclusion of each GME.

6.7 Triggers and Contingencies

Table 12, **Table 13** and **Table 14** below summarise the trigger levels and applicable contingency actions for NAPL and dissolved phase concentrations in groundwater, and for groundwater gauging.

The results of any groundwater monitoring should be assessed against these trigger levels and the contingency actions undertaken if triggers have been identified.

Table 12 NAPL Triggers and Contingency Actions

Trigger	Contingency Action
New occurrence of NAPL in a well	• Further gauging to confirm the presence of NAPL. • Assess the potential source and if there is any potential for a new release to have occurred. • Assess for potential changes to the CSM and assess whether there is a potential change in risk profile. • Develop a scope to further assess and implement appropriate NAPL management activities, if required. Actions may include, but are not limited to, sampling and fingerprinting of NAPL, testing of NAPL mobility and transmissivity, and/or removal/remediation of NAPL from groundwater.

Trigger	Contingency Action
Increase in NAPL thickness that cannot be attributed to groundwater level fluctuation (i.e., not within historical NAPL thickness or groundwater elevation).	• Review historical groundwater data. • Evaluate NAPL thickness in adjacent wells and changes in NAPL gradients. • Assess for potential changes to the CSM and assess whether there is a potential change in risk profile. • Develop a scope to further assess and implement appropriate NAPL management activities, if required. Actions may include, but are not limited to, sampling and fingerprinting of NAPL, testing of NAPL mobility and transmissivity, and/or removal/remediation of NAPL from groundwater.
First time identification of dissolved phase petroleum hydrocarbon compound concentrations exceeding solubility limits in groundwater from a well downgradient from a NAPL containing well.	• Review historical groundwater data. • Evaluate NAPL thickness in adjacent wells and changes in NAPL gradients. • Assess for potential changes to the CSM and assess whether there is a potential change in risk profile. • Develop and implement appropriate management and assessment activities, if required.

Table 13 Dissolved Phase Triggers and Contingency Actions

Trigger	Contingency Action
CoPC result(s) exceed criteria, where previously there was no exceedance.	• Assess whether the quality of the data is acceptable. • Assess the significance of criteria exceedance to consider whether further actions are necessary • Assess if any on- or off-Site activities can be identified which may have introduced the trigger result. • Assess whether the CSM is still valid. • If the CSM has potentially changed, assess whether there is a potential change in risk profile, and if so, develop a scope to confirm results, and further assess and implement mitigation measures, if required. • Develop and implement appropriate management, assessment activities and/or remediation, if required.
Increase in CoPC concentrations by an order of magnitude, compared to the most recent previous GME at this location.	
CoPC results show an increasing trend based on application of the Mann-Kendall statistical technique.	

Table 14 Groundwater Elevation and Flow Direction Triggers and Contingency Actions

Trigger	Contingency Action
Groundwater elevation is detected or inferred to be less than 1 m below the bottom of a building slab.	• Determine if the building or structure has mitigations, as required by Section 4.4 of the SEMP, and confirm that they have been maintained and are operational. • If the building or structure does not have suitable mitigations, develop and implement an assessment of risks to building users from shallow groundwater, which may include but is not limited to further groundwater sampling and assessment, soil vapour or indoor air sampling. • Prepare and implement appropriate management measures to mitigate any risks identified.
Groundwater elevations have significantly decreased	• Assess the area of elevation decrease and assess if PASS may have been exposed. • If PASS may have been exposed, develop and implement appropriate management, assessment, and/or remediation activities, if required.
Groundwater flow direction and inferred discharge points have significantly altered	• Assess if change in flow direction alters CSM and if any risks to potential sensitive receptors (i.e., aquatic ecosystems in the River Derwent or Sullivans Cove) are elevated. • Prepare and implement appropriate assessment, management and/or remediation measures to mitigate any risks identified.

6.8 Reporting

A GME report should be prepared following each GME by the organisation who conducted the groundwater sampling. The GME report should include at a minimum (where applicable):

- Background information on the Site and setting, including any changes at the Site (such as development, construction, or land use) which have occurred since the previous GME.
- Confirmation that the scope prepared for the sampling event has been fulfilled or otherwise provide the rationale for any variations.
- Sample collection and analysis data, including:
  - Field records of groundwater level, field parameters, groundwater well condition and/or repair, calibration of any instrumentation used, decontamination, and any other activities conducted in the field.
  - Laboratory analysis documentation, including Chain of Custody, Certificates of Analysis, and any laboratory conducted QA/QC checks.
  - Any other field records relevant to the groundwater investigation conducted.
- Tabulation of groundwater depths and field parameters, and of analytical results against criteria.
- Site maps or figures showing monitoring points, inferred groundwater contours, and criteria exceedances.
- Assessment on the status of groundwater impacts, assessment of potential changes to the impact areas or extents, concentration and stability, and potential changes to the risk profile.
- Review of the data against triggers levels and contingency actions and recommendations for any action that may be required.

- Review of the frequency of sampling and if any modification to the scope for the next GME are warranted, such as increase or decrease in number of wells to be gauged and sampled, or changes in proposed analytical suites.

  Analytical suites or overall monitoring frequency may be modified and decreased, if it is assessed and can be demonstrated that:

  - There is sufficient data to establish risk status.
  - Groundwater concentrations trends are established.
  - No works or development of the Site or surrounding areas which may disturb groundwater or which represent an ongoing risk of groundwater contamination are occurring or anticipated.
  - Possible changes to groundwater condition and potential risks to receptors can be adequately monitored by other data collection.

  Updates to the scope of GMEs are not considered to trigger a requirement to update or issue new versions of the GQMP or SEMP. Any changes should be captured in the review of these documents, which occurs at a minimum of every three years (see **Section 7.0**)
- Review of whether the Site CSM is still accurate or requires update, or if any update of this GQMP is required (i.e., a new or significantly altered environmental risk in groundwater has been identified).
- Scope recommended activities to be undertaken during or prior to the next GME, including any well maintenance, repair or replacement required.

If not previously conducted, any risks to potential off-Site users from groundwater identified based on the results of the GME, or assumptions on groundwater use by occupiers of off-Site land which form part of the assessment of groundwater data, should be communicated to the owners/controllers of those areas.

7.0 Review and Update Process

The approach to monitoring the quality of groundwater as outlined in this GQMP must be reviewed with the SEMP as described in Section 5.4 of the SEMP, namely:

- Every three years, based on the range of 1 to 5 years provided in *Environmental Management Plan Guidelines* (DCCEEW, 2024).
- If significant changes in Site use or environmental condition (i.e., a chemical release) occur.
- If significant changes to environmental legislation occur.

In addition, as part of reporting on the annual GME (**Section 6.8**), groundwater data should be considered and assessed to considered if a GQMP update is required if a new or significantly altered environmental risk in groundwater has been identified, if the groundwater CSM requires significant changes, or if other information has been uncovered which .

As part of this review, the condition and usage of the Site and surrounding land, and the CSM, should be considered and the risk profile and adopted criteria for groundwater reassessed and updated if required. Any changes in legislative or regulatory requirements or recommended practices should be incorporated into the GQMP for ongoing monitoring or management of groundwater.

If as part of future revisions, the GQMP is separated from the SEMP or the Site is sub-divided and separate GQMPs are developed for sub-areas, the information on roles and responsibilities, Site background, and any ongoing environmental management requirements relating to groundwater must be incorporated into the new or updated GQMP.

Ongoing monitoring should only cease if it can be demonstrated that:

- There is sufficient data to characterise the groundwater at the Site.
- Groundwater elevations and inferred flow are stable and unlikely to have meaningful change.
- Any contamination of groundwater remaining, including dissolved chemicals or NAPL in groundwater, is stable and not migrating, and does not represent any unacceptable risk to human health or ecological receptors on- or off-Site.
- No works or development of the Site or surrounding areas which may disturb groundwater or which represent an ongoing risk of groundwater contamination are occurring or anticipated.

Cessation of ongoing groundwater monitoring must only occur if the above has been documented and verified by an Environmental Auditor.

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AECOM Australia Pty Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of the Macquarie Point Development Corporation and only those third parties who have been authorised in writing by AECOM to rely on this Report.

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

Appendix A

Figures

Appendix A Figures

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Figure F2 Site Layout

Figure F3 Inferred Shallow Groundwater Contours – Site-Wide – June 2025

Figure F4 Potential Shallow Groundwater Interaction Area

Figure F5 Groundwater Monitoring Event – Scope of Work

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0 100 200 400
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LEGEND
Site Boundary

SITE LOCATION

Macquarie Point Development Corporation
Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure
F1

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REGATTA POINT

STATE GROWTH AREA

AUDIT AREA 4 EAST

THE ESCARPMENT (AUDIT AREA 4 WEST)

NORTHERN VEHICULAR ACCESS

THE ROYAL ENGINEERS BUILDING AND LAND

THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)

THE PRECINCT NORTH (LOT B)

THE GATEWAY

THE GOODS SHED AND YARD (AUDIT AREA 1)

GOODS SHED

THE PRECINCT SOUTH

RED SHED

SEAROAD SHED SLAB

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N

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0 25 50 100

metres

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Legend

- Regatta Point Boundary
- Proposed Future Building Footprint
- Proposed Basement Carpark
- Assessment Area
- Site Boundary

Proposed Landuse

- Aboriginal Culturally Informed Zone
- Residential Development and Public Foreshore Zone
- Paved area and extension to the Aboriginal Culturally Informed Zone
- Multipurpose Stadium and Associated Concourse Zone
- Complementary Integrated Mixed Use Zone
- Royal Engineers Building and Land
- Antarctic Facilities Zone
- Transport Corridor
- Vegetated Area

SITE LAYOUT AND PROPOSED DEVELOPMENT PLAN

Macquarie Point Development Corporation

Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure F2

Map Document: (\\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Projects\603X\60321835\4. Tech work area\4.99 GIS\02_Maps\2025\10\Audit_Area_4_East\F2_Proposed_Development_Plan_AA4_East.mxd)

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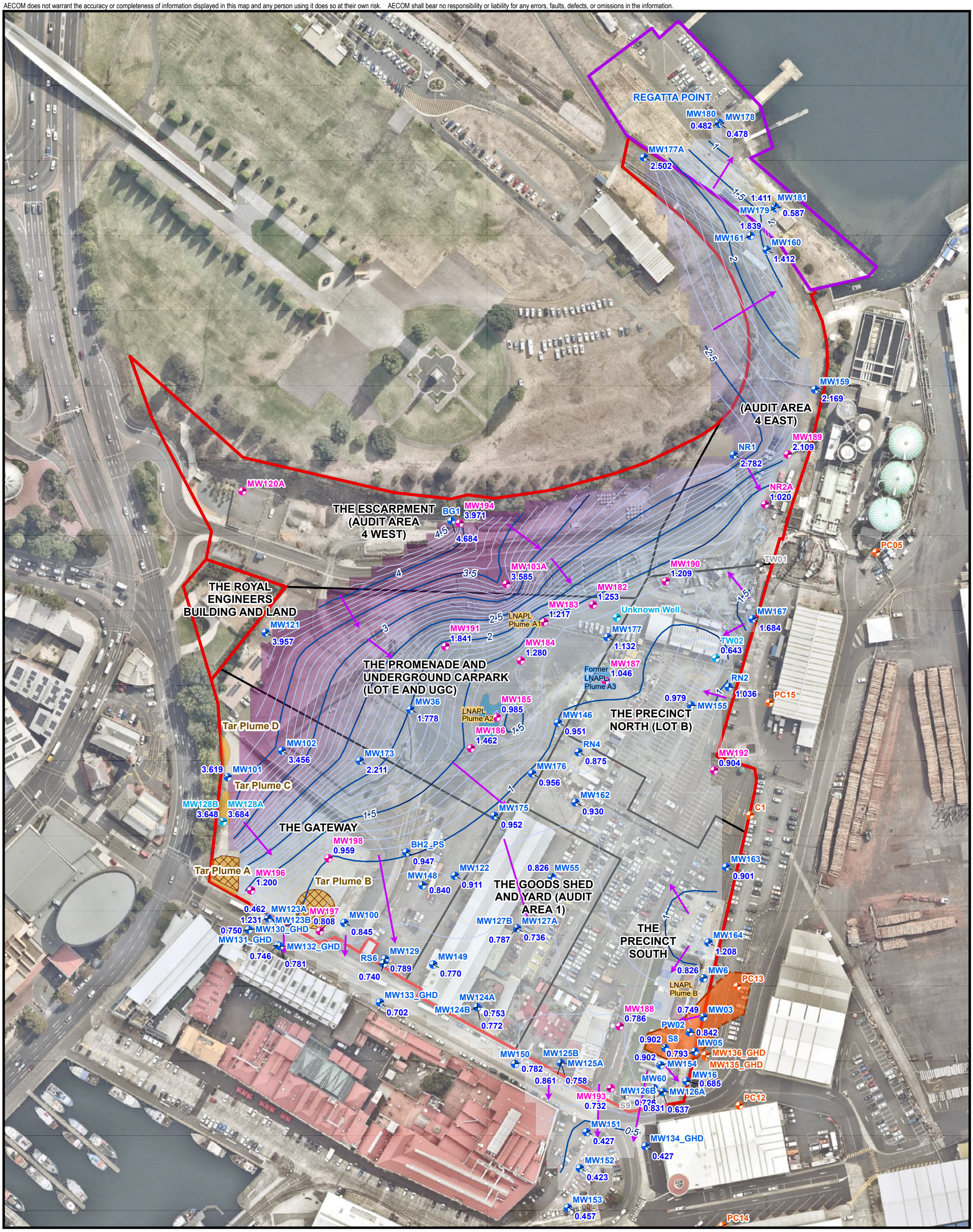

PROJECT ID 60321835 CREATED BY PK LAST MODIFIED PK 20 Jan 2026 AECOM www.aecom.com	Legend New Groundwater Well Existing Groundwater Well Lost/Destroyed Well Reinstated and Resurveyed Existing Well TasPorts Well ISS Treated Material Inferred Tar Extent Inferred Groundwater Contour (Major) Inferred Groundwater Contour (Minor) Inferred Extent of LNAPL Plume Historical Inferred Extent of LNAPL Plume Assessment Area Boundary Regatta Point Boundary Site Boundary Groundwater Contour Elevation (mAHD) 4.59782 0.423804	**INFERRED SHALLOW GROUNDWATER CONTOURS - SITE-WIDE - JUNE 2025**
N DATUM GDA 1994, PROJECTION MGA ZONE 55 0 25 50 100 metres 1:1,900 (when printed at A3)		**Macquarie Point Development Corporation** *Groundwater Quality Management Plan* Macquarie Point, Hobart, TAS **Figure** **F3**

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REGATTA POINT
MW180 0.482
MW178 0.478
MW177A 2.502
MW181 1.411
MW179 0.587
MW161 1.839
MW160 1.412
MW159 2.169
(AUDIT AREA 4 EAST)
MW189 2.109
NR1 2.782
NR3A 1.020
PC05
TW01
MW190 1.209
Final level - 1.7 mAHD
MW182 1.253
MW183 1.217
Unknown Well
MW167 1.684
MW177 1.132
TW02 0.643
RN2 1.036
PC15
0.979
MW155
THE PRECINCT NORTH (LOT B)
MW192 0.904
C1
MW163 0.901
MW164 1.208
THE PRECINCT SOUTH
0.826 MW6
PC13
LNAPL Plume B
MW188 0.786
0.749 MW03
PW02 0.842
0.902 S8 0.793
MW136_GHD
0.902 MW05 MW135_GHD
MW154 0.685
MW60 MW16
MW126B MW126A
PC12
MW193 0.732
S9 0.726 0.637
MW151 0.427
MW134_GHD 0.427
MW152 0.423
MW153 0.457
PC14
THE GOODS SHED AND YARD (AUDIT AREA 1)
MW127B 0.787
MW127A 0.736
0.826 MW55
MW122 0.911
MW148 0.840
MW198 0.959
BH2_PS 0.947
Tar Plume A
MW196 1.200
Tar Plume B
Final level - 3.3 mAHD
0.462 MW123A
MW197
1.231 MW123B 0.808
MW100 0.845
0.750 MW130_GHD
MW131_GHD
MW132_GHD 0.746 0.781
MW129 0.789
RS6 0.740
MW149 0.770
MW133_GHD 0.702
MW124A
MW124B 0.753 0.772
MW150 0.782
MW125B
MW125A 0.861 0.758
THE GATEWAY
MW128B 3.648
MW128A 3.684
MW120A
MW102 3.456
MW101 3.619
Tar Plume C
Tar Plume D
THE ROYAL ENGINEERS BUILDING AND LAND
MW121 3.957
THE ESCARPMENT (AUDIT AREA 4 WEST)
BG1 4.684
MW194 3.971
MW103A 3.585
Final level - 4.8 mAHD
MW191 1.841
MW184 1.280
MW173 2.211
THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)
MW36 1.778
MW185 0.985
LNAPL Plume A2
MW186 1.462
Final level - 3.0 mAHD
Former LNAPL Plume A3
MW187 1.046
MW146 0.951
RN4 0.875
MW176 0.956
MW162 0.930
MW175 0.952
1 2 2.5 3 3.5 4 4.5 1.5

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DATUM GDA 1994, PROJECTION MGA ZONE 55
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Legend
- New Groundwater Well
- Existing Groundwater Well
- Lost/Destroyed Well
- Reinstated and Resurveyed Existing Well
- TasPorts Well
- ISS Treated Material
- Inferred Tar Extent
- Groundwater Elevation Contours
- Inferred Extent of LNAPL Plume
- Historical Inferred Extent of LNAPL Plume
- Groundwater inferred to be ≤ 1 m below building slab following development
- Assessment Area Boundary
- Regatta Point Boundary
- Site Boundary

Final Surface Level
- Final level - 1.7 mAHD
- Final level - 2.9 mAHD
- Final level - 3.0 mAHD
- Final level - 3.3 mAHD
- Final level - 4.8 mAHD

POTENTIAL SHALLOW GROUNDWATER INTERACTION AREA

Macquarie Point Development Corporation

Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure F4

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REGATTA POINT
MW180 0.482
MW178 0.478
MW177A 2.502
MW181 0.587
MW179 1.411
MW161 1.839
MW160 1.412
MW159 2.169
(AUDIT AREA 4 EAST)
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PC05
TW01
MW190 1.209
MW167 1.684
TW02 0.643
RN2 1.036
PC15
MW155 0.979
THE PRECINCT NORTH (LOT B)
MW192 0.904
C1
MW163 0.901
MW164 1.208
MW6 0.826
PC13
MW03 0.749
PW02 0.842
MW05 0.902
S8 0.793
MW136_GHD
MW135_GHD
MW154 0.902
MW16 0.685
MW126A
PC12
MW151 0.427
MW134_GHD 0.427
MW152 0.423
MW153 0.457
PC14
THE PRECINCT SOUTH
LNAPL Plume B
MW188 0.786
MW187 1.046
Former LNAPL Plume A3
MW177 1.132
MW183 1.217
MW182 1.253
MW190 1.209
MW103A 3.585
THE ESCARPMENT (AUDIT AREA 4 WEST)
BG1
MW194 3.971
4.684
MW120A
THE ROYAL ENGINEERS BUILDING AND LAND
MW121 3.957
THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)
LNAPL Plume A1
MW191 1.841
MW184 1.280
MW36 1.778
LNAPL Plume A2
MW185 0.985
MW186 1.462
MW146 0.951
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MW176 0.956
MW162 0.930
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Tar Plume D
MW102 3.456
MW173 2.211
3.619 MW101
Tar Plume C
MW128B 3.648
MW128A 3.684
THE GATEWAY
MW198 0.959
BH2_PS 0.947
Tar Plume A
MW196 1.200
Tar Plume B
MW148 0.840
MW122 0.911
0.826 MW55
THE GOODS SHED AND YARD (AUDIT AREA 1)
0.462 MW123A
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MW100 0.845
0.750 MW130_GHD
MW131_GHD
MW132_GHD
0.746
0.781
RS6
MW129 0.789
MW149 0.770
0.740
MW133_GHD 0.702
MW124A
MW124B 0.753
0.772
MW127B 0.787
MW127A 0.736
MW150 0.782
MW125B
MW125A 0.758
0.861
MW193 0.732
MW126B
0.726
0.831
0.637
S9

Legend
- Gauge Only
- Sample (General Suite)
- Sample (General and PFAS Suites)
- Lost/Destroyed Well
- ISS Treated Material
- Inferred Tar Extent
- Inferred Groundwater Contour (Major)
- Inferred Groundwater Contour (Minor)
- Inferred Extent of LNAPL Plume
- Historical Inferred Extent of LNAPL Plume
- Assessment Area Boundary
- Regatta Point Boundary
- Site Boundary

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GROUNDWATER MONITORING EVENT SCOPE OF WORK

Macquarie Point Development Corporation

Groundwater Quality Management Plan

Macquarie Point, Hobart, TAS

Figure
F5

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Appendix B

Tables

Appendix B Tables

List of Attached Tables

Table T1 Site Monitoring Well Network

Table T2 Groundwater Well Gauging and Sampling Scope

Table T1 - Groundwater Well Network

								Most Recent Gauging Data						
Area	Well ID	Easting (MGA94)	Northing (MGA94)	Top of Casing (m AHD)	Approximate Well Depth (m bgl)	Screened Interval (m bgl)	Screened Lithology	Date Gauged / Access Attempted	Depth to LNAPL (m bTOC)	Depth to Groundwater (m bTOC)	LNAPL Thickness (m)	SWL (m AHD)[2]	LNAPL-Corrected GW Elevation (mAHD)	Comments
1. The Goods Shed Yard	MW124A	527507.730	5252350.790	3.767	5.00	2.0-5.0	Fill	13-Jun-25	-	2.995	-	0.772	0.772	GC, NO, Over LEL
1. The Goods Shed Yard	MW124B	527507.670	5252350.790	3.738	11.30	9.4-11.4	Alluvial/ Marine Deposits	13-Jun-25	-	2.985	-	0.753	0.753	GC, NO
1. The Goods Shed Yard	MW127A	527529.640	5252393.950	3.896	4.70	1.8-4.8	Fill	13-Jun-25	-	3.109	-	0.787	0.787	GC, NO, Over LEL
1. The Goods Shed Yard	MW127B	527529.680	5252393.990	3.866	16.80	15.6-16.6	Slope Deposits	13-Jun-25	-	3.130	-	0.736	0.736	GC, Organic odour, 77% LEL
1. The Goods Shed Yard	MW149	527483.676	5252374.243	4.024	4.70	2.0-5.0	Fill	13-Jun-25	-	3.254	-	0.770	0.770	GC, NO
1. The Goods Shed Yard	MW55	527548.733	5252422.331	3.789	5.00	3.0-6.0	Fill	13-Jun-25	-	2.963	-	0.826	0.826	GC, NO, Over LEL
2. The Escarpment	BG1	527493.615	5252617.707	7.492	3.44	0.5-3.5	Fill / Dolerite	16-Jun-25	-	2.808	-	4.684	4.684	Data Logger
2. The Escarpment	MW103A	527523.755	5252582.928	6.299	5.00	2.0-5.0	Dolerite bedrock	16-Jun-25	-	2.714	-	3.585	3.585	GC, NO
2. The Escarpment	MW120A	527378.983	5252633.983	7.942	8.51	2.0-9.0	Dolerite bedrock	25-Jun-25	-	7.988	-	-0.046	-0.046	GC, NO, well dry for two weeks following installation (5 June), very slowly recharging
2. The Escarpment	MW194	527498.158	5252616.538	7.465	5.96	1.5-6.0	Dolerite bedrock	16-Jun-25	-	3.494	-	3.971	3.971	GC, NO
3. Audit Area 4 East	MW159	527693.238	5252689.962	5.757	7.58	3.5-8.0	Bedrock	16-Jun-25	-	3.588	-	2.169	2.169	GC, NO
3. Audit Area 4 East	MW160	527666.699	5252766.390	7.306	9.48	3.5-8.0	Bedrock	16-Jun-25	-	5.894	-	1.412	1.412	GC, NO
3. Audit Area 4 East	MW161	527657.800	5252774.319	7.634	6.45	3.5-6.5	Bedrock	16-Jun-25	-	5.795	-	1.839	1.839	GC, NO
3. Audit Area 4 East	MW177A	527598.808	5252815.946	9.497	7.15	4.3-7.3	Bedrock	16-Jun-25	-	6.995	-	2.502	2.502	GC, NO
3. Audit Area 4 East	MW189	527678.261	5252654.104	5.233	6.55	2.7-6.5	Bedrock	16-Jun-25	-	3.124	-	2.109	2.109	GC, NO
3. Audit Area 4 East	NR1	527648.559	5252654.045	8.295	8.00	3.5-8.0	Bedrock	16-Jun-25	-	5.513	-	2.782	2.782	GC, NO, 6% LEL
3. Audit Area 4 East	NR2A	527665.785	5252626.689	5.073	5.92	1.5-6.0	Fill / Sand	16-Jun-25	-	4.053	-	1.020	1.020	GC, NO
4. The Promenade and Underground Carpark	MW121	527391.610	5252556.420	6.957	5.00	2.0-5.0	Weathered Dolerite	13-Jun-25	-	3.000	-	3.957	3.957	No gatic lid, dirt in gatic, NO
4. The Promenade and Underground Carpark	MW146	527552.111	5252507.052	4.186	5.49	2.5-5.5	Fill	16-Jun-25	-	3.235	-	0.951	0.951	GC, 24% LEL
4. The Promenade and Underground Carpark	MW175	527517.100	5252456.440	3.904	4.00	1.5-4.5	Fill	13-Jun-25	-	2.952	-	0.952	0.952	GC, NO, 100mm PVC
4. The Promenade and Underground Carpark	MW176	527537.900	5252479.310	4.036	4.58	1.5-4.5	Fill	16-Jun-25	-	3.080	-	0.956	0.956	GC, NO, NS
4. The Promenade and Underground Carpark	MW177	527579.184	5252554.472	4.529	4.50	1.5-4.5	Fill	16-Jun-25	-	3.397	-	1.132	1.132	100mm well casing
4. The Promenade and Underground Carpark	MW182	527571.272	5252571.919	4.858	5.62	2.0-6.0	Fill	16-Jun-25	-	3.605	-	1.253	1.253	GC, NO
4. The Promenade and Underground Carpark	MW183	527544.466	5252562.171	5.052	5.82	1.5-6.0	Fill	16-Jun-25	-	3.835	-	1.217	1.217	GC, 53% LEL
4. The Promenade and Underground Carpark	MW184	527531.675	5252541.194	4.864	5.85	1.5-6.0	Fill	16-Jun-25	-	3.584	-	1.280	1.280	GC, NO, NS
4. The Promenade and Underground Carpark	MW185	527518.554	5252510.048	4.638	5.80	2.0-6.0	Fill	16-Jun-25	-	3.653	-	0.985	0.985	GC, HC sheen, Over LEL
4. The Promenade and Underground Carpark	MW186	527504.381	5252492.922	4.832	5.91	2.0-6.0	Fill	16-Jun-25	-	3.370	-	1.462	1.462	GC, HC odour, NS, 18% LEL
4. The Promenade and Underground Carpark	MW191	527490.356	5252549.038	5.659	4.58	1.5-6.0	Dolerite (weathered to fresh)	13-Jun-25	-	3.818	-	1.841	1.841	GC, NO, 8% LEL
4. The Promenade and Underground Carpark	MW36	527525.300	5252509.000	5.647	6.57	4.0-7.0	Fill/Bedrock	16-Jun-25	-	3.869	-	1.778	1.778	Gatic Missing
5. The Precinct North	MW155	527625.037	5252516.399	3.929	4.51	1.5-4.5	Fill	16-Jun-25	-	2.950	-	0.979	0.979	GC, NO, NS, 44% LEL
5. The Precinct North	MW167	527658.873	5252563.922	4.164	4.83	2.0-5.0	Fill	16-Jun-25	-	2.480	-	1.684	1.684	GC, NO
5. The Precinct North	MW187	527578.434	5252529.858	4.258	9.35	2.0-6.5	Fill	16-Jun-25	-	3.212	-	1.046	1.046	GC, NO, HC Sheen
5. The Precinct North	MW190	527611.266	5252584.652	4.703	4.93	1.5-5.0	Fill	16-Jun-25	-	3.494	-	1.209	1.209	GC, NO
5. The Precinct North	MW192	527637.744	5252480.774	3.601	5.89	1.5-6.0	Fill	16-Jun-25	-	2.697	-	0.904	0.904	GC, NO, NS
5. The Precinct North	RN2	527645.786	5252526.638	4.182	5.36	1.0-5.0	Fill	16-Jun-25	-	3.146	-	1.036	1.036	GC, NO, NS, Over LEL
5. The Precinct North	TW02	527638.679	5252542.362	4.086	5.76	2.4-5.5	Fill	16-Jun-25	-	3.443	-	0.643	0.643	NO, New TOC, screen measures at 2.88 to 5.76 mBTOC
6. The Precinct South	MW03	527629.967	5252344.531	2.596	8.63	2-7.5	Fill	16-Jun-25	1.830	1.900	0.070	0.696	0.749	Over LEL, Brown NAPL on probe, HC odour
6. The Precinct South	MW05	527625.558	5252326.180	2.663	4.33	1.4-4.4	Fill	16-Jun-25	-	1.870	-	0.793	0.793	HC odour, GC
6. The Precinct South	MW125A	527553.730	5252320.260	3.306	5.99	2.0-5.0	Fill	16-Jun-25	-	2.445	-	0.861	0.861	GC, NO
6. The Precinct South	MW125B	527553.730	5252320.260	3.309	15.28	13.8-15.3	Marine Deposits	16-Jun-25	-	2.551	-	0.758	0.758	GC, NO
6. The Precinct South	MW126A	527609.600	5252304.450	2.857	5.13	2.1-5.1	Fill	16-Jun-25	-	2.131	-	0.726	0.726	GC, NO
6. The Precinct South	MW126B	527609.600	5252304.450	2.831	18.88	15.9.0-18.9	Slope Deposits	16-Jun-25	-	2.194	-	0.637	0.637	GC, NO
6. The Precinct South	MW154	527608.419	5252318.975	2.827	3.80	1.0-4.0	Fill	16-Jun-25	-	1.925	-	0.902	0.902	H2O above TOC, 45% LEL
6. The Precinct South	MW16	527622.576	5252310.246	2.630	4.91	3.0-6.0	Fill	16-Jun-25	-	1.945	-	0.685	0.685	85% LEL
6. The Precinct South	MW162	527561.725	5252463.136	4.079	4.73	2.0-5.0	Fill	16-Jun-25	-	3.149	-	0.930	0.930	GC, 6% LEL
6. The Precinct South	MW163	527644.415	5252427.853	2.837	3.82	0.95-3.95	Fill	16-Jun-25	-	1.936	-	0.901	0.901	H2O above TOC, Over LEL
6. The Precinct South	MW164	527634.673	5252386.218	2.685	3.86	0.5-4.0	Fill	16-Jun-25	-	1.477	-	1.208	1.208	GC, NO, NS, 28% LEL
6. The Precinct South	MW188	527586.042	5252340.345	3.080	4.95	1.0-5.0	Fill	16-Jun-25	-	2.294	-	0.786	0.786	GC, NO, Over LEL
6. The Precinct South	MW193	527581.087	5252306.338	2.924	5.48	1.0-5.0	Fill	16-Jun-25	-	2.192	-	0.732	0.732	GC, NO, Over LEL
6. The Precinct South	MW6	527631.882	5252366.709	2.896	4.89	2.0-5.0	Fill	16-Jun-25	-	2.070	-	0.826	0.826	Over LEL, Level logger
6. The Precinct South	MW60	527604.842	5252306.320	2.864	6.00	3.0-6.0	Fill	16-Jun-25	-	2.033	-	0.831	0.831	GC, NO
6. The Precinct South	PW02	527624.264	5252337.008	2.723	6.00	1.5-6.0	Fill	16-Jun-25	1.871	1.913	0.042	0.810	0.842	15% LEL, Brown NAPL on probe, HC odour
6. The Precinct South	RN4	527563.308	5252490.930	4.045	5.17	1.5-6.0	Fill/Marine Deposits	16-Jun-25	-	3.170	-	0.875	0.875	GC, NO, NS, 32% LEL
6. The Precinct South	S8	527610.904	5252328.497	2.830	5.20	1.2-5.2	Fill	16-Jun-25	1.909	1.990	0.810	0.840	0.902	Over LEL. Brown NAPL on probe, HC odour
6. The Precinct South	S9	527588.943	5252302.383	2.910	4.00	1.0-4.0	Fill	16-Jun-25	-	-	-	-	-	Lost under garden bed
7. The Gateway	BH2_PS	527483.786	5252435.896	5.286	7.03	Unknown	Fill/Marine Deposits	16-Jun-25	-	4.339	-	0.947	0.947	GC, NO
7. The Gateway	MW100	527434.926	5252397.121	4.006	11.50	3.0-9.0	Fill	13-Jun-25	-	3.161	-	0.845	0.845	GC, NO
7. The Gateway	MW101	527370.927	5252477.012	5.317	3.60	1.6-4.6	Fill	13-Jun-25	-	1.698	-	3.619	3.619	GC, NO
7. The Gateway	MW102	527400.582	5252491.493	5.778	4.49	1.6-4.6	Fill/Weathered Dolerite/Slope Deposits	13-Jun-25	-	2.322	-	3.456	3.456	No gatic lid, dirt in gatic, NO
7. The Gateway	MW122	527495.560	5252422.980	3.933	4.00	2.0-4.0	Fill	13-Jun-25	-	3.022	-	0.911	0.911	GC, NO
7. The Gateway	MW128A	527368.319	5252452.571	5.207	2.98	1.8-4.8	Slope Deposits/Bedrock	13-Jun-25	-	1.523	-	3.684	3.684	GC, NO
7. The Gateway	MW128B	527368.350	5252452.570	5.229	3.50	10.0-13.0	Bedrock	13-Jun-25	-	1.581	-	3.648	3.648	GC, NO
7. The Gateway	MW129	527457.190	5252377.340	3.800	16.00	14.0-16.0	Slope Deposits	13-Jun-25	-	3.060	-	0.740	0.740	GC, NO
7. The Gateway	MW148	527477.706	5252417.844	3.786	4.90	2.0-5.0	Fill	13-Jun-25	-	2.946	-	0.840	0.840	GC, NO
7. The Gateway	MW173	527443.426	5252486.041	5.928	4.92	2.0-5.0	Fill/Marine Deposits	16-Jun-25	-	3.717	-	2.211	2.211	GC
7. The Gateway	MW196	527383.693	5252415.008	3.299	6.03	1.5-6.0	Fill	25-Jun-25	-	2.099	-	1.200	1.200	
7. The Gateway	MW197	527421.438	5252392.726	3.290	5.90	3.7-6	Marine Deposits	25-Jun-25	-	2.482	-	0.808	0.808	
7. The Gateway	MW198	527426.182	5252432.536	3.201	5.21	2.0-6.0	Fill	16-Jun-25	-	2.242	-	0.959	0.959	GC, NO
7. The Gateway	RS6	527456.344	5252374.791	3.792	5.50	1.5-6.0	Fill	13-Jun-25	-	3.003	-	0.789	0.789	GC, NO
8. Regatta Point	MW178	527640.962	5252835.628	1.282	4.85	2.7-5.0	Bedrock	16-Jun-25	-	0.804	-	0.478	0.478	GC, NO
8. Regatta Point	MW179	527671.789	5252789.467	2.273	5.39	1.5-5.5	Bedrock	16-Jun-25	-	1.686	-	0.587	0.587	GC, NO
8. Regatta Point	MW180	527640.331	5252836.358	1.243	1.89	0.7-2.2	Fill	16-Jun-25	-	0.761	-	0.482	0.482	GC, NO
8. Regatta Point	MW181	527671.149	5252790.232	2.261	0.85	0.4-0.95	Fill	16-Jun-25	-	-	-	-	-	GC, NO, dry
9. Offsite	C1	527657.503	5252456.170	3.142	4.50	1.0-4.5	Fill	27-Feb-25	-	2.281		0.861	0.861	
9. Offsite	MW123A	527393.270	5252399.740	3.223	3.65	1.8-3.8	Fill	13-Jun-25	-	1.992	-	1.231	1.231	GC, NO, 2 x bolts missing
9. Offsite	MW123B	527393.230	5252399.730	3.278	17.45	14.6-17.6	Fill	13-Jun-25	-	2.816	-	0.462	0.462	GC, NO, 2 x bolts missing
9. Offsite	MW130_GHD	527382.450	5252393.370	2.728	4.71	2.0-5.0	Marine Deposits	12-Jun-25	-	1.978	-	0.750	0.750	Grass in gatic, new gatic lid installed
9. Offsite	MW131_GHD	527398.420	5252384.860	2.611	9.66	6.7-9.7	Marine Deposits	12-Jun-25	-	1.865	-	0.746	0.746	GC, NO, Datalogger
9. Offsite	MW132_GHD	527399.600	5252384.260	2.631	3.89	2.5-4.5	Fill/Marine Deposits	12-Jun-25	-	1.850	-	0.781	0.781	GC, NO, 2 x bolts missing
9. Offsite	MW133_GHD	527454.400	5252353.360	3.127	4.45	2.0-3.0	Fill	12-Jun-25	-	2.425	-	0.702	0.702	GC, NO, Datalogger
9. Offsite	MW134_GHD	527600.190	5252274.580	3.057	5.99	4.0-7.0	Fill	16-Jun-25	-	2.630	-	0.427	0.427	LEL Over
9. Offsite	MW135_GHD	527632.940	5252353.790	2.597	5.00	2.0-5.0	Fill	27-Feb-25	-	1.939	-	0.658	0.658	Access not granted to gauge
9. Offsite	MW136_GHD	527633.060	5252324.500	2.549	13.50	10.2-13.50	Fill	4-Feb-16	-	2.050	-	0.499	0.499	
9. Offsite	MW150	527528.454	5252319.791	3.265	4.39	1.0-5.0	Fill / Marine Deposits	13-Jun-25	-	2.483	-	0.782	0.782	GC, NO, H2O in gatic above TOC, 2 x bolts missing
9. Offsite	MW151	527567.708	5252282.430	2.553	4.87	1.0-5.5	Fill / Marine Deposits	12-Jun-25	-	2.126	-	0.427	0.427	GC, NO
9. Offsite	MW152	527564.181	5252262.443	2.563	4.98	1.0-5.5	Fill/Marine Deposits	12-Jun-25	-	2.140	-	0.423	0.423	GC, NO, 1% LEL
9. Offsite	MW153	527557.540	5252240.934	2.449	4.42	1.0-4.6	Fill/Marine Deposits	12-Jun-25	-	1.992	-	0.457	0.457	GC, NO
9. Offsite	PC05	527726.727	5252600.326	Unknown	3.28	No data	Fill	27-Feb-25	ND	2.313	-	-	-	Good condition, no sheen, no odour, orange organic material on probe
9. Offsite	PC08	527746.787	5252222.601	Unknown	2.10	No data	Fill	-	-	-	-	-	-	No access attempted by field staff.
9. Offsite	PC10	527817.921	5252666.445	Unknown	4.42	No data	Fill	27-Feb-25	-	-	-	-	-	Bolts sheared unable to open - need driller
9. Offsite	PC11	527779.795	5252522.473	Unknown	4.56	No data	Fill	27-Feb-25	-	-	-	-	-	Bolts sheared unable to open - need driller
9. Offsite	PC12	527651.691	5252296.989	Unknown	4.98	No data	Fill	27-Feb-25	ND	2.525	-	-	-	LEL 17, organic material on probe, good condition
9. Offsite	PC13	527650.528	5252362.247	2.636	4.33	No data	Fill	27-Feb-25	1.3	1.310	0.01	1.326	1.334	Good condition, 1 cm of LNAPL
9. Offsite	PC14	527642.432	5252230.789	Unknown	2.20	No data	Fill	-	-	-	-	-	-	No access attempted by field staff. A mark which may be this well is visible on aerial photographs.
9. Offsite	PC15	527668.146	5252518.054	3.489	4.38	No data	Fill	27-Feb-25	-	-	-	-	-	Under large shipping container unable to locate

Notes:

m bgl - metres below ground level
TOC - top of casing
AHD - Australian Height Datum
SWL - Standing Water Level
GC - Good condition
NO - No odour
HC - Hydrocarbon
LEL - Lower explosive limit
H20 - Water
NS - no sheen
NAPL - non-aqueous phase liquid

[1] *The Easting and Northing coordinates presented are the MGA94 Coordinates*
[2] *SWL values in wells containing LNAPL have been corrected for the depression of the LNAPL/water interface in the well by multiplying the apparent LNAPL thickness in the well an LNAPL specific gravity of 0.76*

Table T2 - GME Scope

AECOM

Area	Well ID	Easting (MGA94)	Northing (MGA94)	Top of Casing (m AHD)	Approximate Well Depth (m bgl)	Screened Interval (m bgl)	Screened Lithology	GME Activities			Purpose and Area	Potential LNAPL Well?
								Gauge?	Sample			
									General Suite	PFAS Suite		
1. The Goods Shed Yard	MW124A	527507.730	5252350.790	3.767	5.00	2.0-5.0	Fill	Yes			Groundwater on southern boundary of the Site.	
1. The Goods Shed Yard	MW124B	527507.670	5252350.790	3.738	11.30	9.4-11.4	Alluvial/ Marine Deposits	Yes			Deep (>10 m bgl) groundwater on southern boundary of the Site. Aquifer is interconnected. Shallow well MW123A used for assessment of groundwater in this area	
1. The Goods Shed Yard	MW127A	527529.640	5252393.950	3.896	4.70	1.8-4.8	Fill	Yes	Yes		Groundwater adjacent to the Goods Shed and downgradient of fuel storage and the former Goods Shed Annexe mechanics workshop	
1. The Goods Shed Yard	MW127B	527529.680	5252393.990	3.866	16.80	15.6-16.6	Slope Deposits	Yes			Deep (>10 m bgl) groundwater adjacent to the Goods Shed and downgradient of fuel storage and the former Goods Shed Annexe mechanics workshop Aquifer is interconnected. Shallow well MW127A used for assessment of groundwater in this area	
1. The Goods Shed Yard	MW149	527483.676	5252374.243	4.024	4.70	2.0-5.0	Fill	Yes			Located in the southern portion of the Site on the western site of the Goods Shed. Well installed to assess groundwater quality down-inferred hydraulic gradient of the Sewer (Main Hobart Pipeline) and former UST locations.	
1. The Goods Shed Yard	MW55	527548.733	5252422.331	3.789	5.00	3.0-6.0	Fill	Yes	Yes		Located in the southern portion of the Site on the western site of the Goods Shed. Well installed to assess groundwater quality down-inferred hydraulic gradient of the Sewer (Main Hobart Pipeline) and the Goods Shed Annexe (former mechanics workshop	
2. The Escarpment	BG1	527493.615	5252617.707	7.492	3.44	0.5-3.5	Fill / Dolerite	Yes	Yes	Yes	Located on northern boundary, upgradient of Site land. Installed to assess groundwater entering the Site. Screened across fill and dolerite	
2. The Escarpment	MW103A	527523.755	5252582.928	6.299	5.00	2.0-5.0	Dolerite bedrock	Yes			Located in the central eastern portion of the Site, up-gradient of LNAPL plumes A1, A2 and former LNAPL Plume A3 and down-gradient of previous soil impacts in the Escarpment, to assess shallow groundwater quality.	
2. The Escarpment	MW120A	527378.983	5252633.983	7.942	8.51	2.0-9.0	Dolerite bedrock	Yes	Yes	Yes	Replacement well for MW120 to assess groundwater entering the north-west corner of the Site.	
2. The Escarpment	MW194	527498.158	5252616.538	7.465	5.96	1.5-6.0	Dolerite bedrock	Yes	Yes	Yes	New well adjacent to BG1 to assess groundwater in dolerite entering the Site.	
3. Audit Area 4 East	MW159	527693.238	5252689.962	5.757	7.58	3.5-8.0	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the vicinity of the WWTP	
3. Audit Area 4 East	MW160	527666.699	5252766.390	7.306	9.48	3.5-8.0	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the upgradient of Regatta Point	
3. Audit Area 4 East	MW161	527657.800	5252774.319	7.634	6.45	3.5-6.5	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the upgradient of Regatta Point	
3. Audit Area 4 East	MW177A	527598.808	5252815.946	9.497	7.15	4.3-7.3	Bedrock	Yes	Yes		Located at the northern portion of the Site. Assess groundwater entering Regatta Point	
3. Audit Area 4 East	MW189	527678.261	5252654.104	5.233	6.55	2.7-6.5	Bedrock	Yes			New well on the eastern boundary of the Site to replace NR4 and assess groundwater entering the Site from the WWTP	
3. Audit Area 4 East	NR1	527648.559	5252654.045	8.295	8.00	3.5-8.0	Bedrock	Yes	Yes		Located in the northeastern portion of the Site. Assess shallow groundwater quality in the vicinity of the former Northern Refuelling Area.	
3. Audit Area 4 East	NR2A	527665.785	5252626.689	5.073	5.92	1.5-6.0	Fill / Sand	Yes	Yes		Located in the eastern boundary of the Site. Assess shallow groundwater quality at the Site boundary adjacent to WWTP and the former Oil and Diesel Pipelines. Replacement for TW01 and NR2	
4. The Promenade and Underground Carpark	MW121	527391.610	5252556.420	6.957	5.00	2.0-5.0	Weathered Dolerite	Yes	Yes	Yes	Located on the western boundary of the Site. Assess shallow groundwater entering the Site.	
4. The Promenade and Underground Carpark	MW146	527552.111	5252507.052	4.186	5.49	2.5-5.5	Fill	Yes			Located in the central portion of the Site. Delineate and assess groundwater quality down-gradient of LNAPL Plumes A1 and A2.	
4. The Promenade and Underground Carpark	MW175	527517.100	5252456.440	3.904	4.00	1.5-4.5	Fill	Yes			Central portion of the Site, downgradient of bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3, and in vicinity of Hobart Sewer.	
4. The Promenade and Underground Carpark	MW176	527537.900	5252479.310	4.036	4.58	1.5-4.5	Fill	Yes			Central portion of the Site, downgradient of bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3, and in vicinity of Hobart Sewer.	
4. The Promenade and Underground Carpark	MW177	527579.184	5252554.472	4.529	4.50	1.5-4.5	Fill	Yes			Central portion of the Site, cross- to downgradient of bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3, and in vicinity of Hobart Sewer.	
4. The Promenade and Underground Carpark	MW182	527571.272	5252571.919	4.858	5.62	2.0-6.0	Fill	Yes	Yes		Groundwater well to delineate LNAPL Plume A1 to the north-east	
4. The Promenade and Underground Carpark	MW183	527544.466	5252562.171	5.052	5.82	1.5-6.0	Fill	Yes	Yes[1]		Groundwater well to intersect LNAPL Plume A1	Yes
4. The Promenade and Underground Carpark	MW184	527531.675	5252541.194	4.864	5.85	1.5-6.0	Fill	Yes	Yes		Groundwater well to delineate LNAPL Plume A1 to the south-west and LNAPL Plume A2 to the north-east	
4. The Promenade and Underground Carpark	MW185	527518.554	5252510.048	4.638	5.80	2.0-6.0	Fill	Yes	Yes[1]		Groundwater well to intersect LNAPL Plume A2	Yes
4. The Promenade and Underground Carpark	MW186	527504.381	5252492.922	4.832	5.91	2.0-6.0	Fill	Yes	Yes		Groundwater well to delineate LNAPL Plume A2 to the south	
4. The Promenade and Underground Carpark	MW191	527490.356	5252549.038	5.659	4.58	1.5-6.0	Dolerite (weathered to fresh)	Yes	Yes		Groundwater well to delineate LNAPL Plume A1 and A2 to the west.	
4. The Promenade and Underground Carpark	MW36	527525.300	5252509.000	5.647	6.57	4.0-7.0	Fill/Bedrock	Yes	Yes		Located in the central portion of the Site. Delineate and assess groundwater quality cross- and up-gradient of LNAPL Plume A2.	
5. The Precinct North	MW155	527625.037	5252516.399	3.929	4.51	1.5-4.5	Fill	Yes	Yes		Located in the central eastern portion of the Site. Assess shallow groundwater quality at the boundary of the Site in the vicinity of the former oil pipeline.	
5. The Precinct North	MW167	527658.873	5252563.922	4.164	4.83	2.0-5.0	Fill	Yes	Yes		Located on the central eastern Site boundary to assess groundwater quality and potential vapour risks associated with previously identified TRH impacts in soil at BH126/MW156 near the water table.	
5. The Precinct North	MW187	527578.434	5252529.858	4.258	9.35	2.0-6.5	Fill	Yes	Yes[1]		Groundwater well to intersect former LNAPL Plume A3 (if present)	Yes
5. The Precinct North	MW190	527611.266	5252584.652	4.703	4.93	1.5-5.0	Fill	Yes	Yes		Groundwater well to assess general groundwater condition in the north-east portion of the Site	
5. The Precinct North	MW192	527637.744	5252480.774	3.601	5.89	1.5-6.0	Fill	Yes	Yes		Groundwater well on the eastern boundary to replace TW03 and assess groundwater entering the Site from the WWTP / TasPorts	
5. The Precinct North	RN2	527645.786	5252526.638	4.182	5.36	1.0-5.0	Fill	Yes	Yes		Located on the eastern boundary of the Site. Assess shallow groundwater quality at the boundary of the Site in the vicinity of the former oil pipeline.	
5. The Precinct North	TW02	527638.679	5252542.362	4.086	5.76	2.4-5.5	Fill	Yes	Yes		Located on the eastern boundary of the Site. Assess shallow groundwater quality at the boundary of the Site in the vicinity of the former oil pipeline.	
6. The Precinct South	MW03	527629.967	5252344.531	2.596	8.63	2-7.5	Fill	Yes			Located on the eastern boundary of the Precinct South to assess shallow groundwater quality. LNAPL previously detected in this well	Yes
6. The Precinct South	MW05	527625.558	5252326.180	2.663	4.33	1.4-4.4	Fill	Yes			Located on the eastern boundary of the Precinct South to assess shallow groundwater quality. LNAPL previously detected in this well	Yes
6. The Precinct South	MW125A	527553.730	5252320.260	3.306	5.99	2.0-5.0	Fill	Yes	Yes		Southern boundary of the Precinct South. South western boundary of the Red Shed. Assess shallow (<10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B.	
6. The Precinct South	MW125B	527553.730	5252320.260	3.309	15.28	13.8-15.3	Marine Deposits	Yes			Southern boundary of the Precinct South. South western boundary of the Red Shed. Assess deep (>10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B. Aquifer is interconnected. Shallow well MW125A used for assessment of groundwater in this area	
6. The Precinct South	MW126A	527609.600	5252304.450	2.857	5.13	2.1-5.1	Fill	Yes	Yes	Yes	South east boundary of the Precinct South. Assess shallow <>10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B.	
6. The Precinct South	MW126B	527609.600	5252304.450	2.831	18.88	15.9.0-18.9	Slope Deposits	Yes			South east boundary of the Precinct South. Assess deep (>10 m bgl) groundwater quality down hydraulic gradient of LNAPL Plume B. Aquifer is interconnected. Shallow well MW126A used for assessment of groundwater in this area	
6. The Precinct South	MW154	527608.419	5252318.975	2.827	3.80	1.0-4.0	Fill	Yes	Yes[1]	Yes[1]	Located in the south eastern portion of the Precinct South. To further delineate LNAPL plume B and/or assess ground water quality impacts.	Yes
6. The Precinct South	MW16	527622.576	5252310.246	2.630	4.91	3.0-6.0	Fill	Yes	Yes	Yes	Located on the eastern boundary of the Precinct South to assess shallow groundwater quality and flow conditions, in proximity to the sea walls and former bulk fuel storage areas.	
6. The Precinct South	MW162	527561.725	5252463.136	4.079	4.73	2.0-5.0	Fill	Yes			Located in the Precinct South down-hydraulic gradient of the former Goods Shed Annexe area (former mechanics area).	
6. The Precinct South	MW163	527644.415	5252427.853	2.837	3.82	0.95-3.95	Fill	Yes			Eastern boundary of the Site to assess groundwater flow and quality at Site boundary	
6. The Precinct South	MW164	527634.673	5252386.218	2.685	3.86	0.5-4.0	Fill	Yes	Yes		Eastern boundary of the Site to assess groundwater flow and quality at Site boundary	
6. The Precinct South	MW188	527586.042	5252340.345	3.080	4.95	1.0-5.0	Fill	Yes	Yes	Yes	Groundwater well to delineate LNAPL Plume B to the west	
6. The Precinct South	MW193	527581.087	5252306.338	2.924	5.48	1.0-5.0	Fill	Yes	Yes	Yes	Groundwater well to delineate LNAPL Plume B to the west	
6. The Precinct South	MW6	527631.882	5252366.709	2.896	4.89	2.0-5.0	Fill	Yes	Yes	Yes	Located on the eastern boundary of the Precinct South. Assess shallow groundwater quality and flow conditions at the Site boundary and in proximity to the sea walls and former bulk fuel storage.	
6. The Precinct South	MW60	527604.842	5252306.320	2.864	6.00	3.0-6.0	Fill	Yes	Yes	Yes	Located in the south eastern portion of the Precinct South. Assess shallow groundwater quality and gain further insight into LNAPL impacts at the southern Site boundary.	
6. The Precinct South	PW02	527624.264	5252337.008	2.723	6.00	1.5-6.0	Fill	Yes			Located on the eastern boundary of the Precinct South. Assess shallow groundwater quality and flow conditions at the Site boundary and in proximity to the sea walls. Gain insight into LNAPL impacts at the Site boundary	Yes
6. The Precinct South	RN4	527563.308	5252490.930	4.045	5.17	1.5-6.0	Fill/Marine Deposits	Yes	Yes		Central portion of the Site, upgradient of Goods Shed Annexe and downgradient of former bulk fuel storage and LNAPL Plumes A1, A2 and former LNAPL Plume A3.	
6. The Precinct South	S8	527610.904	5252328.497	2.830	5.20	1.2-5.2	Fill	Yes			Located in the eastern portion of the Precinct South within SeaRoad Shed Slab. Assessing shallow groundwater quality and assess LNAPL.	Yes
6. The Precinct South	S9	527588.943	5252302.383	2.910	4.00	1.0-4.0	Fill	Yes			Located on the south-eastern boundary of the Site. Assessing shallow groundwater quality downgradient of LNAPL Plume B.	
7. The Gateway	BH2_PS	527483.786	5252435.896	5.286	7.03	Unknown	Fill/Marine Deposits	Yes	Yes		Located in the south-western portion of the Site, cross-gradient to LNAPL Plume A2 and former gasworks areas.	
7. The Gateway	MW100	527434.926	5252397.121	4.006	11.50	3.0-9.0	Fill	Yes			Located in the southern portion of the Site, down-gradient of gasworks area and cross-gradient to DNAPL Plume B	
7. The Gateway	MW101	527370.927	5252477.012	5.317	3.60	1.6-4.6	Fill	Yes	Yes		Located on the south-western boundary of the Site, between DNAPL Plumes C and D. Assess groundwater entering the Site.	
7. The Gateway	MW102	527400.582	5252491.493	5.778	4.49	1.6-4.6	Fill/Weathered Dolerite/Slope Deposits	Yes	Yes		In the central western portion of the Site. Assess groundwater in the vicinity of the former Roundhouse and cross-gradient of gasworks.	
7. The Gateway	MW122	527495.560	5252422.980	3.933	4.00	2.0-4.0	Fill	Yes	Yes		Located in the central southern portion of the Site. Provides indication of potential impact from sewer infrastructure and LNAPL Plume A2 (i.e. located down/cross inferred hydraulic gradient).	
7. The Gateway	MW128A	527368.319	5252452.571	5.207	2.98	1.8-4.8	Slope Deposits/Bedrock	Yes	Yes		Located on the western boundary of the Site. Assess shallow groundwater entering the Site in the former gasworks area.	
7. The Gateway	MW128B	527368.350	5252452.570	5.229	3.50	10.0-13.0	Bedrock	Yes			Located on the western boundary of the Site. Assess deep (>10 m bgl) groundwater entering the Site in the former gasworks area. Aquifer is interconnected. Shallow well MW128A used for assessment of groundwater in this area	
7. The Gateway	MW129	527457.190	5252377.340	3.800	16.00	14.0-16.0	Slope Deposits	Yes			Located adjacent to the central southern boundary of the Site. Assess deep groundwater quality at the Site boundary in proximity to sewer infrastructure and former UST location.	
7. The Gateway	MW148	527477.706	5252417.844	3.786	4.90	2.0-5.0	Fill	Yes	Yes		Located in the south-west portion the Site, to assess potential impact sourced from former UST locations.	
7. The Gateway	MW173	527443.426	5252486.041	5.928	4.92	2.0-5.0	Fill/Marine Deposits	Yes	Yes		In the central western portion of the Site. Assess groundwater in the vicinity of the former Roundhouse and cross-gradient of gasworks.	
7. The Gateway	MW196	527383.693	5252415.008	3.299	6.03	1.5-6.0	Fill	Yes	Yes		Groundwater well to assess groundwater condition at Brick Pit12, downgradient of Tar Plume A	
7. The Gateway	MW197	527421.438	5252392.726	3.290	5.90	3.7-6	Marine Deposits	Yes	Yes		Groundwater well to assess groundwater condition downgradient of Tar Plume B	
7. The Gateway	MW198	527426.182	5252432.536	3.201	5.21	2.0-6.0	Fill	Yes	Yes		Groundwater well to assess groundwater condition at Brick Pit12, downgradient of Tar Plume B	
7. The Gateway	RS6	527456.344	5252374.791	3.792	5.50	1.5-6.0	Fill	Yes			Located adjacent to the central southern boundary of the Site, to assess groundwater quality at the Site boundary in proximity to sewer infrastructure and the UST location. MW129 is a newer well at the same location.	
8. Regatta Point	MW178	527640.962	5252835.628	1.282	4.85	2.7-5.0	Bedrock	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in dolerite	
8. Regatta Point	MW179	527671.789	5252789.467	2.273	5.39	1.5-5.5	Bedrock	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in dolerite	
8. Regatta Point	MW180	527640.331	5252836.358	1.243	1.89	0.7-2.2	Fill	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in fill (if present)	
8. Regatta Point	MW181	527671.149	5252790.232	2.261	0.85	0.4-0.95	Fill	Yes	Yes		Located on Regatta Point. Assess shallow groundwater in fill (if present)	

Table T2 - GME Scope

Area	Well ID	Easting (MGA94)	Northing (MGA94)	Top of Casing (m AHD)	Approximate Well Depth (m bgl)	Screened Interval (m bgl)	Screened Lithology	GME Activities			Purpose and Area	Potential LNAPL Well?
								Gauge?	Sample			
									General Suite	PFAS Suite		
9. Offsite	C1	527657.503	5252456.170	3.142	4.50	1.0-4.5	Fill	Yes[2]			Located east of the Precinct South in TasPorts land. Limited access has been historically provided to assess groundwater flow and monitoring.	
9. Offsite	MW123A	527393.270	5252399.740	3.223	3.65	1.8-3.8	Fill	Yes	Yes		Located along Evans Street, south of the former gasworks area.	
9. Offsite	MW123B	527393.230	5252399.730	3.278	17.45	14.6-17.6	Fill	Yes			Located along Evans Street, south of the former gasworks area. Screened to assess deep (>10 m bgl) groundwater	
9. Offsite	MW130_GHD	527382.450	5252393.370	2.728	4.71	2.0-5.0	Marine Deposits	Yes[3]	Yes[3]		Located along Evans Street. Assess groundwater quality off-Site and downgradient of gasworks	
9. Offsite	MW131_GHD	527398.420	5252384.860	2.611	9.66	6.7-9.7	Marine Deposits	Yes[3]	Yes[3]		Located along Evans Street. Assess deep groundwater quality off-Site and downgradient of gasworks Aquifer is interconnected. Shallow well MW123A used for assessment of groundwater in this area	
9. Offsite	MW132_GHD	527399.600	5252384.260	2.631	3.89	2.5-4.5	Fill/Marine Deposits	Yes[3]			Located along Evans Street. Assess groundwater quality off-Site and downgradient of gasworks	
9. Offsite	MW133_GHD	527454.400	5252353.360	3.127	4.45	2.0-3.0	Fill	Yes[3]	Yes[3]		Located on western end of Evans St to the south of Site. Assess shallow groundwater quality within Evans St (former Hobart Rivulet) and down-hydraulic gradient of Site.	
9. Offsite	MW134_GHD	527600.190	5252274.580	3.057	5.99	4.0-7.0	Fill	Yes[2]	Yes[2]	Yes[2]	Located along Evans Street. Assess groundwater quality off-Site and downgradient of LNAPL Plume B	
9. Offsite	MW135_GHD	527632.940	5252353.790	2.597	5.00	2.0-5.0	Fill	Yes[2]	Yes[2]	Yes[2]	Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	MW136_GHD	527633.060	5252324.500	2.549	13.50	10.2-13.50	Fill	Yes[2]			Located on TasPorts land to the east. Assess adjacent deep (>10 m bgl)groundwater quality Aquifer is interconnected. Shallow well MW135_GHD used for assessment of groundwater in this area	
9. Offsite	MW150	527528.454	5252319.791	3.265	4.39	1.0-5.0	Fill / Marine Deposits	Yes[3]	Yes[3]		Located on eastern end of Evans St to the south of Site. Assess shallow groundwater quality within Evans St (former Hobart Rivulet) and down-hydraulic gradient of Site.	
9. Offsite	MW151	527567.708	5252282.430	2.553	4.87	1.0-5.5	Fill / Marine Deposits	Yes	Yes	Yes	Located on eastern end of Evans St to the south of Site. Assess shallow groundwater quality within Evans St (former Hobart Rivulet) and down-hydraulic gradient of Site.	
9. Offsite	MW152	527564.181	5252262.443	2.563	4.98	1.0-5.5	Fill/Marine Deposits	Yes	Yes		Located in UniTas carpark to the south and east of Site. Assess shallow groundwater quality down hydraulic gradient of Site towards Sullivans Cove.	
9. Offsite	MW153	527557.540	5252240.934	2.449	4.42	1.0-4.6	Fill/Marine Deposits	Yes	Yes		Located in UniTas carpark to the south and east of Site. Assess shallow groundwater quality down hydraulic gradient of Site towards Sullivans Cove.	
9. Offsite	PC05	527726.727	5252600.326	Unknown	3.28	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC08	527746.787	5252222.601	Unknown	2.10	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC10	527817.921	5252666.445	Unknown	4.42	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC11	527779.795	5252522.473	Unknown	4.56	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC12	527651.691	5252296.989	Unknown	4.98	No data	Fill	Yes[2]	Yes[2]	Yes[2]	Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC13	527650.528	5252362.247	2.636	4.33	No data	Fill	Yes[2]	Yes[1,2]	Yes[1,2]	Located on TasPorts land to the east. Assess adjacent groundwater quality	Yes
9. Offsite	PC14	527642.432	5252230.789	Unknown	2.20	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
9. Offsite	PC15	527668.146	5252518.054	3.489	4.38	No data	Fill	Yes[2]	Yes[2]		Located on TasPorts land to the east. Assess adjacent groundwater quality	
							Total	**95**	**69**	**16**		

Notes
1. Sample if LNAPL is not present
2. Access approval from third party (TasPorts) required
3. Traffic management generally required

Appendix C

Adopted Groundwater Criteria

Table C1 - Tier 1 Groundwater Criteria - Drinking Water (Health)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
630-20-6	1,1,1,2-Tetrachloroethane	Water	0.57 µg/L	US EPARSL NOV 2024 - Tap Water Quality
71-55-6	1,1,1-Trichloroethane	Water	8000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
79-34-5	1,1,2,2-Tetrachloroethane	Water	0.076 µg/L	US EPARSL NOV 2024 - Tap Water Quality
79-00-5	1,1,2-Trichloroethane	Water	0.28 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-34-3	1,1-Dichloroethane	Water	2.8 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-35-4	1,1-Dichloroethene	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health
87-61-6	1,2,3-Trichlorobenzene	Water	7 µg/L	US EPARSL NOV 2024 - Tap Water Quality
96-18-4	1,2,3-Trichloropropane	Water	0.00075 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-94-3	1,2,4,5-Tetrachlorobenzene	Water	1.7 µg/L	US EPARSL NOV 2024 - Tap Water Quality
120-82-1	1,2,4-Trichlorobenzene	Water	1.2 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-63-6	1,2,4-trimethylbenzene	Water	56 µg/L	US EPARSL NOV 2024 - Tap Water Quality
96-12-8	1,2-Dibromo-3-chloropropane	Water	0.00033 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-93-4	1,2-Dibromoethane (EDB)	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
95-50-1	1,2-Dichlorobenzene	Water	1.5 mg/L	NHMRC ADWG (amended 2025) Human Health
107-06-2	1,2-Dichloroethane	Water	3 µg/L	NHMRC ADWG (amended 2025) Human Health
78-87-5	1,2-Dichloropropane	Water	0.85 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-67-8	1,3,5-trimethylbenzene	Water	60 µg/L	US EPARSL NOV 2024 - Tap Water Quality
99-35-4	1,3,5-Trinitrobenzene	Water	590 µg/L	US EPARSL NOV 2024 - Tap Water Quality
142-28-9	1,3-Dichloropropane	Water	370 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-46-7	1,4-Dichlorobenzene	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health
90-12-0	1-Methylnaphthalene	Water	1.1 µg/L	US EPARSL NOV 2024 - Tap Water Quality
58-90-2	2,3,4,6-Tetrachlorophenol	Water	240 µg/L	US EPARSL NOV 2024 - Tap Water Quality
93-76-5	2,4,5-Trichlorophenoxy acetic acid	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health
88-06-2	2,4,6-Trichlorophenol	Water	0.02 mg/L	NHMRC ADWG (amended 2025) Human Health
120-83-2	2,4-Dichlorophenol	Water	0.2 mg/L	NHMRC ADWG (amended 2025) Human Health
105-67-9	2,4-Dimethylphenol	Water	360 µg/L	US EPARSL NOV 2024 - Tap Water Quality
51-28-5	2,4-Dinitrophenol	Water	39 µg/L	US EPARSL NOV 2024 - Tap Water Quality
121-14-2	2,4-Dinitrotoluene	Water	0.24 µg/L	US EPARSL NOV 2024 - Tap Water Quality
606-20-2	2,6-Dinitrotoluene	Water	0.049 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-58-7	2-Chloronaphthalene	Water	750 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-57-8	2-Chlorophenol	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health
95-49-8	2-Chlorotoluene	Water	240 µg/L	US EPARSL NOV 2024 - Tap Water Quality
131-89-5	2-Cyclohexyl-4,6-dinitrophenol	Water	23 µg/L	US EPARSL NOV 2024 - Tap Water Quality
591-78-6	2-hexanone (MBK)	Water	38 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-57-6	2-Methylnaphthalene	Water	36 µg/L	US EPARSL NOV 2024 - Tap Water Quality
95-48-7	2-Methylphenol (o-Cresol)	Water	930 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-59-8	2-Naphthylamine	Water	0.039 µg/L	US EPARSL NOV 2024 - Tap Water Quality
88-74-4	2-Nitroaniline	Water	190 µg/L	US EPARSL NOV 2024 - Tap Water Quality
67-64-1	2-Propanone (Acetone)	Water	18000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
91-94-1	3,3-Dichlorobenzidine	Water	0.13 µg/L	US EPARSL NOV 2024 - Tap Water Quality
56-49-5	3-Methylcholanthrene	Water	0.0011 µg/L	US EPARSL NOV 2024 - Tap Water Quality
534-52-1	4,6-Dinitro-2-methylphenol	Water	1.5 µg/L	US EPARSL NOV 2024 - Tap Water Quality
92-67-1	4-Aminobiphenyl	Water	0.003 µg/L	US EPARSL NOV 2024 - Tap Water Quality
59-50-7	4-Chloro-3-methylphenol	Water	1400 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-47-8	4-Chloroaniline	Water	0.37 µg/L	US EPARSL NOV 2024 - Tap Water Quality
106-43-4	4-Chlorotoluene	Water	250 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-10-1	4-Methyl-2-pentanone (MIBK)	Water	6300 µg/L	US EPARSL NOV 2024 - Tap Water Quality
100-01-6	4-Nitroaniline	Water	3.8 µg/L	US EPARSL NOV 2024 - Tap Water Quality
99-55-8	5-Nitro-o-toluidine	Water	8.2 µg/L	US EPARSL NOV 2024 - Tap Water Quality
57-97-6	7,12-Dimethylbenz(a)anthracene	Water	0.0001 µg/L	US EPARSL NOV 2024 - Tap Water Quality
319-84-6	a-BHC	Water	0.0072 µg/L	US EPARSL NOV 2024 - Tap Water Quality
83-32-9	Acenaphthene	Water	530 µg/L	US EPARSL NOV 2024 - Tap Water Quality
98-86-2	Acetophenone	Water	1900 µg/L	US EPARSL NOV 2024 - Tap Water Quality
309-00-2	Aldrin	Water	0.00092 µg/L	US EPARSL NOV 2024 - Tap Water Quality
309-00-2 + 60-57-1	Aldrin + Dieldrin	Water	0.0003 mg/L	NHMRC ADWG (amended 2025) Human Health
107-05-1	Allyl chloride	Water	0.73 µg/L	US EPARSL NOV 2024 - Tap Water Quality
62-53-3	Aniline	Water	13 µg/L	US EPARSL NOV 2024 - Tap Water Quality
120-12-7	Anthracene	Water	1800 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-36-0	Antimony	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health
12674-11-2	Arochlor 1016	Water	0.22 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11104-28-2	Arochlor 1221	Water	0.0047 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11141-16-5	Arochlor 1232	Water	0.0047 µg/L	US EPARSL NOV 2024 - Tap Water Quality
53469-21-9	Arochlor 1242	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
12672-29-6	Arochlor 1248	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11097-69-1	Arochlor 1254	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
11096-82-5	Arochlor 1260	Water	0.0078 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-38-2	Arsenic	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
103-33-3	Azobenzene	Water	0.12 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-39-3	Barium	Water	2 mg/L	NHMRC ADWG (amended 2025) Human Health
319-85-7	b-BHC	Water	0.025 µg/L	US EPARSL NOV 2024 - Tap Water Quality
56-55-3	Benz(a)anthracene	Water	0.03 µg/L	US EPARSL NOV 2024 - Tap Water Quality
71-43-2	Benzene	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
92-87-5	Benzidine	Water	0.00011 µg/L	US EPARSL NOV 2024 - Tap Water Quality
50-32-8	Benzo(a)pyrene	Water	0.01 µg/L	NHMRC ADWG (amended 2025) Human Health

Table C1 - Tier 1 Groundwater Criteria - Drinking Water (Health)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
207-08-9	Benzo(k)fluoranthene	Water	2.5 µg/L	US EPARSL NOV 2024 - Tap Water Quality
98-07-7	Benzotrichloride	Water	0.003 µg/L	US EPARSL NOV 2024 - Tap Water Quality
100-44-7	Benzyl chloride	Water	0.089 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-41-7	Beryllium	Water	0.06 mg/L	NHMRC ADWG (amended 2025) Human Health
111-91-1	Bis(2-chloroethoxy) methane	Water	59 µg/L	US EPARSL NOV 2024 - Tap Water Quality
111-44-4	Bis(2-chloroethyl) ether	Water	0.014 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-60-1	Bis(2-chloroisopropyl)ether	Water	710 µg/L	US EPARSL NOV 2024 - Tap Water Quality
117-81-7	Bis(2-ethylhexyl)phthalate	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
7440-42-8	Boron	Water	4 mg/L	NHMRC ADWG (amended 2025) Human Health
108-86-1	Bromobenzene	Water	62 µg/L	US EPARSL NOV 2024 - Tap Water Quality
74-97-5	Bromochloromethane	Water	83 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-27-4	Bromodichloromethane	Water	0.06 mg/L	WHO (2011) Drinking Water Guidelines
74-83-9	Bromomethane	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
85-68-7	Butyl benzyl phthalate	Water	16 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-43-9	Cadmium	Water	0.002 mg/L	NHMRC ADWG (amended 2025) Human Health
75-15-0	Carbon disulfide	Water	810 µg/L	US EPARSL NOV 2024 - Tap Water Quality
56-23-5	Carbon Tetrachloride	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health
470-90-6	Chlorfenvinphos	Water	11 µg/L	US EPARSL NOV 2024 - Tap Water Quality
108-90-7	Chlorobenzene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health
510-15-6	Chlorobenzilate	Water	0.31 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-00-3	Chloroethane	Water	21000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
74-87-3	Chloromethane	Water	190 µg/L	US EPARSL NOV 2024 - Tap Water Quality
2921-88-2	Chlorpyrifos	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
5598-13-0	Chlorpyrifos-methyl	Water	120 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-47-3	Chromium	Water	0.05 mg/L	WHO (2011) Drinking Water Guidelines
16065-83-1	Chromium (trivalent)	Water	22000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
218-01-9	Chrysene	Water	25 µg/L	US EPARSL NOV 2024 - Tap Water Quality
156-59-2	cis-1,2-Dichloroethene	Water	36 µg/L	US EPARSL NOV 2024 - Tap Water Quality
1476-11-5	cis-1,4-Dichloro-2-butene	Water	0.0013 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-48-4	Cobalt	Water	6 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7440-50-8	Copper	Water	2 mg/L	NHMRC ADWG (amended 2025) Human Health
57-12-5	Cyanide Total	Water	0.08 mg/L	NHMRC ADWG (amended 2025) Human Health
72-54-8	DDD	Water	0.032 µg/L	US EPARSL NOV 2024 - Tap Water Quality
72-55-9	DDE	Water	0.046 µg/L	US EPARSL NOV 2024 - Tap Water Quality
50-29-3	DDT	Water	0.009 mg/L	NHMRC ADWG (amended 2025) Human Health
DDT+DDE+DDD	DDT+DDE+DDD	Water	0.001 mg/L	NZ Drinking Water 2008
333-41-5	Diazinon	Water	0.004 mg/L	NHMRC ADWG (amended 2025) Human Health
53-70-3	Dibenz(a,h)anthracene	Water	0.025 µg/L	US EPARSL NOV 2024 - Tap Water Quality
132-64-9	Dibenzofuran	Water	7.9 µg/L	US EPARSL NOV 2024 - Tap Water Quality
124-48-1	Dibromochloromethane	Water	0.1 mg/L	WHO (2011) Drinking Water Guidelines
74-95-3	Dibromomethane	Water	8.3 µg/L	US EPARSL NOV 2024 - Tap Water Quality
84-74-2	Dibutyl Phthalate	Water	900 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-71-8	Dichlorodifluoromethane (Freon 12)	Water	200 µg/L	US EPARSL NOV 2024 - Tap Water Quality
75-09-2	Dichloromethane	Water	0.004 mg/L	NHMRC ADWG (amended 2025) Human Health
62-73-7	Dichlorvos	Water	0.005 mg/L	NHMRC ADWG (amended 2025) Human Health
60-57-1	Dieldrin	Water	0.0018 µg/L	US EPARSL NOV 2024 - Tap Water Quality
84-66-2	Diethyl phthalate	Water	15000 µg/L	US EPARSL NOV 2024 - Tap Water Quality
60-51-5	Dimethoate	Water	0.007 mg/L	NHMRC ADWG (amended 2025) Human Health
60-11-7	Dimethylaminoazobenzene	Water	0.005 µg/L	US EPARSL NOV 2024 - Tap Water Quality
117-84-0	Di-n-octyl phthalate	Water	200 µg/L	US EPARSL NOV 2024 - Tap Water Quality
88-85-7	Dinoseb	Water	15 µg/L	US EPARSL NOV 2024 - Tap Water Quality
122-39-4	Diphenylamine	Water	1300 µg/L	US EPARSL NOV 2024 - Tap Water Quality
68583-22-2	E. Coli	Water	1 CFU/100mL	NZ Drinking Water 2008
72-20-8	Endrin	Water	0.0006 mg/L	WHO (2011) Drinking Water Guidelines
563-12-2	Ethion	Water	0.004 mg/L	NHMRC ADWG (amended 2025) Human Health
100-41-4	Ethylbenzene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health
55-38-9	Fenthion	Water	0.007 mg/L	NHMRC ADWG (amended 2025) Human Health
206-44-0	Fluoranthene	Water	800 µg/L	US EPARSL NOV 2024 - Tap Water Quality
86-73-7	Fluorene	Water	290 µg/L	US EPARSL NOV 2024 - Tap Water Quality
16984-48-8	Fluoride	Water	1.5 mg/L	NHMRC ADWG (amended 2025) Human Health
58-89-9	g-BHC (Lindane)	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
76-44-8	Heptachlor	Water	0.0003 mg/L	NHMRC ADWG (amended 2025) Human Health
1024-57-3	Heptachlor epoxide	Water	0.0014 µg/L	US EPARSL NOV 2024 - Tap Water Quality
118-74-1	Hexachlorobenzene (HCB)	Water	0.0098 µg/L	US EPARSL NOV 2024 - Tap Water Quality
87-68-3	Hexachlorobutadiene	Water	0.0007 mg/L	NHMRC ADWG (amended 2025) Human Health
77-47-4	Hexachlorocyclopentadiene	Water	0.41 µg/L	US EPARSL NOV 2024 - Tap Water Quality
67-72-1	Hexachloroethane	Water	0.33 µg/L	US EPARSL NOV 2024 - Tap Water Quality
193-39-5	Indeno(1,2,3-cd)pyrene	Water	0.25 µg/L	US EPARSL NOV 2024 - Tap Water Quality
78-59-1	Isophorone	Water	78 µg/L	US EPARSL NOV 2024 - Tap Water Quality
98-82-8	Isopropylbenzene (Cumene)	Water	450 µg/L	US EPARSL NOV 2024 - Tap Water Quality
7439-92-1	Lead	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
121-75-5	Malathion	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health
7439-96-5	Manganese	Water	0.5 mg/L	NHMRC ADWG (amended 2025) Human Health
7439-97-6	Mercury	Water	0.001 mg/L	NHMRC ADWG (amended 2025) Human Health
72-43-5	Methoxychlor	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health

Table C1 - Tier 1 Groundwater Criteria - Drinking Water (Health)
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Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
7439-98-7	Molybdenum	Water	0.05 mg/L	NHMRC ADWG (amended 2025) Human Health
53-96-3	N-2-Fluorenyl Acetamide	Water	0.016 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
91-20-3	Naphthalene	Water	0.12 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
104-51-8	n-butylbenzene	Water	1000 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
7440-02-0	Nickel	Water	0.39 mg/L	US EPA RSL NOV 2024 - Tap Water Quality
14797-55-8(as N)	Nitrate (as N)	Water	11.2 mg/L	US EPA RSL NOV 2024 - Tap Water Quality
14797-55-8	Nitrate (as NO3-)	Water	50 mg/L	NHMRC ADWG (amended 2025) Human Health
14797-65-0(as N)	Nitrite (as N)	Water	11.2 mg/l	NHMRC ADWG (amended 2025) Human Health
98-95-3	Nitrobenzene	Water	0.14 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
924-16-3	N-Nitrosodibutylamine	Water	0.0027 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
55-18-5	N-Nitrosodiethylamine	Water	0.00017 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
621-64-7	N-Nitrosodipropylamine	Water	0.011 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
10595-95-6	N-Nitrosomethylethylamine	Water	0.00071 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
59-89-2	N-Nitrosomorpholine	Water	0.012 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
100-75-4	N-Nitrosopiperidine	Water	0.0082 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
930-55-2	N-Nitrosopyrrolidine	Water	0.037 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
103-65-1	n-propylbenzene	Water	660 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
95-47-6	o-Xylene	Water	190 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
608-93-5	Pentachlorobenzene	Water	3.2 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
76-01-7	Pentachloroethane	Water	0.65 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
82-68-8	Pentachloronitrobenzene	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health
87-86-5	Pentachlorophenol	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
375-73-5	Perfluorobutane sulfonic acid (PFBS)	Water	1 µg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4	Perfluorohexane sulfonic acid (PFHxS)	Water	0.03 µg/L	NHMRC ADWG (amended 2025) Human Health
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	Water	0.008 µg/L	NHMRC ADWG (amended 2025) Human Health
335-67-1	Perfluorooctanoic acid (PFOA)	Water	0.2 µg/L	NHMRC ADWG (amended 2025) Human Health
62-44-2	Phenacetin	Water	34 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
108-95-2	Phenol	Water	5800 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
23505-41-1	Pirimphos-ethyl	Water	0.0005 mg/L	NHMRC ADWG (amended 2025) Human Health
1336-36-3	Polychlorinated Biphenyls	Water	0.044 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
23950-58-5	Pronamide	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health
129-00-0	Pyrene	Water	120 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
135-98-8	sec-butylbenzene	Water	2000 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
7782-49-2	Selenium	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health
7440-22-4	Silver	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health
100-42-5	Styrene	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health
14808-79-8	Sulfate as SO4	Water	500 mg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4/1763-23-1	Sum PFHxS and PFOS	Water	0.07 µg/L	PFAS NEMP 3.0 2025
98-06-6	tert-butylbenzene	Water	690 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
127-18-4	Tetrachloroethene (PCE)	Water	0.05 mg/L	NHMRC ADWG (amended 2025) Human Health
463-56-9	Thiocyanate	Water	4 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
7440-31-5	Tin	Water	12000 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
108-88-3	Toluene	Water	0.8 mg/L	NHMRC ADWG (amended 2025) Human Health
1319-77-3	Total Cresols	Water	1500 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
1330-20-7	Total Xylenes	Water	0.6 mg/L	NHMRC ADWG (amended 2025) Human Health
8001-35-2	Toxaphene	Water	0.071 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
156-60-5	trans-1,2-Dichloroethene	Water	360 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
110-57-6	trans-1,4-Dichloro-2-butene	Water	0.0013 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
75-25-2	Tribromomethane (Bromoform)	Water	0.1 mg/L	WHO (2011) Drinking Water Guidelines
79-01-6	Trichloroethene	Water	0.02 mg/L	WHO (2011) Drinking Water Guidelines
75-69-4	Trichlorofluoromethane (Freon 11)	Water	5200 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
67-66-3	Trichloromethane (Chloroform)	Water	0.3 mg/L	WHO (2011) Drinking Water Guidelines
1582-09-8	Trifluralin	Water	0.09 mg/L	NHMRC ADWG (amended 2025) Human Health
7440-62-2	Vanadium	Water	86 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
108-05-4	Vinyl acetate	Water	410 µg/L	US EPA RSL NOV 2024 - Tap Water Quality
75-01-4	Vinyl chloride	Water	0.0003 mg/L	NHMRC ADWG (amended 2025) Human Health

Table C2 - Tier 1 Groundwater Criteria - Drinking Water (Aesthetics)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
95-50-1	1,2-Dichlorobenzene	Water	0.001 mg/L	NHMRC ADWG (amended 2013) Aesthetic
541-73-1	1,3-Dichlorobenzene	Water	0.02 mg/L	NHMRC ADWG (amended 2013) Aesthetic
106-46-7	1,4-Dichlorobenzene	Water	0.0003 mg/L	NHMRC ADWG (amended 2013) Aesthetic
88-06-2	2,4,6-Trichlorophenol	Water	0.002 mg/L	NHMRC ADWG (amended 2013) Aesthetic
120-83-2	2,4-Dichlorophenol	Water	0.0003 mg/L	NHMRC ADWG (amended 2013) Aesthetic
95-57-8	2-Chlorophenol	Water	0.0001 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7429-90-5	Aluminium	Water	0.2 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7664-41-7	Ammonia (as NH3)	Water	0.5 mg/L	NHMRC ADWG (amended 2013) Aesthetic
16887-00-6	Chloride	Water	250 mg/L	NHMRC ADWG (amended 2013) Aesthetic
108-90-7	Chlorobenzene	Water	0.01 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7440-50-8	Copper	Water	1 mg/L	NHMRC ADWG (amended 2013) Aesthetic
100-41-4	Ethylbenzene	Water	0.003 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7439-89-6	Iron	Water	0.3 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7439-96-5	Manganese	Water	0.1 mg/L	NHMRC ADWG (amended 2013) Aesthetic
14797-55-8(as N)	Nitrate (as N)	Water	10000 ug/L	NHMRC ADWG (amended 2013) Aesthetic
pH_Lab	pH (Lab)	Water	6.5 - 8.5 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7440-23-5	Sodium	Water	180 mg/L	NHMRC ADWG (amended 2013) Aesthetic
100-42-5	Styrene	Water	0.004 mg/L	NHMRC ADWG (amended 2013) Aesthetic
14808-79-8	Sulfate as SO4	Water	250 mg/L	NHMRC ADWG (amended 2013) Aesthetic
108-88-3	Toluene	Water	0.025 mg/L	NHMRC ADWG (amended 2013) Aesthetic
TDS	Total Dissolved Solids	Water	600 mg/L	NHMRC ADWG (amended 2013) Aesthetic
1330-20-7	Total Xylenes	Water	0.02 mg/L	NHMRC ADWG (amended 2013) Aesthetic
7440-66-6	Zinc	Water	3 mg/L	NHMRC ADWG (amended 2013) Aesthetic

Table C3 - Tier 1 Groundwater Criteria - Drinking Water (Primary / Secondary Contact)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
630-20-6	1,1,1,2-Tetrachloroethane	Water	5.7 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
71-55-6	1,1,1-Trichloroethane	Water	80000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
79-34-5	1,1,2,2-Tetrachloroethane	Water	0.76 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
79-00-5	1,1,2-Trichloroethane	Water	2.8 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-34-3	1,1-Dichloroethane	Water	28 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-35-4	1,1-Dichloroethene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
87-61-6	1,2,3-Trichlorobenzene	Water	70 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
96-18-4	1,2,3-Trichloropropane	Water	0.0075 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-94-3	1,2,4,5-Tetrachlorobenzene	Water	17 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
120-82-1	1,2,4-Trichlorobenzene	Water	12 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-63-6	1,2,4-trimethylbenzene	Water	560 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
96-12-8	1,2-Dibromo-3-chloropropane	Water	0.0033 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-93-4	1,2-Dibromoethane (EDB)	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
95-50-1	1,2-Dichlorobenzene	Water	15 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
107-06-2	1,2-Dichloroethane	Water	30 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
78-87-5	1,2-Dichloropropane	Water	8.5 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-67-8	1,3,5-trimethylbenzene	Water	600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
99-35-4	1,3,5-Trinitrobenzene	Water	5900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
142-28-9	1,3-Dichloropropane	Water	3700 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-46-7	1,4-Dichlorobenzene	Water	0.4 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
90-12-0	1-Methylnaphthalene	Water	0.063 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
58-90-2	2,3,4,6-Tetrachlorophenol	Water	2400 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
93-76-5	2,4,5-Trichlorophenoxy acetic acid	Water	1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
88-06-2	2,4,6-Trichlorophenol	Water	0.2 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
120-83-2	2,4-Dichlorophenol	Water	2 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
105-67-9	2,4-Dimethylphenol	Water	3600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
51-28-5	2,4-Dinitrophenol	Water	390 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
121-14-2	2,4-Dinitrotoluene	Water	2.4 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
606-20-2	2,6-Dinitrotoluene	Water	0.49 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-58-7	2-Chloronaphthalene	Water	7500 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-57-8	2-Chlorophenol	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
95-49-8	2-Chlorotoluene	Water	2400 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
131-89-5	2-Cyclohexyl-4,6-dinitrophenol	Water	230 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
591-78-6	2-hexanone (MBK)	Water	380 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-57-6	2-Methylnaphthalene	Water	360 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-48-7	2-Methylphenol (o-Cresol)	Water	9300 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-59-8	2-Naphthylamine	Water	0.39 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
88-74-4	2-Nitroaniline	Water	1900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
67-64-1	2-Propanone (Acetone)	Water	180000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-94-1	3,3-Dichlorobenzidine	Water	1.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
56-49-5	3-Methylcholanthrene	Water	0.011 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
534-52-1	4,6-Dinitro-2-methylphenol	Water	15 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
92-67-1	4-Aminobiphenyl	Water	0.03 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
59-50-7	4-Chloro-3-methylphenol	Water	14000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-47-8	4-Chloroaniline	Water	3.7 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
106-43-4	4-Chlorotoluene	Water	2500 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-10-1	4-Methyl-2-pentanone (MIBK)	Water	63000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
100-01-6	4-Nitroaniline	Water	38 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
99-55-8	5-Nitro-o-toluidine	Water	82 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
57-97-6	7,12-Dimethylbenz(a)anthracene	Water	0.001 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
319-84-6	a-BHC	Water	0.072 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
83-32-9	Acenaphthene	Water	5300 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
98-86-2	Acetophenone	Water	19000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
309-00-2	Aldrin	Water	0.0092 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
309-00-2 + 60-57-1	Aldrin + Dieldrin	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
107-05-1	Allyl chloride	Water	7.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
62-53-3	Aniline	Water	130 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
120-12-7	Anthracene	Water	18000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-36-0	Antimony	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
12674-11-2	Arochlor 1016	Water	2.2 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11104-28-2	Arochlor 1221	Water	0.047 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11141-16-5	Arochlor 1232	Water	0.047 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
53469-21-9	Arochlor 1242	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
12672-29-6	Arochlor 1248	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11097-69-1	Arochlor 1254	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
11096-82-5	Arochlor 1260	Water	0.078 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-38-2	Arsenic	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
103-33-3	Azobenzene	Water	1.2 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-39-3	Barium	Water	20 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
319-85-7	b-BHC	Water	0.25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
56-55-3	Benz(a)anthracene	Water	0.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
71-43-2	Benzene	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
92-87-5	Benzidine	Water	0.0011 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
50-32-8	Benzo(a)pyrene	Water	0.1 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
207-08-9	Benzo(k)fluoranthene	Water	25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
98-07-7	Benzotrichloride	Water	0.03 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
100-44-7	Benzyl chloride	Water	0.89 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-41-7	Beryllium	Water	0.6 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
111-91-1	Bis(2-chloroethoxy) methane	Water	590 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
111-44-4	Bis(2-chloroethyl) ether	Water	0.14 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
108-60-1	Bis(2-chloroisopropyl)ether	Water	7100 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
117-81-7	Bis(2-ethylhexyl)phthalate	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7440-42-8	Boron	Water	40 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
108-86-1	Bromobenzene	Water	620 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
74-97-5	Bromochloromethane	Water	830 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-27-4	Bromodichloromethane	Water	0.6 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
74-83-9	Bromomethane	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
85-68-7	Butyl benzyl phthalate	Water	160 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-43-9	Cadmium	Water	0.02 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
75-15-0	Carbon disulfide	Water	8100 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
56-23-5	Carbon Tetrachloride	Water	0.03 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
470-90-6	Chlorfenvinphos	Water	110 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-90-7	Chlorobenzene	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
510-15-6	Chlorobenzilate	Water	3.1 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-00-3	Chloroethane	Water	83000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
74-87-3	Chloromethane	Water	1900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
2921-88-2	Chlorpyrifos	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
5598-13-0	Chlorpyrifos-methyl	Water	1200 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-47-3	Chromium	Water	0.5 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
16065-83-1	Chromium (trivalent)	Water	220000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
218-01-9	Chrysene	Water	250 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
156-59-2	cis-1,2-Dichloroethene	Water	360 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
1476-11-5	cis-1,4-Dichloro-2-butene	Water	0.013 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-48-4	Cobalt	Water	60 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-50-8	Copper	Water	20 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
57-12-5	Cyanide Total	Water	0.8 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
72-54-8	DDD	Water	0.32 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
72-55-9	DDE	Water	0.46 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
50-29-3	DDT	Water	0.09 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
DDT+DDE+DDD	DDT+DDE+DDD	Water	0.01 mg/L	NZ Drinking Water 2008 (AF x 10)
333-41-5	Diazinon	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
53-70-3	Dibenz(a,h)anthracene	Water	0.25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
132-64-9	Dibenzofuran	Water	79 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
124-48-1	Dibromochloromethane	Water	1 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
74-95-3	Dibromomethane	Water	83 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
84-74-2	Dibutyl Phthalate	Water	9000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-71-8	Dichlorodifluoromethane (Freon 12)	Water	2000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-09-2	Dichloromethane	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
62-73-7	Dichlorvos	Water	0.05 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
60-57-1	Dieldrin	Water	0.018 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
84-66-2	Diethyl phthalate	Water	150000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
60-51-5	Dimethoate	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
60-11-7	Dimethylaminoazobenzene	Water	0.05 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
117-84-0	Di-n-octyl phthalate	Water	2000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
88-85-7	Dinoseb	Water	150 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
122-39-4	Diphenylamine	Water	13000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
68583-22-2	E. Coli	Water	10 CFU/100mL	NZ Drinking Water 2008 (AF x 10)
72-20-8	Endrin	Water	0.006 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
563-12-2	Ethion	Water	0.04 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
100-41-4	Ethylbenzene	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
55-38-9	Fenthion	Water	0.07 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
206-44-0	Fluoranthene	Water	8000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
86-73-7	Fluorene	Water	2900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
16984-48-8	Fluoride	Water	15 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
12789-03-6	gamma-Chlordane	Water	0.02 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
58-89-9	g-BHC (Lindane)	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
608-73-1	HCH-technical	Water	0.25 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
76-44-8	Heptachlor	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1024-57-3	Heptachlor epoxide	Water	0.014 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
118-74-1	Hexachlorobenzene (HCB)	Water	0.098 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
87-68-3	Hexachlorobutadiene	Water	0.007 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
77-47-4	Hexachlorocyclopentadiene	Water	4.1 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
67-72-1	Hexachloroethane	Water	3.3 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
193-39-5	Indeno(1,2,3-cd)pyrene	Water	2.5 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
78-59-1	Isophorone	Water	780 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
98-82-8	Isopropylbenzene (Cumene)	Water	4500 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7439-92-1	Lead	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
121-75-5	Malathion	Water	0.7 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7439-96-5	Manganese	Water	5 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7439-97-6	Mercury	Water	0.01 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
72-43-5	Methoxychlor	Water	3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7439-98-7	Molybdenum	Water	0.5 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
53-96-3	N-2-Fluorenyl Acetamide	Water	0.16 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
91-20-3	Naphthalene	Water	1.2 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
104-51-8	n-butylbenzene	Water	10000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-02-0	Nickel	Water	3.9 mg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
14797-55-8(as N)	Nitrate (as N)	Water	112 mg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
14797-55-8	Nitrate (as NO3-)	Water	500 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
14797-65-0(as N)	Nitrite (as N)	Water	10 mg/l	Guidelines for Canadian Drinking Water (2014) MAC (AF x 10)

Table C3 - Tier 1 Groundwater Criteria - Drinking Water (Primary / Secondary Contact)
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
98-95-3	Nitrobenzene	Water	1.4 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
924-16-3	N-Nitrosodibutylamine	Water	0.027 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
55-18-5	N-Nitrosodiethylamine	Water	0.0017 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
621-64-7	N-Nitrosodipropylamine	Water	0.11 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
10595-95-6	N-Nitrosomethylethylamine	Water	0.0071 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
59-89-2	N-Nitrosomorpholine	Water	0.12 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
100-75-4	N-Nitrosopiperidine	Water	0.082 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
930-55-2	N-Nitrosopyrrolidine	Water	0.37 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
103-65-1	n-propylbenzene	Water	6600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
95-47-6	o-Xylene	Water	1900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
608-93-5	Pentachlorobenzene	Water	32 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
76-01-7	Pentachloroethane	Water	6.5 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
82-68-8	Pentachloronitrobenzene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
87-86-5	Pentachlorophenol	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
375-73-5	Perfluorobutane sulfonic acid (PFBS)	Water	10 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
355-46-4	Perfluorohexane sulfonic acid (PFHxS)	Water	0.3 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	Water	0.08 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
335-67-1	Perfluorooctanoic acid (PFOA)	Water	2 µg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
62-44-2	Phenacetin	Water	340 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-95-2	Phenol	Water	58000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
23505-41-1	Pirimphos-ethyl	Water	0.005 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1336-36-3	Polychlorinated Biphenyls	Water	0.44 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
23950-58-5	Pronamide	Water	0.7 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
129-00-0	Pyrene	Water	1200 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
135-98-8	sec-butylbenzene	Water	20000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7782-49-2	Selenium	Water	0.1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7440-22-4	Silver	Water	1 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
100-42-5	Styrene	Water	0.3 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
14808-79-8	Sulfate as SO4	Water	5000 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
355-46-4/1763-23-1	Sum PFHxS and PFOS	Water	2 µg/L	PFAS NEMP 3.0 2025
98-06-6	tert-butylbenzene	Water	6900 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
127-18-4	Tetrachloroethene (PCE)	Water	0.5 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
463-56-9	Thiocyanate	Water	40 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
7440-31-5	Tin	Water	12000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-88-3	Toluene	Water	8 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
1319-77-3	Total Cresols	Water	15000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
1330-20-7	Total Xylenes	Water	6 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
8001-35-2	Toxaphene	Water	0.71 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
156-60-5	trans-1,2-Dichloroethene	Water	3600 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
110-57-6	trans-1,4-Dichloro-2-butene	Water	0.013 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-25-2	Tribromomethane (Bromoform)	Water	1 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
79-01-6	Trichloroethene	Water	0.2 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
75-69-4	Trichlorofluoromethane (Freon 11)	Water	52000 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
67-66-3	Trichloromethane (Chloroform)	Water	3 mg/L	WHO (2011) Drinking Water Guidelines (AF x 10)
1582-09-8	Trifluralin	Water	0.9 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)
7440-62-2	Vanadium	Water	860 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
108-05-4	Vinyl acetate	Water	4100 µg/L	US EPARSL NOV2024 - Tap Water Quality (AF x 10)
75-01-4	Vinyl chloride	Water	0.003 mg/L	NHMRC ADWG (amended 2025) Human Health (AF x 10)

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 HSL D - Sand 2 to <4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Xylenes	Water	No Limit	
71-43-2	Benzene	Water	4.9 mg/L	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	4.83 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	242 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	6.03 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	452 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	132 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	4.02 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	189 mg/l	
F1-BTEX	C6-C10 less BTEX	Water	4.1 mg/L	
F2-NAPHTHALENE	>C10-C16 minus naphthalene (F2)	Water	4.8 mg/L	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview*, United Kingdom Research and Innovation, 2024

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 IMW - Sand - 2-<4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Total Xylenes	Water	No Limit	
71-43-2	Benzene	Water	No Limit	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	1390 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	69600 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	1740 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	129000 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	37900 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	1160 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	54300 mg/l	
F1-BTEX	TPH C6 - C10 Fraction	Water	No Limit	
F2-NAPHTHALENE	TPH >C10 - C16 Fraction	Water	No Limit	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview*, United Kingdom Research and Innovation, 2024

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 HSL C - Sand 2 to <4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Xylenes	Water	No Limit	
71-43-2	Benzene	Water	No Limit	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	656 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	33000 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	820 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	61900 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	17900 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	547 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	25700 mg/l	
F1-BTEX	C6-C10 less BTEX	Water	No Limit	
F2-NAPHTHALENE	>C10-C16 minus naphthalene (F2)	Water	No Limit	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview* , United Kingdom Research and Innovation, 2024

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
100-41-4	Ethylbenzene	Water	No Limit	CRC CARE 2011 HSL A&B - Sand 2 to <4m
108-88-3	Toluene	Water	No Limit	
1330-20-7	Xylenes	Water	No Limit	
71-43-2	Benzene	Water	0.8 mg/L	
91-20-3	Naphthalene	Water	No Limit	
C10-C12-Aliph	TRH >C10-C12 aliphatic	Water	0.763 mg/l	
C10-C12-Arom	TRH >C10-C12 aromatic	Water	38.4 mg/l	
C12-C16-Aliph	TRH >C12-C16 aliphatic	Water	0.953 mg/l	
C12-C16-Arom	TRH >C12-C16 aromatic	Water	71.9 mg/l	
C6-C8-Aliph	TRH >C6-C8 aliphatic	Water	20.8 mg/l	
C8-C10-Aliph	TRH >C8-C10 aliphatic	Water	0.636 mg/l	
C8-C10-Arom	TRH >C8-C10 aromatic	Water	29.9 mg/l	
F1-BTEX	C6-C10 less BTEX	Water	0.64 mg/L	
F2-NAPHTHALENE	>C10-C16 minus naphthalene (F2)	Water	0.76 mg/L	
74-82-8	Methane	Water	1600 µg/L	*Methane in UK Groundwater Research Overview* , United Kingdom Research and Innovation, 2024

ChemCode	ChemName	Matrix Type	Adopted Criteria	Source
C10-C40	>C10-C40 fraction (sum)	Water	600 ug/L	RIVM (2001) Dutch Intervention Value
71-55-6	1,1,1-Trichloroethane	Water	400 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
79-34-5	1,1,2,2-Tetrachloroethane	Water	500 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
79-00-5	1,1,2-Trichloroethane	Water	5800 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very Low reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
75-34-3	1,1-Dichloroethane	Water	250 µg/L	R3 BTAG Marine Benchmarks
75-35-4	1,1-Dichloroethene	Water	900 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
634-66-2	1,2,3,4-Tetrachlorobenzene	Water	6 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
634-90-2	1,2,3,5-Tetrachlorobenzene	Water	7 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
87-61-6	1,2,3-Trichlorobenzene	Water	16 µg/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
95-94-3	1,2,4,5-Tetrachlorobenzene	Water	7 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
120-82-1	1,2,4-Trichlorobenzene	Water	140 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
95-63-6	1,2,4-trimethylbenzene	Water	19 ug/L	R3 BTAG Marine Benchmarks
95-50-1	1,2-Dichlorobenzene	Water	200 ug/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
107-06-2	1,2-Dichloroethane	Water	2600 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
540-59-0	1,2-Dichloroethene	Water	680 ug/L	R3 BTAG Marine Benchmarks
78-87-5	1,2-Dichloropropane	Water	1200 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
108-70-3	1,3,5-Trichlorobenzene	Water	20 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
99-35-4	1,3,5-Trinitrobenzene	Water	4 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
541-73-1	1,3-Dichlorobenzene	Water	260 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
142-28-9	1,3-Dichloropropane	Water	1400 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
106-46-7	1,4-Dichlorobenzene	Water	60 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Very Low reliability.
90-13-1	1-Chloronaphthalene	Water	0.7 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
58-90-2	2,3,4,6-Tetrachlorophenol	Water	20 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
15950-66-0	2,3,4-Trichlorophenol	Water	4 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
935-95-5	2,3,5,6-Tetrachlorophenol	Water	1.4 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
933-78-8	2,3,5-Trichlorophenol	Water	2 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
933-75-5	2,3,6-Trichlorophenol	Water	2 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
576-24-9	2,3-Dichlorophenol	Water	31 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
95-95-4	2,4,5-Trichlorophenol	Water	4 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
88-06-2	2,4,6-Trichlorophenol	Water	20 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
120-83-2	2,4-Dichlorophenol	Water	160 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
105-67-9	2,4-Dimethylphenol	Water	2 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
51-28-5	2,4-Dinitrophenol	Water	45 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
121-14-2	2,4-Dinitrotoluene	Water	65 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
87-65-0	2,6-Dichlorophenol	Water	34 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
606-20-2	2,6-Dinitrotoluene	Water	0.3 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
95-57-8	2-Chlorophenol	Water	490 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
95-48-7	2-Methylphenol (o-Cresol)	Water	1020 ug/L	R3 BTAG Marine Benchmarks
88-75-5	2-Nitrophenol	Water	2 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
91-94-1	3,3-Dichlorobenzidine	Water	0.5 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
95-77-2	3,4-Dichlorophenol	Water	2 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
591-35-5	3,5-Dichlorophenol	Water	4 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
108-10-1	4-Methyl-2-pentanone (MIBK)	Water	123000 ug/L	R3 BTAG Marine Benchmarks
0100-02-07	4-Nitrophenol	Water	58 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
319-84-6	a-BHC	Water	25 ug/L	R3 BTAG Marine Benchmarks
309-00-2	Aldrin	Water	0.003 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
107-05-1	Allyl chloride	Water	3 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
7429-90-5	Aluminium	Water	72 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability
7664-41-7 (as N)	Ammonia (as N)	Water	1200 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
62-53-3	Aniline	Water	250 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
120-12-7	Anthracene	Water	0.4 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability. Higher SPV adopted for bioaccumulation potential
12674-11-2	Arochlor 1016	Water	4 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
11104-28-2	Arochlor 1221	Water	0.009 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
11141-16-5	Arochlor 1232	Water	1 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
53469-21-9	Arochlor 1242	Water	0.3 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
12672-29-6	Arochlor 1248	Water	0.3 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
11097-69-1	Arochlor 1254	Water	0.1 µg/L	ANZECC (2000) Ecosystems Marine Water Low Reliability
7440-36-0	Antimony	Water	9 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
7440-38-2	Arsenic	Water	42 ug/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
22569-72-8	Arsenic III	Water	94 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
71-43-2	Benzene	Water	900 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
92-87-5	Benzidine	Water	2.5 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
50-32-8	Benzo(a)pyrene	Water	0.2 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7440-41-7	Beryllium	Water	0.13 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
117-81-7	Bis(2-ethylhexyl)phthalate	Water	1 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
7440-42-8	Boron	Water	1500 µg/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025)
C10-C36	C10-C36 fraction (sum)	Water	600 ug/L	RIVM (2001) Dutch Intervention Value
7440-43-9	Cadmium	Water	14 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
75-15-0	Carbon disulfide	Water	20 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
56-23-5	Carbon Tetrachloride	Water	320 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
108-90-7	Chlorobenzene	Water	100 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
2921-88-2	Chlorpyrifos	Water	0.04 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability. DGV may not protect key test species from acute (and chronic) toxicity. Check toxicant DGV technical brief for spread of data and its significance. This DGV is greater than the value for acute toxicity (Warne et al., 2018).
7440-47-3	Chromium	Water	20 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Guideline value for Cr(VI)
18540-29-9	Chromium (hexavalent)	Water	20 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
16065-83-1	Chromium (trivalent)	Water	49 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
7440-48-4	Cobalt	Water	14 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability
7440-50-8	Copper	Water	3 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability.
57-12-5	Cyanide Total	Water	7 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very Low reliability. Cyanide as un-ionised HCN, measured as [CN].
72-55-9	DDE	Water	0.0005 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
50-29-3	DDT	Water	0.0004 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
333-41-5	Diazinon	Water	0.01 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
84-74-2	Dibutyl Phthalate	Water	26 ug/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
75-09-2	Dichloromethane	Water	5000 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
60-57-1	Dieldrin	Water	0.01 µg/L	ANZG (2018) Freshwater Unknown LOSP Toxicant DGVs (June 2025)
84-66-2	Diethyl phthalate	Water	1000 ug/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
60-51-5	Dimethoate	Water	0.15 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
115-29-7	Endosulfan	Water	0.02 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability.
115-29-7	Endosulfan	Water	0.02 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
72-20-8	Endrin	Water	0.01 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
100-41-4	Ethylbenzene	Water	110 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
206-44-0	Fluoranthene	Water	1.4 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability. Higher SPV adopted for bioaccumulation potential
58-89-9	g-BHC (Lindane)	Water	0.007 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
76-44-8	Heptachlor	Water	0.0004 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
1024-57-3	Heptachlor epoxide	Water	0.0036 ug/L	USEPA (2013) Water Quality Criteria - Aquatic Life (Chronic, Marine)
118-74-1	Hexachlorobenzene (HCB)	Water	0.2 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability

ChemCode	ChemName	Matrix Type	Adopted Criteria	Source
87-68-3	Hexachlorobutadiene	Water	0.03 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
77-47-4	Hexachlorocyclopentadiene	Water	0.05 ug/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
67-72-1	Hexachloroethane	Water	360 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
78-59-1	Isophorone	Water	130 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
98-82-8	Isopropylbenzene (Cumene)	Water	30 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7439-92-1	Lead	Water	6.6 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability.
121-75-5	Malathion	Water	0.2 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7439-96-5	Manganese	Water	2500 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7439-97-6	Mercury	Water	0.4 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Very High reliability.
72-43-5	Methoxychlor	Water	0.004 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
7439-98-7	Molybdenum	Water	34 µg/L	ANZG (2018) Marine Water Unknown LOSP Toxicant DGVs (June 2025)
108-38-3	m-Xylene	Water	100 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
91-20-3	Naphthalene	Water	90 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
7440-02-0	Nickel	Water	200 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability
14797-55-8	Nitrate (as NO3-)	Water	700 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
98-95-3	Nitrobenzene	Water	550 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Low reliability
95-47-6	o-Xylene	Water	470 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
608-93-5	Pentachlorobenzene	Water	2.5 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
76-01-7	Pentachloroethane	Water	120 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
87-86-5	Pentachlorophenol	Water	33 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) -
1763-23-1	Perfluorooctane sulfonic acid (PFOS)	Water	0.13 ug/l	PFAS National Environmental Management Plan
335-67-1	Perfluorooctanoic acid (PFOA)	Water	220 ug/l	PFAS National Environmental Management Plan
pH_Lab	pH (Lab)	Water	6.5 - 9 pH Units	USEPA (2013) Water Quality Criteria - Aquatic Life (Chronic, Marine)
85-01-8	Phenanthrene	Water	2 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
108-95-2	Phenol	Water	520 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Low reliability
1336-36-3	Polychlorinated Biphenyls	Water	0.03 ug/L	USEPA (2013) Water Quality Criteria - Aquatic Life (Chronic, Marine)
7782-49-2	Selenium	Water	18 µg/L	ANZG (2018) Freshwater 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7440-22-4	Silver	Water	1.8 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
100-42-5	Styrene	Water	910 ug/L	R3 BTAG Marine Benchmarks
127-18-4	Tetrachloroethene (PCE)	Water	70 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7440-31-5	Tin	Water	10 µg/L	ANZECC (2000) Ecosystems Marine Water Med-Low Reliability
108-88-3	Toluene	Water	180 µg/L	ANZG (2018) Marine Water 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7723-14-0	Total Phosphorus	Water	0.1 ug/L	R3 BTAG Marine Benchmarks
1330-20-7	Total Xylenes	Water	100 ug/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
8001-35-2	Toxaphene	Water	0.006 µg/L	ANZG (2018) Marine Waters Unknown LOSP Toxicant DGVs (June 2025)
75-25-2	Tribromomethane (Bromoform)	Water	640 ug/L	R3 BTAG Marine Benchmarks
79-01-6	Trichloroethene	Water	400 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
67-66-3	Trichloromethane (Chloroform)	Water	1100 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability. DGV may not protect key test species from chronic toxicity. Check toxicant DGV technical brief and Read the detail, below, for spread of data and its significance.
1582-09-8	Trifluralin	Water	4.4 µg/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Moderate reliability
7440-62-2	Vanadium	Water	160 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - High reliability
75-01-4	Vinyl chloride	Water	140 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Unknown reliability
7440-66-6	Zinc	Water	12 µg/L	ANZG (2018) Marine Water 90_ LOSP Toxicant DGVs (June 2025) - Very high reliability
0131-11-3	Dimethyl phthalate	Water	3700 ug/L	ANZG (2018) Freshwater 95_ LOSP Toxicant DGVs (June 2025) - Unknown reliability

ChemCode	ChemName	MatrixType	Adopted Criteria	Comments
107-02-8	Acrolein	Water	0.1 mg/L	ANZECC (2000) Agriculture, Parks & Gardens - STV
16984-48-8	Fluoride	Water	2 mg/L	
330-54-1	diuron	Water	0.002 mg/L	
61-82-5	Amitrol	Water	0.002 mg/L	
7429-90-5	Aluminium	Water	20 mg/L	
7439-89-6	Iron	Water	10 mg/L	
7439-92-1	Lead	Water	5 mg/L	
7439-93-2	Lithium	Water	2.5 mg/L	
7439-96-5	Manganese	Water	10 mg/L	
7439-97-6	Mercury	Water	0.002 mg/L	
7439-98-7	Molybdenum	Water	0.05 mg/L	
7440-02-0	Nickel	Water	2 mg/L	
7440-38-2	Arsenic	Water	2 mg/L	
7440-41-7	Beryllium	Water	0.5 mg/L	
7440-42-8	Boron	Water	0.5 mg/L	
7440-43-9	Cadmium	Water	0.05 mg/L	
7440-47-3	Chromium	Water	1 mg/L	
7440-48-4	Cobalt	Water	0.1 mg/L	
7440-50-8	Copper	Water	5 mg/L	
7440-61-1	Uranium	Water	0.1 mg/L	
7440-62-2	Vanadium	Water	0.5 mg/L	
7440-66-6	Zinc	Water	5 mg/L	
75-99-0	2,2-DPA (Dalapon)	Water	0.004 mg/L	
7723-14-0	Phosphorous	Water	0.8 mg/L	
7727-37-9	Nitrogen	Water	25 mg/L	
7782-49-2	Selenium	Water	0.05 mg/L	

ChemCode	ChemName	MatrixType	Adopted Criteria	Comments
14797-55-8	Nitrate	Water	400 mg/L	ANZECC (2000) Stock Watering
14797-65-0	Nitrite	Water	30 mg/L	ANZECC (2000) Stock Watering
14808-79-8	Sulphate	Water	2000 mg/L	ANZECC (2000) Stock Watering
16984-48-8	Fluoride	Water	2 mg/L	ANZECC (2000) Stock Watering
375-73-5	Perfluorobutanesulfonic acid (PFBS)	Water	1 µg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4	PFHxS	Water	0.03 µg/L	NHMRC ADWG (amended 2025) Human Health
335-67-1	PFOA	Water	0.2 µg/L	NHMRC ADWG (amended 2025) Human Health
1763-23-1	PFOS	Water	0.008 µg/L	NHMRC ADWG (amended 2025) Human Health
355-46-4/1763-23-1	Sum of PFOS and PFHxS	Water	2 µg/L	PFAS NEMP 3.0 2025
7429-90-5	Aluminium	Water	5 mg/L	ANZECC (2000) Stock Watering
7439-92-1	Lead	Water	0.1 mg/L	ANZECC (2000) Stock Watering
7439-97-6	Mercury	Water	0.002 mg/L	ANZECC (2000) Stock Watering
7439-98-7	Molybdenum	Water	0.15 mg/L	ANZECC (2000) Stock Watering
7440-02-0	Nickel	Water	1 mg/L	ANZECC (2000) Stock Watering
7440-38-2	Arsenic	Water	0.5 mg/L	ANZECC (2000) Stock Watering
7440-42-8	Boron	Water	5 mg/L	ANZECC (2000) Stock Watering
7440-43-9	Cadmium	Water	0.01 mg/L	ANZECC (2000) Stock Watering
7440-47-3	Chromium	Water	1 mg/L	ANZECC (2000) Stock Watering
7440-48-4	Cobalt	Water	1 mg/L	ANZECC (2000) Stock Watering
7440-50-8	Copper	Water	0.4 mg/L	ANZECC (2000) Stock Watering
7440-61-1	Uranium	Water	0.2 mg/L	ANZECC (2000) Stock Watering
7440-61-1	Uranium	Water	0.2 Bq/L	ANZECC (2000) Stock Watering
7440-66-6	Zinc	Water	20 mg/L	ANZECC (2000) Stock Watering
7440-70-2	Calcium	Water	1000 mg/L	ANZECC (2000) Stock Watering
7782-49-2	Selenium	Water	0.02 mg/L	ANZECC (2000) Stock Watering
Radium-226	Radium 226	Water	5 Bq/L	ANZECC (2000) Stock Watering
Radium-228	Radium 228	Water	2 Bq/L	ANZECC (2000) Stock Watering

Table C11 - Tier 1 Groundwater Criteria - Buildings and Structures
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria	Source
14808-79-8 Turb	Sulfate (as SO4)	Water	1000 mg/L	AS2159-2009 - Buildings and Structures
16887-00-6	Chloride	Water	6000 mg/L	

Table C12 - Groundwater Criteria - Remediation Criteria
Groundwater Quality Management Plan
Macquarie Point Development Project

ChemCode	ChemName	MatrixType	Adopted Criteria (mg/L)								Source
			Potential Future Residents (slab-on-grade with unknown construction or multi-storey building)	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) *	Potential Future Commercial/Light Industrial Workers (low-rise slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers	
50-32-8	Benzo(a)pyrene	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	0.05	Not Volatile	Not Volatile	*Review of Site Specific Remediation Criteria 2025, Macquarie Point,* AECOM Australia Pty Ltd, 10 October 2025
91-20-3	Naphthalene	Water	2	3	7	12	28	6	Not Limiting	Not Limiting	
71-43-2	Benzene	Water	0.8	0.8	6	5	9	5	Not Limiting	Not Limiting	
108-88-3	Toluene	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	5500	Not Limiting	Not Limiting	
100-41-4	Ethylbenzene	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	1600	Not Limiting	Not Limiting	
1330-20-7	Xylenes (total)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	2800	Not Limiting	Not Limiting	
C6-C8-Aliph	TPH C6-C8 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	16,000	Not Limiting	Not Limiting	
C8-C10-Aliph	TPH >C8-C10 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	79	Not Limiting	Not Limiting	
C8-C10-Arom	TPH >C8-C10 (Aromatic)	Water	30	30	Not Limiting	Not Limiting	Not Limiting	360	Not Limiting	Not Limiting	
C10-C12-Aliph	TPH >C10-C12 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	40	Not Limiting	Not Limiting	
C10-C12-Arom	TPH >C10-C12 (Aromatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	190	Not Limiting	Not Limiting	
C12-C16-Aliph	TPH >C12-C16 (Aliphatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	67	Not Limiting	Not Limiting	
C12-C16-Arom	TPH >C12-C16 (Aromatic)	Water	Not Limiting	Not Limiting	Not Limiting	Not Volatile	Not Volatile	160	Not Limiting	Not Limiting	
Aliphatic>C16-C21	TPH >C16-C21 (Aliphatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	3,300	Not Limiting	Not Limiting	
CWG-ARE3	TPH >C16-C21 (Aromatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	94	Not Limiting	Not Limiting	
C21-C34-Aliph	TPH >C21-C34 (Aliphatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	3,300	Not Limiting	Not Limiting	
C21-C34-Arom	TPH >C21-C34 (Aromatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Limiting	Not Limiting	
C34-C40-Aliph	TPH >C34-C40 (Aliphatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	3,300	Not Limiting	Not Limiting	
C34-C40-Arom	TPH >C34-C40 (Aromatic)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Limiting	Not Limiting	
105-67-9	Dimethylphenol, 2,4-	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	1,300	Not Volatile	Not Volatile	
95-48-7	Methylphenol-2 (cresol, o-)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	4,300	Not Volatile	Not Volatile	
108-39-4	Methylphenol-3 (cresol, m-)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	4,200	Not Volatile	Not Volatile	
106-44-5	Methylphenol-4 (cresol, p-)	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	4,300	Not Volatile	Not Volatile	
62-53-3	Aniline	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	890	Not Volatile	Not Volatile	
132-64-9	Dibenzofuran	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	8	Not Volatile	Not Volatile	
100-42-5	Styrene	Water	96	99	Not Limiting	Not Limiting	Not Limiting	160	Not Limiting	Not Limiting	
F1-BTEX	C6-C10 fraction (minus BTEX)(F1)	Water	30	30	Not Limiting	Not Limiting	Not Limiting	79	Not Limiting	Not Limiting	The minimum criteria for aliphatic/aromatic fractions have been adopted for broader TRH fractions
F2-NAPHTHALENE	>C10-C16 (minus Naphthalene)(F2)	Water	Not Limiting	Not Limiting	Not Limiting	Not Limiting	Not Limiting	40	Not Limiting	Not Limiting	
C16-C34	>C16-C34 fraction	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Volatile	Not Limiting	
C34-C40	>C34-C40 fraction	Water	Not Volatile	Not Volatile	Not Volatile	Not Volatile	Not Volatile	39	Not Volatile	Not Limiting	

Not Volatile - No Remediation Criteria has been adopted as the exposure pathway under this scenario is inhalation only
Not Limiting - The calculated Remediation Criteria exceeds the theoretical soil saturation limit and therefore unacceptable risks via vapour inhalation will not occur.

Appendix D

AECOM Standard Operating Procedures

Appendix D AECOM Standard Operating Procedures

Attached Standard Operating Procedures

Q4AN-EV-402 – Groundwater Well Development

Q4AN-EV-407 – Groundwater Sampling – Low Flow Pump

Q4AN-EV-414 – NAPL and Groundwater Gauging

FQM - Groundwater Well Development

Q4AN(EV)-402-PR1

1.0 Purpose and Scope

To develop groundwater monitoring wells appropriately to ensure a representative sample of the groundwater quality can be obtained, accurate aquifer parameters can be determined and/or to maximise well efficiency.

This Fieldwork Instruction (FI) describes the broad methodology for groundwater well development. The aim is to remove from the annulus, between the screen and hole wall, clays or compacted material resulting from the drilling operations, as well as the fine material from the water-bearing formation itself[1]. Well development is necessary to remove the finer grained material from the well screens and gravel pack that may otherwise interfere with water quality analyses, and to improve the hydraulic efficiency and characteristics of the gravel pack or hydrologic unit adjacent to the well screens. The methods of development may vary according to the physical characteristics of the hydrological units in which the monitoring well is screened and with the drilling method used. Well development may be undertaken by a variety of techniques, including the following:

- Bailing (see FQM Groundwater Sampling – Bailer – ANZ - ENV)
- Power Pack or Waterra Footvalve pumps (e.g. Waterra) with surge block (see FQM - Groundwater Sampling – Hydrasleeve – ANZ - ENV – in preparation)
- Suction pumps
- Airlifting (not to be used for groundwater monitoring wells)

The choice of well development method will depend upon factors such as the well design (diameter and depth), drilling technique and well purpose (production or monitoring).

2.0 References

a. ANZECC and National Health and Medical Research Council (NH&MRC) (January, 1992) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites

b. AS4482.1-2005 *Guide to the sampling and investigation of potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds*

c. AS4482.1-2005 *Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances*

d. EPA Publication 441 (*A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes).*

e. EPA Publication 669 *(Groundwater Sampling Guidelines)*, April 2000.

f. EPA Victoria, SEPP, Prevention and Management of Contamination of Land, State Government of Victoria, June 2002

g. National Environment Protection Council (NEPC) (December, 1999) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) Guideline on the Investigation Levels for Soil and Groundwater

h. NEPC, 2009. National Environmental Protection (Assessment of site contamination) Measure. Schedule B (2): Guideline on data collection, sample design and reporting. National Environment Protection Council, Canberra.

i. National Uniform Drillers Licensing Committee (NUDLC), Minimum Construction Requirements for Water Bores in Australia 2011 (3rd Edition February 2012).

j. FQM Photo-Ionisation Detector (PID) – ANZ - ENV Q4AN(EV)-003-PR1.

k. FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV Q4AN(EV)-004-PR1

l. FQM Groundwater Sampling Methodologies – ANZ - ENV Q4AN(EV)-405-PR1

[1] National Uniform Drillers Licensing Committee (NUDLC), Minimum Construction Requirements for Water Bores in Australia 2011 (3rd Edition February 2012).

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m. FQM Groundwater Sampling – Bailer – ANZ - ENV Q4AN(EV)-406-PR1.

n. FQM Groundwater Sampling – Low Flow Pump – ANZ - ENV Q4AN(EV)-407-PR1

o. FQM Groundwater Sampling – Peristaltic Pump – ANZ – ENV Q4AN(EV)-408-PR1

p. FQM Groundwater Sampling - Hydrasleeve – ANZ – ENV Q4AN(EV)-409-PR1 (in preparation)

q. FQM Groundwater Quality Measurements – ANZ – ENV Q4AN(EV)-410-PR1 (in preparation)

3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methods detailed in this Fieldwork Instruction. To ensure equipment is in good working order prior to use, is maintained according to supplier's advice and is appropriately calibrated or verified. Any faults shall be reported to the Project Manager or the equipment supplier as soon as they are identified.
Project Manager	The Project Manager (PM) is responsible for ensuring equipment used are fit for purpose and developing work scope and services to be delivered to a client within the designated timeline.
Regional SH&E Manager	The Regional Safety, Health and Environment (SH&E) Manager is an assigned person in each office and is responsible for reviewing and approving the project specific risk assessment (Project Safety Plan/Safe Work Method Statement), monitoring the implementation of SH&E Plans, interface with PMs in matters of health and safety, investigating reports of incidents or accidents and approving drilling contractors to undertake the proposed works.

4.0 Equipment and Materials

4.1 Equipment

All well development techniques require:

- Oil water interface probe or water level meter;
- Water Quality Meter (WQM); and
- Imhoff cone or white dish.

The specific equipment required for bailing and foot valve/surge block methods are outlined in the individual FIs for these techniques. The equipment required for airlifting includes:

- Compressor; and
- Airlines/tubing or drill rods.

Optional or supplemental equipment required to complete this task may include:

- Photo Ionisation Detector (PID);
- Lower Explosive Limit (LEL) Detector; and
- T-piece or diversion head.

4.1.1 Electronic Dip Meter

An electronic dip meter is suitable for the measurement of groundwater levels only. Where NAPL is expected or suspected to be present in groundwater wells an oil/water interface meter should be used. A short beeping sound is made when the electronic dip meter intersects the standing water level.

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4.1.2 Oil/Water Interface Meter

The oil/water interface probe should be used where LNAPL or DNAPL are expected or suspected to be present in the wells. The probe emits two different sounds for distinguishing the depth to NAPL (continuous tone) and the standing water level (short beeping). In the case of LNAPL, the continuous tone will occur typically before the beeping tone; with DNAPL, the continuous tone would occur towards the base of the well, after the beeping tone.

Additional equipment required for groundwater well development depends on the technique adopted. A discussion of the equipment required for bailing and Waterra pumping is provided in the individual work Instructions for these techniques. The following discussion refers to equipment required for well development using airlifting only.

4.1.3 Water Quality Meter

A water quality meter will typically comprise instrument probes to measure electrical conductivity (EC), pH, temperature, oxidation reduction potential (ORP) and dissolved oxygen (DO). When renting a water quality meter, the rental company should supply a calibration certificate indicating that the equipment has been cleaned, calibrated and is ready for use. The calibration sheet should be kept with the project notes, scanned and filed at the end of the field program. If calibration has not been undertaken, or there is no evidence of calibration, this will need to be completed prior to commencing fieldworks. Calibration of the water quality meter should also be undertaken weekly and should be recorded on calibration sheets (FQM Water Quality Meter Calibration Record – ANZ – ENV). Calibration solutions should be available onsite at all times to allow probe readings to be confirmed. This is particularly important if the readings appear to be erroneous compared to historical results, typical aquifer water quality or are unrealistic. Additional information on using and calibrating a water quality meter is found in FQM Groundwater Quality Measurements – ANZ - ENV.

4.1.4 Compressor

A compressor is typically supplied by the drilling contractor but may also be hired as a trailer mounted or portable system. When developing, a filter should be used to prevent volatile hydrocarbon gases produced by compressor operation from contaminating the compressed air which is injected into the well.

4.1.5 Drill rods

Air can be introduced to the groundwater bore by forcing it inside drilling rods. This is only possible where the drill rig is present on site. Drill rods are often used for development of deep bores to mitigate manual handling issues. Where hydrocarbon compounds are contaminants of interest associated with the groundwater, consideration should be made to the types of lubricants used on these rods i.e. silicon based rod grease or “chicken fat” should be used to lubricate rod threads, canola oil or similar should be used to lubricate rotary hammer bits.

4.1.6 Airlines / Tubing

Airlines usually take the form of poly pipe or HDPE. These need to be long enough to reach the bottom of the well, with extra length at the surface. The diameter of the pipe used will depend on availability of materials, depth to water, depth of bore and bore diameter. The poly pipe needs to be able to with stand high pressures caused by use of compressed air and have appropriate fittings to connect to the compressor. Before installation, the airlines should be checked for any blockages. Airlines are usually supplied by the drilling contractor.

4.1.7 Photo Ionisation Detector (PID)

Refer to FQM Photo-Ionisation Detector (PID) – ANZ - ENV, for applicability, operation and calibration of a PID.

4.1.8 Lower Explosive Limit (LEL) Detector

Refer to FQM Lower Explosive Limit (LEL) Detector – ANZ - ENV, for applicability, operation and calibration of a LEL.

4.1.9 T-piece or Diversion Head

A t-piece is usually made out of PVC and forms an “L” shape which forces groundwater to flow away from the bore. A diversion head is similar but often involves use of an end cap with a tap or outlet to divert water from the bore. This will usually be made and supplied by the drilling contractor. These methods are ways to control the normally violent expulsion of water during airlifting. Where contamination (including high salinity) is a concern, this allows groundwater to be diverted into an appropriate container (lined pit or IBC) and collected for offsite disposal.

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4.2 Materials

Materials and consumables that may be required to complete this task include:

- Buckets
- Potable water
- Phosphate free detergent (e.g. Decon 90)
- Deionised water
- Scrubbing brush
- Paper towels
- Liquid contaminated waste container
- Spray bottle for deionised water
- Solid contaminated waste bags
- Alcohol wipes
- Steel brush

5.0 Background

The purpose of groundwater well development is to:

- Remove any drilling fluids (water or mud) introduced into the aquifer during drilling;
- Stabilise the gravel filter pack; and
- Ensure groundwater obtained during sampling events is representative of groundwater from the aquifer.

Well development should be vigorous enough to ensure these objectives are met, but not so vigorous as to cause any damage to the bore.

Groundwater well development should be undertaken as soon as practical following well installation i.e. once grout has set.

Observations made during well development can assist in determining groundwater sampling rates and techniques and flow rates for aquifer testing purposes.

Groundwater levels and chemistry should be allowed to stabilise for at least 1 week prior to water level measurement, aquifer testing or water quality sampling.

Groundwater bore volumes involve talking into account the volume of water in the well and the volume of water in the filter pack, as per the following equation:

$$V = ((\rho \times \pi (R_1^2 - R_2^2) \times h) + (\pi \times R_2^2 \times h)) \times 1000$$

V = bore volume (L)

ρ = porosity of filter pack (assumed to be approximately 0.2)

R_1 = Radius of borehole (half of drilling bit diameter) (m)

R_2 = Radius of casing (half internal casing diameter) (m)

h = Water column (depth of well – depth to water) (m)

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The following table provides an indication of approximate multiplication factors to be used when calculating bore volumes (L) for typical groundwater bore installations by the following equation:

V = MP x (depth of well – depth to water)

Table 1 Multiplication Factors to be used when calculating bore volumes for typical casing and borehole diameters

	Casing Diameter (mm)								
Bore Diameter (mm) (approximate inches)	32	50	100	125	150	175	200	225	250
100 (4'')	2.2	3.1	-	-	-	-	-	-	-
125 (5")	3.1	4.0	8.7	-	-	-	-	-	-
150 (6")	4.2	5.1	9.8	13.4	-	-	-	-	-
175 (7")	5.5	6.4	11.1	14.6	19.0	-	-	-	-
200 (8")	6.9	7.9	12.6	16.1	20.4	25.5	-	-	-
225 (9")	8.6	9.5	14.2	17.8	22.1	27.2	33.1	-	-
250 (10")	10.5	11.4	16.1	19.6	24.0	29.1	35.0	41.6	-
275 (11")	12.5	13.5	18.2	21.7	26.0	31.1	37.0	43.7	51.2
300 (12")	14.8	15.7	20.4	24.0	28.3	33.4	39.3	46.0	53.4
325 (13")	17.2	18.2	22.9	26.4	30.7	35.8	41.7	48.4	55.9
350 (14")	19.9	20.8	25.5	29.0	33.4	38.5	44.4	51.1	58.5
375 (15")	22.7	23.7	28.4	31.9	36.2	41.3	47.2	53.9	61.4

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6.0 Fieldwork Instruction

(PRINT THIS SECTION FOR USE IN THE FIELD)

This section details the step by step processes for completing the task and should accompany AECOM field personnel in the field. Any variations to this Fieldwork Instruction required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

Note that if samples are to be collected for the analysis of Per- and Polyfluoroalkyl Substances (PFAS) additional equipment and clothing restrictions must be provided by the Project Manager.

Olfactory assessment (smelling) of groundwater shall not be undertaken due to the potential for atmospheric hazards of unknown type and concentration to be present. Only ambient odours should be recorded.

6.1 Decontamination

Any equipment placed into a groundwater well for development purposes shall be decontaminated prior to use and between each groundwater well location by the following procedure.

- Scrub the equipment with a stiff steel brush to remove excess dirt prior to decontamination. Collect the dirt over a waste bag and dispose in the bag. Wipe the equipment using disposable alcohol wipes. Dispose of the alcohol wipes into a contaminated waste bag.
- Aggressively wash the equipment using a plastic scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable, e.g. Decon 90).
- Rinse the equipment with potable water over another bucket and collect the rinse water for later disposal as contaminated waste.
- Rinse the equipment with deionised water (spray this over it generously with a plastic spray bottle) over a bucket for later disposal as contaminated waste. The deionised water should preferably be supplied by the laboratory with a batch number for traceability.
- The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product on the probe after rinsing or sheen in the wash solution buckets.

Where equipment is large and cumbersome such as drilling rods used for development, this equipment should be decontaminated prior to installation in the well, between each location and at the end of the well development program. Decontamination should involve:

- Removing large soil fragments from the equipment using a steel brush or by scraping. Any contaminated dirt should be collected over a waste bag or bund and disposed of in bags or contaminated waste drums.
- The equipment should be washed with high pressure potable water, preferably with a solution of potable water and detergent (phosphate free and biodegradable, e.g. Decon 90).
- High pressure potable water should be used for a final rinse of the equipment. The water used for decontamination purposes should be collected in a bunded area (either permanent or portable) and pumped into a liquid container for disposal offsite as a contaminated liquid.

6.2 Groundwater Well Development

6.2.1 Methods

The most often used methods of well development include mechanical surging and bailing for pumping, over pumping, airlift pumping and jetting. An important factor in any method is that the development work be started slowly and gently and increased as the well is developed. Most methods of well development requires the application of sufficient energy to disturb the gravel pack, thereby freeing the fines and allowing them to be drawn into the well. The coarser fraction settles and stabilizes the surrounding foundation.

When an air compressor is used, it should be equipped with an oil air filter or oil trap to minimize the introduction of oil into the well. The use of vegetable based oils should be considered if required of the contractor.

The well development method employed should be more vigorous than the proposed sampling method. However, development procedures for wells completed in fine sand and silt strata should involve methods that

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are relatively gentle so the strata material will not be incorporated into the gravel pack. Vigorous surging during development can produce mixing of the fine strata and gravel pack and produce turbid samples.

Development methods should be carefully selected based on the potential contaminants present, the quality of waste water generated, and the requirements for containment and treatment of waste water. The specific methods include:

- Mechanical surging – water is forced to flow into and out of the well screens by operating a plunger or surge block, or bailer up and down in the well casing. A pump or bailer should then be used to remove dislodged sediments from the well (the use of a Waterra foot-valve pump in small diameter well screens can in itself have a mechanical surging effect)
- Air lift pumping – an air lift pump is operated by cycling the air pressure on and off for short periods of time. This operation will produce a surging action that will dislodge fine-grained particles. Applying a steady, low pressure will remove the fines that have been drawn into the well by the surging action. Efforts should be made to avoid pumping air into the gravel pack and adjacent unit as the air may inhibit future sampling efforts or alter ambient water chemistry. High pressure should be avoided to prevent damage to small diameter PVC casings, screens and gravel packs. The sudden evacuation of water stored in the casing by airlift will create substantial hydrostatic imbalance between the formation and inside of the casing which may lead to screen collapse and failure.
- Over pumping – a submersible pump is used to stress the formation and force water out the formation from a larger radius than would otherwise be affected.

6.2.2 Generic Step – by Step

This step provides the methodology for general well development. Details of bailing and foot valve pump techniques are outlined in the individual work instructions indicated in Section 2 above. Short, general description of the mechanics of development (keywords: gentle start, dislodging sediment, surging action etc.).

1. The wells least likely to be contaminated should be targeted first so as to minimise any potential cross – contamination between wells.
2. Appropriate air monitoring for gases and volatile compounds should be undertaken (PID, LEL, landfill gas) prior to commencing and throughout the course of the well development where applicable.
3. -Standing water levels and total depth of the well should be measured using an oil water interface probe or water level meter. This is used to calculate groundwater bore volumes.
4. The chosen development apparatus should be installed into the well (bailer, airlifting lines, waterra tubing). Using the chosen development method, water should be removed from the well and contained in the appropriate containers for disposal. This may involve collecting water into a bucket or jerry can during bailing or waterra. When airlifting is being used, removed groundwater can be diverted via a T-piece or diversion head into an IBC. Where groundwater contamination, including elevated salinity levels, is not of concern, groundwater may be disposed of to ground with appropriate environmental considerations and approvals.
5. Water quality parameters (pH, EC, DO, ORP and temperature) should be measured and observations of colour, turbidity and odour made periodically during the well development. This should be recorded on the FQM Groundwater Sampling and Purging Record – ANZ – ENV . For bailing, suction pump and foot valve/surge block methods, water quality readings should be collected at the same rates as for groundwater sampling using these methods (outlined in FQM Groundwater Sampling – Bailer – ANZ - ENV and FQM Groundwater Sampling - Hydrasleeve – ANZ - ENV [in preparation]). When using airlifting, water should be collected in a bucket and quality readings should be taken and recorded every half an hour.
6. During development using waterra or airlifting, the groundwater flow rate should be estimated. This can be undertaken by allowing water to flow into a bucket which has volumetric markings and recording the time taken to fill a pre-determined volume using a stopwatch. This reading can then be converted to L/sec or L/min flow rate measurements. Flow rates should be measured periodically throughout the development process and recorded on the development records.
7. In general, well development should continue until a minimum of 2 bore volumes have been removed from the well. After 2 bore volumes have been removed, development should continue until water quality readings have stabilised (see FQM Groundwater Quality Measurements – ANZ - ENV [in preparation] for discussion on collecting water quality readings) Under the following scenarios, it is necessary to remove additional volumes of groundwater:

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- Where water has been used during drilling, an estimation of the water used should be made and this volume should be removed from the well as a minimum.
- Where bores are to be used for a production purposes, groundwater development should continue until less than 5 mg of sand sized particles are obtained for 1000L of groundwater or until no sand or silt is produced for an hour (NUDLC 2012).

8. Well development will begin after the monitoring well is completely installed and before water sampling. Development will be continued until representative water free of the drilling fluids, cuttings and other materials introduced during well construction is obtained. Representative water quality is assumed to be obtained when the pH, temp, and EC readings stabilise and the water is visually clear of suspended solids. The minimum duration of well development will vary with the method used to develop the well and with the nature of the aquifer material.
9. The method employed and results of the water quality parameters (pH, EC, DO, ORP and temperature) should be measured and observations of colour, turbidity and odour made periodically during the well development. This should be recorded on well development sheets (FQM Groundwater Sampling and Purging Record – ANZ – ENV). For bailing, suction pump and foot valve/surge block methods, water quality readings should be collected at the same rates as for groundwater sampling using these methods (outlined in FQM Groundwater Sampling – Bailer – ANZ - ENV and FQM Groundwater Sampling - Hydrasleeve – ANZ – ENV [in preparation]). When using airlifting, water should be collected in a bucket and quality readings should be taken and recorded every half an hour.
10. No time limit to development, although should be discussed with PM
11. Where mud has been used as a drilling fluid it is essential to break down the wall cake and remove the drilling mud used. Development of mudded holes should be continued until a significant reduction in groundwater turbidity is observed and groundwater parameters have stabilised.
12. Following development, the standing water level and total depth of the well should be measured and recorded for comparison to the original readings. Development may remove sediment from the base of the well so that it appears to be “deeper”.
13. Groundwater produced during development should be collected into drums or IBCs if it is considered to be potentially contaminated. The drums shall be appropriately labelled and stored in a secure location prior to collection and disposal by a licensed waste contractor.
14. If applicable, measure the concentration of vapours exiting the well using a PID by placing the intake nozzle above the well casing. Record the highest concentration measured by the PID in FQM Groundwater Sampling and Purging Record – ANZ - ENV.
15. Slowly lower the measurement probe down the well until the probe intersects groundwater.
16. Measure the depth to groundwater in metres (to two decimal places) from the measurement tape by holding the tape next to the top of casing. The top of casing may be the highest point on the well casing or a point that was previously marker on the casing for surveying.
17. Confirm the measured depth to groundwater by repeating Sections 5.2.11 to 5.2.12 until three consistent measurements are taken (i.e. ±0.01 m). Record the depth to groundwater in FQM Groundwater Sampling and Purging Record – ANZ - ENV.
18. Measure the total depth of the well by turning off the measurement probe and lowering the probe to the bottom of the well. This is usually determined by the point where there is no tension on the measurement tape.
19. -Measure the total depth of the well in metres (two decimal places may be sufficient) by holding the measurement tape next to top of casing. Record the total well depth in FQM Groundwater Sampling and Purging Record – ANZ - ENV.

7.0 Troubleshooting

I have purged 3 bore volumes from the bore but the groundwater parameters have not stabilised

Water quality parameters may not always stabilise within the realistic time frame of development. This may reflect aquifer heterogeneity.

Airlifting is only producing very small flow rates of groundwater to surface or is not being lifted out of the bore

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This may reflect a short static water column and slow groundwater recharge. It is possible to place two pieces of poly pipe inside each other and inject air into the thinner diameter piece. The large piece acts to restrict the “diameter of the bore” and forces water to the surface. However, this will produce water at a low flow rate. While this method will allow removal of water, it will be very slow and may not develop the bore to maximum efficiency.

I have been developing a bore for hours but it is still generating sand sized particles.

This may require an assessment of the original geology and bore construction. This should be completed in consultation with the PM or PiC. Sand may be produced where a borehole has been left open (not screened and cased), due to damaged casing/screen, shifted filter pack, or if the screen/filter pack used was not of an appropriate aperture/size.

8.0 Records

a. FQM Groundwater Well Development Form – ANZ – ENV Q4AN(EV)-402-FM1

b. FQM Groundwater Sampling and Purging Record – ANZ – ENV Q4AN(EV)-405-FM1

c. FQM Water Quality Meter Calibration Record – ANZ – ENV Q4AN(EV)-410-FM1

9.0 Change Log

Rev. #	Revision date	Affected sections	Description of change
1	2-May-2016	All	Conversion to AECOM Australia Pty Ltd.
2	1-Sep-2021	Sections 3, 6 and 8	Cautionary note. References update.

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FQM - Groundwater Sampling - Low Flow Pump

1.0 Purpose and Scope

To instruct field staff on how to collect representative site-specific groundwater samples from the aquifer formation, with minimal disturbance to the water column.

This Field Instruction (FI) describes the methodology for the collection of groundwater samples using a bladder pump (low flow technique). This procedure should be read in conjunction with the following Australian/New Zealand Standards:

- AS NZS 5667.1.1998 – Water Quality Sampling – Part 1 Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples; and
- AS NZS 5667.11,1998 – Water quality - Sampling guidance on sampling of groundwaters.

2.0 References

a. Standards Australia/New Zealand 1998, AS/NZ 5667.1:1998 Water Quality – Sampling, Part 1: Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples, Standards Australia, NSW.

b. Standards Australia/New Zealand 1998, AS/NZ 5667.11:1998 Water Quality – Sampling, Part 11: Guidance on Sampling of Groundwaters, Standards Australia NSW.

c. EHP Queensland, 2009. Monitoring and Sampling Manual 2009, Version 2, July 2013 format edits. Department of Environment and Heritage Protection. State Government of Queensland.

d. EPA Victoria, 2000. Publication 669: Groundwater Sampling Guidelines. Environment Protection Authority. State Government of Victoria.

e. National Environment Protection Council (December, 1999) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) (as amended 2013).

f. Puls, R.W. and Barcelona, M.J. 1996, 'Low flow (minimal drawdown) ground-water sampling procedures', EPA Ground Water Issue, EPA/540/S-95/504, Washington.

g. Sundaram, B., Feitz, A., Caritat, P. de, Plazinska, A., Brodie, R., Coram, J. and Ransley, T., 2009. Groundwater Sampling and Analysis – A Field Guide. Geoscience Australia, Record 2009/27 95pp.

h. US EPA, 1996. Low stress (low flow) purging and sampling procedure for the collection of ground water samples from monitoring wells, Revision 2.

i. FQM Photo-Ionisation Detector (PID) – ANZ - ENV Q4AN(EV)-003-PR1.

j. FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV Q4AN(EV)-004-PR1.

k. FQM Groundwater Monitoring Well Installation – ANZ - ENV Q4AN(EV)-401-PR1.

l. FQM Groundwater Well Development – ANZ - ENV Q4AN(EV)-402-PR1.

m. FQM Groundwater Level Gauging – ANZ - ENV Q4AN(EV)-403-PR1.

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3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methods detailed in this FI. To ensure equipment is in good working order prior to use, is maintained according to supplier's advice and is appropriately calibrated or verified, have a basic understanding of common faults and field based repairs. Any faults shall be reported to the Project Manager (PM) or the equipment supplier as soon as they are identified. To ensure Quality Assurance/Quality Control and Health and Safety Compliance.
Project Manager	Define the objectives and appropriate methodology to field staff prior to mobilisation into the field. The Project Manager should check (or designate another to check) the gauging data recorded by the fieldwork staff for anomalies such as measurements inconsistent with historical groundwater level fluctuations or well construction records. To ensure Quality Assurance/Quality Control and Health and Safety Compliance.
Regional SH&E Manager	The Regional Safety, Health and Environment (SH&E) Manager is one of the assigned person and is responsible for reviewing and approving the project specific risk assessment (e.g. Project Safety Plan/Safe Work Method Statement), monitoring the implementation of project specific risk assessment plans, interface with project managers in matters of safety, health and environment, and investigating reports of incidents or accidents.

4.0 Equipment and Materials

4.1 Equipment

Equipment required to complete this task includes:

- Low Flow (Bladder) Pump Casing;
- Wire hanger;
- Control Box;
- Compressor (Air or CO_2 Gas cylinder, Regulator and Hose);
- Water Quality Meter and Flow-through-cell; and
- Oil-water Interface Meter or Electronic Dip Meter drawdown meter.

Optional or supplemental equipment:

- Lower Explosive Limit (LEL) Detector; and
- Photo Ionisation Detector (PID).

For remote sites consideration should be given to providing a backup set of equipment, if the cost of remobilization is high, and there is no access to technical repair facilities.

4.1.1 Water Level Meter

A water level meter, also called electric dip meter, is used to measure the depth to standing water. Where Non Aqueous Phase Liquid (NAPL) is expected or suspected to be present in groundwater wells an oil/water interface meter should be used. A beeping sound is made when the electronic dip meter intersects the standing water level.

4.1.2 Drawdown Meter

A drawdown meter works differently to a water level meter: it makes a beeping sound when exposed to air and is silent in water. The probe should be locked in place in the water column above the pump inlet approximately 10 cm below the pre-pumping water level. As the water level drops during pumping the probe will beep when it is exposed to air. The probe can then be lowered until the beeping stops and the process repeated. The water levels will be recorded against time during the pumping on the field sheets.

4.1.3 Oil/Water Interface Meter

The oil/water interface probe should be used where Light Non Aqueous Phase Liquid (LNAPL) or Dense Non Aqueous Phase Liquid (DNAPL) are expected or suspected to be present in the wells. The probe emits two different sounds for distinguishing the depth to NAPL (continuous tone) and the standing water level (short beeping). Because LNAPL floats on top of water, the continuous tone will occur typically before the beeping tone;

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with DNAPL, the continuous tone would occur towards the base of the well, after the beeping tone of the water column. As the water level drops during pumping the probe will stop beeping when it is exposed to air. The probe can then be lowered until the beeping starts to gauge water level and the process repeated. The water levels will be recorded against time during the pumping on the field sheets.

4.1.4 Water Quality Meter

A water quality meter will typically comprise instrument probes to measure electrical conductivity (EC), pH, temperature, oxidation reduction potential (ORP) and dissolved oxygen (DO). Common water quality meters include YSI and TPS FLMV. When renting a water quality meter, the rental company should supply a calibration certificate indicating that the equipment has been cleaned, calibrated and is ready for use. Ensure that a flow-through cell is included with the water quality meter.

4.1.5 Low Flow Pump Casing/Wire Hanger

Casing which is lowered down the well to pump groundwater. Holds the bladder that is used to pump water, one bladder is used per well and replaced during decontamination. The pump is connected to both the discharge line and airline. Both these lines must be securely in place with a tight seal for the pump to work properly. The pump contains o-rings that must be checked each time before the pump is used, for if one is missing or worn the pump will not operate properly.

A wire cable/hanger is connected to the pump from the surface, to hold the pump in place as a safe guard to stop it falling down the well. The D-bolt on the hanger should be checked between each well during the decontamination process to prevent it from loosening and dropping the pump down the well.

4.1.6 Low Flow Control Box

Used to control the rate at which water is pumped (Cycle per Minute) and the pressure that the water is pumped out of the well. The control box (shown in **Figure 1)** may contain a compressor or is connected to the gas cylinder through the hose and regulator, and also the pump through the air line. Low flow controller may be connected via 12v cables to a battery.

Figure 1 Low Flow Control Box

4.1.7 Compressor, Gas Cylinder, Regulator & Hose (if required)

CO_2 gas cylinder can be used to pump groundwater. This is connected to a regulator and regulator is connected to the hose.

Note the pressure on the gas bottle. A full gas bottle should read 5,000 kpa (1,900 psi), and will allow you to sample approximately 20 wells (varying with well depth). If the bottle reads 500 kpa or less it should be marked empty and replaced.

Compressors can be either battery powered or powered using a combustion engine, make sure the pressures are appropriately controlled and that a clear knowledge of operation and the HSEP reflects compressor use prior to mobilization.

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4.1.8 Photo Ionisation Detector (PID)

Refer to FQM Operating a Photo-Ionisation Detector (PID) – ANZ – ENV , for applicability, operation and calibration of a PID.

4.1.9 Lower Explosive Limit (LEL) Detector

Refer to FQM Operating a Lower Explosive Limit (LEL) Monitoring – ANZ - ENV, for applicability, operation and calibration of a LEL.

4.2 Materials

Materials and consumables that may be required to complete this task include:

- Appropriate Buckets (based on COPC)
- Potable water
- Phosphate free detergent (e.g. Liquinox, **do not use Decon 90**)
- Deionised water
- Scrubbing brush
- Paper towel
- Alcohol Wipes
- Waste water container (e.g. jerry can)
- Laboratory supplied sampling containers
- Laboratory supplied rinstate water
- Garbage bags
- Field book
- Permanent markers
- Duct tape
- Nitrile gloves
- Hex keys
- Tools for opening well gatic (e.g. hammer, screw driver)
- Spare o-rings and hex bolts
- Scissors/Tube Cutters
- Funnel
- Tubing – Air & Discharge line (enough metres for all wells include spares)
- Esky/cool box
- Ice/ice blocks
- Low-flow bladders (1 per well with spares)
- Adjustable spanner
- Permanent markers and pens
- Stericup Filters or in-line filters (if required for COPCs)
- Hand pump (if Stericup filters are used);

5.0 Background

The objective of groundwater sampling is to obtain water samples that best represent natural undisturbed hydrogeological conditions. Low flow sampling is one of the techniques used to achieve this. It works by lowering the pump to a specified depth in the bore screen, thus pumping water coming into the bore from the aquifer, to achieve representative samples of the aquifer with minimal disturbance to the standing water in the well.

Before commencing low flow sampling, some important factors should be considered including, the method used historically on the site for sample collection. The groundwater characteristics may take some time to stabilise after installation and development of new wells. Refer to FQM Groundwater Monitoring Well Installation – ANZ - ENV and FQM Groundwater Well Development – ANZ - ENV for further information regarding the monitoring well installation and development.

Pumping should be done in a manner that minimises stress (drawdown) to the system to the extent practical.

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6.0 Fieldwork Instruction

(PRINT THIS SECTION FOR USE IN THE FIELD)

Any variations to this Fieldwork Instruction required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

Note that if samples are to be collected for the analysis of Per- and Polyfluoroalkyl Substances (PFAS) additional equipment and clothing restrictions must be provided by the Project Manager.

Olfactory assessment (smelling) of groundwater shall not be undertaken due to the potential for atmospheric hazards of unknown type and concentration to be present. Only ambient odours should be recorded.

6.1 Decontamination

The equipment (low flow pump/interface probe) shall be decontaminated prior to use and between sampling each surface sample location by the following procedure.

1. Wipe the probe and measuring tape (the length that comes into contact with groundwater) using disposable alcohol wipes. Dispose of the alcohol wipes into a contaminated waste bag.
2. Empty pump bladder and leftover groundwater in waste water container using a funnel.
3. Wash the low flow pump, suspension wire, probe and associated tape using a scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable).
4. Rinse the low flow pump, probe, wire and tape with potable water in another bucket.
5. Final rinse of all apparatus using deionised water in a spray bottle/bucket or directly from the deionized water container.
6. The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product on the probe after rinsing or sheen in the wash solution buckets.

6.2 Low Flow Groundwater Sampling

- YSI model WQMs should be turned on 30 minutes before sampling to allow sensors to stabilise. Ensure protective covers are removed from probe;
- Check the pressure on the gas cylinder – a full cylinder should read initially on the regulator 5000 kpa; and
- Check for leakage of CO_2 or air in the system, if identified immediately turn off CO_2/compressor and undertake repair/change equipment with apparatus isolated and de-energized.

1. The wells on the site least likely to be contaminated should be targeted first so as to reduce the risk of potential cross contamination between sample locations.
2. (If using CO_2) Connect gas cylinder/compressor to regulator, the regulator to hose and the hose to the control box.
3. Turn on the gas/start compressor, control box and Water Quality Meter (WQM).
4. Ensure pump casing and hanger cable have been decontaminated. Install new disposable bladder in pump, check o-rings are all in place correctly and undamaged. Connect hanger cable to pump casing, ensuring d-bolt is tightly secured.
5. Connect the tubing line to the pump casing, discharge line (larger diameter) and air line (thinner diameter). If using twin tubing (joined tubing), ensure the excess glue has been removed from tubing line using scissors or tube cutters before connecting to pump and controller to prevent damage to inlets and o-rings. Once connected pull on the tubing to test they are secure.
6. Open the monitoring well cover by (a) unlocking the flush mount well gatic with a hex key or (b) lifting the hinge lid on the monument/stick up well cover or (c) removing the lid on any other well cover as required (e.g. quarter turn well covers).

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Monitoring well covers can cut / injure hands. Use cut resistant gloves to open well covers. Be careful for wells with positive pressure (such as landfill leachate bores that could pop off the loosened well cap. Keep body parts clear of well when opening).

Biological hazards (e.g. spiders, ants) may be present within gatic covers, exercise caution when opening wells. Wear gloves and remove cobwebs before placing hands into the well.

7. Remove the well cap (e.g. J-plug), PVC end cap, torque cap.

High concentrations of vapours can build up in the well and be released into the breathing zone when the well cap is removed. Implement appropriate work space monitoring (e.g. LEL, PID, colorimetric gas detection tubes) and HSE procedures (e.g. maintain appropriate fire extinguishers in work area) prior to removal of well cap.

8. Measure the SWL in the well with the interface probe. This depth will be taken as the original SWL on your purging sheet.

Wells should be gauged prior to the commencement of any sampling, where possible.

9. Lower pump into well slowly to avoid water column disturbance (pump should not be lowered to the bottom of well as this could cause resuspension of solids which will have collected at the bottom of the well). Lower tubing and wire carefully together to prevent tangling which can lead to the pump becoming lodged in the well. Review each well completion log to select the depth to which the pump inlet will be set. The pump should be positioned dependent on the contaminant of concern or to target high permeability zones. Where this is not known, the pump inlet should be located approximately in the middle of the screened interval so as not to disturb the bottom of the well and allow for sufficient water above the pump. Ensure the hanger cable is tight and that the cable reel has been locked in place. The depth of the pump inlet can be measured by using the interface probe / water meter to measure the depth to the top of the pump. Record depth to pump on purging sheet.

10. Attach the tubing airline to the control box (see **Figure 1**). Attach discharge line (larger diameter) to the flow cell in the bottom outlet to allow flow cell to fill with water before discharge. Place flow cell into a bucket to ensure overflow from discharge is contained.

11. Remeasure the SWL in the well, or use the drawdown meter to monitor any drawdown during pumping.

The difference in depth between the SWL recorded before the pump was lowered into the well and after will give a rough estimate of how quick the well will recharge if no historical data is available (the larger the difference in depths the slower the recharge as a general rule).

12. Measure depth to top of pump and record as purging depth on purge sheet. If this is not possible i.e. in wells with a diameter greater than 50 mm, an estimate can be made.

13. For CO_2 setup - Set the air pressure on the gas cylinder regulator and control box throttle to required pressure. Using the formula Purging Depth (1 metre = 1 psi) + 10 psi = Air Pressure e.g. 15m depth = (15x1) +10 = 25. The pressure should be slightly greater on the gas cylinder regulator compared to the control throttle. Watch the rate at which water is discharged and adjust pressure as necessary.

Review previous sampling sheets to obtain an idea of the appropriate pumping rate. Set the controller to the estimated flow rate or if unknown start on 100 ml/min (CPM 1). One cycle yields approximately 100 ml of water. Groundwater flow should be between 0.1-0.4 L/ min.

14. For O_2 setup – set the fill and discharge times. Discharge times are the time it takes to squeeze the bladder and fill time is the time allowed for the bladder to refill. Fill and discharge rates depend on hydrostatic pressure (i.e. water above the pump). The airline pressure gauge should not exceed the equivalent depth to water 1 PSI = 0.7 m of water.

Review previous sampling sheets to obtain an idea of the appropriate flow rate. If discharge falls off before the discharge cycle is complete, the discharge time can be lowered. If drawdown is significant, fill time can be increased.

15. Start the pump. Allow purged water to overflow (into a container) the flow-through cell before starting to take water quality parameter readings and standing water level readings, once this occurs take readings every three minutes (where sampling rate is 100ml/minute or more) or five minutes (if flow rate is less than 100ml/minute).

16. Fill in data on CPM or fill/discharge rate, SWL readings and water quality parameters on the field purging sheet.

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The drawdown should not exceed 10 cm difference from the original SWL at any time. However it is more important that the groundwater quality parameters stabilise before sampling. If the drawdown is dropping continuously lower the flow rate to see if the SWL will stabilise. Once the SWL stabilises wait for three successive stable parameter readings before sampling (at 3 to 5 minute interval between each successive reading).

If you are still getting drawdown with the very low pump rates, contact PM for advice.

17. Once field parameters have stabilised samples can be collected (a minimum of 1 L of groundwater should be removed prior to sampling). The water quality parameters are considered stable when for three successive readings the parameters are within the following: ±10% Dissolved Oxygen; ±3% Electrical Conductivity; ±0.05 pH; ±10 mV Redox Potential; and ±0.2°C Temperature. Pay attention to water quality parameters and check that readings are as expected based on site knowledge and chemistry. Issues often occur with WQMs. Parameters can also be easily recorded incorrectly if the wrong units or parameter is referenced. Taking time to set-up WQM display screen with the required parameters and units may help as parameters that are not recorded (e.g. salinity) are not displayed. Contact PM and/or equipment supplier if unsure of readings or experiencing issues with WQM.

Record all purging and sampling details on the FQM Groundwater Sampling and Purging Record – ANZ - ENV.

If water quality parameters have changed significantly since last GME call the PM.

18. Maintain the same pumping rate for sampling. Disconnect the pump's tubing from the flow-through-cell so that the samples are collected from the pump's discharge tubing. Air pressure on the gas cylinder can be turned down so samples can be filled with minimal turbulence (if applicable).
19. Fill samples over a bucket/basin to minimise spillage.
20. Store samples in esky with sufficient ice or ice bricks. Ice should form a bed beneath samples and cover samples. Glass vials and bottles should be stored in bubble wrap and eskies should not be over-filled.
21. Turn the controller off. Remove the pump from the monitoring well. Decontaminate the pump and probe following steps decontamination steps in section **6.1** and dispose of the tubing, bladder and other waste. The flow-through cell doesn't need to be rinsed between wells (unless a sheen, strong hydrocarbon odour or sediment is noticed to keep it in good working condition). Water quality sensors should be rinsed with tap water.

- If SWL varied during purging, measure the SWL after sampling to ensure that levels did not exceed 10 cm difference from the original SWL.
- If this is the last well for the day, or before a break, the gas line should be turned off and de-pressurised before leaving by turning the gas off at the cylinder and running the controller through one or two cycles. All caps should be replaced on the WQM.

22. Replace cap on well, lock gatic. Check area for anything left behind before leaving.

7.0 Troubleshooting

a. **Water isn't discharging from the pump:**

1. Check gas bottle is not empty/compressor is operating.
2. Check air pressure gauges on the gas bottle and controller are at appropriate levels (if applicable).
3. Re-connect air hose to compressor to ensure there isn't a leak.
4. Remove pump from well.
5. Check water and air lines connecting pump to ensure there isn't a leak.
6. Check o-rings are in place in pump; replace any worn o-rings.
7. Check bladder hasn't broken and is in good condition.
8. Decontaminate or clean pump and inlet to remove sediment.

b. **There are air bubbles (observed audibly from the well head) in the water discharge tube:**

1. O-rings are missing or worn, check and replace if needed.

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2. Air line connecting to pump is leaking causing water bubble in discharge line, re-connect both air and water tubes connecting to pump.
3. Bladder is missing or not sealed.

c. **The water level keeps fluctuating up and down rapidly:**

1. O-rings are missing or worn, check and replace if needed.
2. Air line connecting to pump is leaking causing water to bubble in well, re-connect both air and water tubes connecting to pump.
3. Bladder is missing or not sealed.

8.0 Records

a. FQM Groundwater Sampling and Purging Record – ANZ - ENV Q4AN(EV)-405-FM1.

9.0 Change Log

Rev. #	Revision date	Affected sections	Description of change
1	2-May-2016	All	Conversion to AECOM Australia Pty Ltd.
2	1-Sep-2021	Sections 3, 6, 8	Cautionary note References update

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FQM - NAPL and Groundwater Level Gauging

Q4AN(EV)-414-PR1

1.0 Purpose and Scope

To obtain accurate and representative measurements of non-aqueous phase liquid (NAPL) levels and groundwater levels in groundwater monitoring wells.

This Fieldwork Instruction describes the methodology for gauging light (floating on groundwater) non-aqueous phase liquid (LNAPL) levels, dense (sinking in groundwater) non-aqueous phase liquid (DNAPL) levels and groundwater levels in monitoring wells.

This document is applicable to the measurement of groundwater levels only using an oil/water interface probe and should be used in preference to FQM Groundwater Level Gauging – ANZ - ENV for investigations at sites that may have NAPLs present in the subsurface.

2.0 References

a. Clements, L., Palaia, T. & Davis, J., 2009. Characterisation of site impacted by petroleum hydrocarbons: National guideline document, CRC CARE Technical Report no. 11, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

b. EPA South Australia, 2007. EPA Guidelines: Regulatory monitoring and testing, Groundwater sampling. Environment Protection Authority. State Government of South Australia.

c. EPA Victoria, 2000. Publication 669: Groundwater sampling guidelines. Environment Protection Authority. State Government of Victoria.

d. ISO, 2005. International standard. ISO 21413:2005(E). Manual methods for the measurements of a groundwater level in a well. International Organization for Standardization. Geneva, Switzerland.

e. NEPC, 20092013. National Environmental Protection (Assessment of site contamination) Measure. Schedule B (2): Guideline on data collection, sample design and reporting. National Environment Protection Council, Canberra.

f. NSW DEC, 2007. Guidelines for the Assessment and Management of Groundwater Contamination. March.

g. Sundaram, B., Feitz, A., Caritat, P. de, Plazinska, A., Brodie, R., Coram, J. and Ransley, T., 2009. Groundwater Sampling and Analysis – A Field Guide. Geoscience Australia, Record 2009/27 95 pp.

h. FQM Photo-Ionisation Detector (PID) – ANZ - ENV Q4AN(EV)-003-PR1.

i. FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV Q4AN(EV)-004-PR1.

j. FQM Groundwater Level Gauging – ANZ - ENV Q4AN(EV)-403-PR1.

k. FQM NAPL Sampling – ENV – ANZ Q4AN(EV)-415-PR1 (in preparation)

3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methodology detailed in this Fieldwork Instruction. To ensure equipment is in good working order prior to use and is maintained according to supplier's advice. Report all anomalies to the Project Manager or the equipment supplier as soon as they are identified. Maintain accurate fieldwork data and observation records and provide to the Project Manager for review and filing in the project central file.
Project Manager	Define the task objectives and provide all relevant information to field staff prior to mobilisation into the field. The Project Manager should check (or designate another to check) the gauging data recorded by the fieldwork staff for anomalies such as measurements inconsistent with historical level fluctuations or well construction records.
Regional SH&E Manager	The Regional Safety, Health and Environment (SH&E) Manager is is responsible for reviewing and approving the project specific risk assessment (e.g. Project Safety Plan/Safe Work Method Statement), monitoring the implementation of project specific risk assessment plans, interface with

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Role	Responsibility
	project managers in matters of safety, health and environment, and investigating reports of incidents or accidents.

4.0 Equipment and Materials

4.1 Equipment

Equipment required to complete this task include:

- Oil/water interface probe;
- Photo Ionisation Detector (PID); and
- Lower Explosive Limit (LEL) Detector.

Optional or supplemental equipment:

- Non-electrical water level meter such as “plopper” or “Fox Whistle”;
- AB(E) fire extinguishers; and
- Oil/fuel spill kit.

4.1.1 Oil/Water Interface Probe

The oil/water interface meter is suitable for LNAPL, DNAPL and groundwater level measurements. Check the equipment user guide for specific operating principles.

4.1.2 Photo Ionisation Detector (PID)

Refer to FQM Photo-Ionisation Detector (PID) – ANZ - ENV , for applicability, operation and calibration of a PID.

4.1.3 Lower Explosive Limit (LEL) Detector

Refer to FQM Lower Explosive Limit (LEL) Monitoring – ANZ - ENV , for applicability, operation and calibration of a LEL Detector.

4.2 Materials

Materials and consumables required to complete this task include:

- Buckets;
- Potable water;
- Phosphate free detergent (e.g. Liquinox, **do not use Decon 90**, especially if sampling for per and poly-fluoroalkyl substances [PFAS] is to be conducted);
- Scrubbing brush;
- Paper towel;
- Alcohol wipes;
- Liquid contaminated waste container;
- Steel rod for electrical grounding (e.g. screwdriver);
- Allen key set;
- Tools for opening well covers, e.g. magnet or pair of pliers;
- Spare o- rings and hex bolts;
- Bailers for confirming presence of NAPL;
- Steel measuring tape;
- Bailer twine;
- Solid contaminated waste bags; and
- Spare batteries.

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5.0 Background

Accurate and reliable groundwater level measurements are essential in determining the hydraulic head, hydraulic gradients (vertical or along the water table), and the likely directions for groundwater flow and contaminant transport at a site. Before commencing a groundwater gauging round, some important factors should be considered, including:

- The groundwater level may take some time to stabilise after development of new wells.
- Groundwater levels fluctuate naturally (e.g. rainfall infiltration and tidal influences) and anthropogenically (e.g. pumping and irrigation), therefore groundwater gauging of a site should be completed in one day or less if possible. If a site is influenced by tidal variations, gauging should ideally be completed within a single tidal stage and water level data loggers may be needed to determine groundwater elevation.
- Effervescent groundwater such as in mineral spring areas or at landfills may cause difficulty gauging.
- Highly saline groundwater can cause the alarm of a dip meter or oil-water interface probe to sound even when the probe is lifted out of the water in the well. This usually occurs if the probe initially was lowered below the water level in the well. The probe may need to be washed, dried and the water level re-measured.
- Highly turbid wells can cause the continuous tone of an oil-water interface meter to sound even when NAPL is absent. If the occurrence of NAPL is unlikely or new, its occurrence should be checked using a new bailer or by looking for evidence of oils on the tape of the meter.
- Electronic dip meters and oil/water interface probes have co-axial conductive wires within a graduated plastic tape. A damaged tape may result in stretching of the graduations and inaccurate measurements. The tape should be calibrated for length against a steel tape prior to use and markings should be checked for legibility.

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6.0 Fieldwork Instruction

(PRINT SECTION 6 AND 7 FOR USE IN THE FIELD)

This section details the step by step processes for completing the task and should accompany AECOM field personnel in the field. Any variations to this Fieldwork Instruction required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

Caution: An explosive atmosphere may be present in the vicinity of an open monitoring well due to vapours emanating from a well with LNAPL floating on groundwater. Refer to the project Health, Safety and Environment Plan (HSEP) for specific controls to manage the potential acute safety hazard.

6.1 Decontamination

The measurement equipment (oil/water interface probe) shall be decontaminated prior to use and between measuring each monitoring well by the following procedure.

1. Wipe the probe and measuring tape (the length that comes into contact with groundwater) using disposable alcohol wipes. Dispose of the alcohol wipes into a contaminated waste bag.
2. Wash the probe and measuring tape (the length that comes into contact with groundwater) using a scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable, NOTE: do not use Decon 90, especially if sampling for PFAS is to be conducted).
3. Rinse the probe and washed section of the measuring tape with potable water over another bucket and collect the rinse water for later disposal as contaminated waste.
4. The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product remains on the probe after rinsing or sheen is present in the wash solution buckets.

6.2 NAPL and Groundwater Level Gauging

This section provides the methodology for the relative measurement of LNAPL (if present), groundwater and DNAPL (if present) levels in that order. Water and NAPL levels should be measured in a sequence from clean to contaminated wells to avoid cross-contamination of wells. A gauging round should be conducted of all monitoring wells at the site as quickly as possible before any samples are collected.

1. Open the monitoring well cover by (a) unlocking the flush mount well gatic with an Allen key (typically 7 mm) or (b) lifting the hinge lid on the monument/stick up well cover or (c) removing the lid on any other well cover as required (e.g. quarter turn well covers).

Monitoring well covers can cut / injure hands. Use cut resistant gloves to open well covers. Be careful for wells with positive pressure (such as landfill leachate bores that could pop off the loosened well cap. Keep body parts clear of well when opening).

Biological hazards (e.g. spiders, ants) may be present within gatic covers, exercise caution when opening wells. Wear gloves and remove cobwebs before placing hands into the well.

2. Remove the well cap (e.g. J-plug), PVC end cap, torque cap. Stand upwind from the well and allow hydrocarbon vapours to dissipate.

High concentrations of vapours can build up in the well and be released into the breathing zone when the well cap is removed. Implement appropriate work space monitoring (e.g. LEL, PID, colorimetric gas detection tubes) and HSE procedures (e.g. maintain appropriate fire extinguishers in work area) prior to removal of well cap.

3. Check the breathing zone above the well using a PID. Only proceed with gauging when the safety requirements stipulated in the project HSEP have been attained, i.e. vapour concentrations are below action levels or appropriate PPE is in use where action levels are exceeded.
4. Measure the concentration of vapours exiting the well using a PID by placing the intake nozzle immediately above the well casing.

Record the highest concentration measured by the PID and also the general condition of the monitoring well (e.g. missing or broken cover or well cap, well head filled with surface water) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV.

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5. Electrically ground the interface probe by attaching the grounding clip to the well casing or to a steel rod (e.g. screwdriver) inserted into the ground.

Caution: Static electricity may cause a spark and ignite vapours if the interface probe is not suitably grounded.

6. Slowly lower the interface probe down the well until the probe intersects LNAPL (if present) as indicated by the noise made by the equipment (typically a continuous tone - refer to equipment user guide for details). Measure the depth to LNAPL in metres (to three decimal places) from the measurement tape by holding the tape next to the top of casing.

The top of casing may be the highest point on the well casing or a point that was previously marked on the casing for surveying.

Record the depth to LNAPL in metres below top of casing (mBTOC) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

7. Slowly continue to lower the probe down the well until groundwater has been intersected (typically beeping tone – refer to equipment user guide for details). Measure the depth to groundwater in metres (to three decimal places) from the measurement tape by holding the tape next to the marked measuring point of the top of casing.

Record the depth to groundwater in metres below top of casing (mBTOC) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

8. Confirm the measured depth to LNAPL and groundwater by repeating Step 6 and 7 until three consistent measurements are taken (i.e. ± 0.002 m).

9. To check for and measure DNAPL (if applicable), continue to lower the probe down the well through groundwater until the probe intersects DNAPL (typically a continuous tone - refer to equipment user guide for details). Measure the depth to DNAPL in metres (to three decimal places) from the measurement tape by holding the tape next to the marked measuring point of the top of casing.

10. Confirm the measured depth to DNAPL and groundwater by repeating Step 9 until three consistent measurements are taken (i.e. ± 0.002 m).

Record the depth to DNAPL in metres below top of casing (mBTOC) in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

If historical NAPL and groundwater levels are available for the monitoring well, compare the water level measurements with previous results for a reality check. That is, if groundwater levels have decreased in most wells since the previous gauging event but increased in one or two, then the anomalous measurements should be re-measured to confirm.

11. Measure the total depth of the well by turning off the interface probe and lowering the probe to the bottom of the well. This is usually determined by the point where there is no tension on the measurement tape. Measure the total depth of the well in metres (to two decimal places) by holding the measurement tape next to the marked measuring point at the top of casing.

Record the total well depth in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

TIP: It may be required to measure the height of the riser pipe in stick up wells. Check with your PM.

12. Where confirmation of NAPL is required by collecting a sample of LNAPL or DNAPL from the well refer to Fieldwork Instruction FQM NAPL Sampling – ENV – ANZ.

Record observations of NAPL (i.e. colour, odour, viscosity) on the interface probe or from a bailer used to collect a NAPL sample in FQM NAPL and Groundwater Level Gauging – ANZ - ENV .

13. Lock the well cap after gauging is complete.

7.0 Troubleshooting

a. I can't find the monitoring well I am supposed to sample

i. Use the figure to identify nearby features and attempt to triangulate its location.

ii. Ask field staff involved in previous monitoring events.

iii. Use a metal detector to sweep the general area.

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iv. Request GPS co-ordinates from the GIS team and use a GPS to locate the well. If possible have a surveyor locate well position.

v. Check the project folder (and historical project folders) for any photographs of the well location.

b. The stickup well has a padlock

i. Check with the PM to ensure AECOM does not hold a key for the well.

ii. Check with client / land owner that a key is not available for the well.

iii. Cut the lock off.

iv. Re-secure the stickup using a cable tie unless client/PM indicates a lock should be replaced on the stickup.

c. The well is dry

i. Confirm that the measured depth to bottom matches the information in the well log / historical gauging logs.

ii. Check to see if the well is seasonally dry

iii. If blocked, unblock the well using appropriate means.

d. I can't get the well cover open or the well cap off

i. Check that the tool is right for the job i.e. the right size Allen key is being used. A welder's magnet may be useful in opening flush mounted well covers.

ii. Gently tap the well cover with a hammer to loosen.

iii. Replace O-rings and cover plate bolts as necessary to avoid the same problem next gauging round.

iv. Do not overexert and risk an injury or damage to the well head. Make a note on the gauging record and contact the Project Manager.

e. I can't get three stable measurements

Atmospheric pressure has the potential to affect the SWL. Wait a few minutes after opening the well cap for the SWL to stabilise and confirm again after an hour.

i. Inspect the measurement tape (whole length) for damage.

ii. Check the tip of the probe for damage, dirt or NAPL.

iii. Try the probe in a bucket of water.

iv. Check the battery.

Refer to the dip meter / interface probe user manual.

8.0 Records

a. FQM NAPL and Groundwater Level Gauging – ANZ - ENV Q4AN(EV)-414-FM1.

9.0 Change Log

Rev #.	Revision date	Affected sections	Description of change
1	2-May-2016	All	Conversion to AECOM Australia Pty Ltd.
2	1-Sep-2021	Sections 3, 6, 8	Cautionary notes, References update

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Appendix G

Site Specific Remediation Criteria

Site Specific Remediation Criteria

In order to assess risks and inform potential remediation works required to allow development of the Macquarie Point Site (the Site) in accordance with the Site *Masterplan* (Macquarie Point *Strategic Framework and Masterplan 2015 – 2030*), AECOM prepared *Derivation of Remediation Criteria* (AECOM, 2016) to develop Site specific Remediation Criteria (RC) for soil and groundwater which are protective of human health under the proposed future land uses at the Site.

The RC were reviewed and updated in 2025 (AECOM, 2025e) for the changes in proposed Site development to the current plan, described in **Section 2.3** of the main report text. A summary of the initial formulation, and updates from the review, are provided below.

The RC consider the following scenarios and land uses based on the initial and current proposed development of the Site:

- High density residential development (slab-on-grade buildings and buildings with a communal basement car park).
- Recreation / open space
- Multi-storey car park
- Commercial/light industrial (slab-on-grade buildings and working within a basement car park).

It is noted that residential development is now only proposed in Regatta Point, which is not one of the assessment areas with existing Site Suitability Statements considered in this report. However, high density residential land use is known to occur off-Site and hydraulically down-gradient along Evans Street to the south of the Site, and the potential exists for groundwater migration from the Site to reach this area. As such, the RC protective of residential use have been applied to groundwater data from the Site.

Information about proposed Site layout, uses and building design can be used to refine the RC to be more Site-specific and reduce conservatism where appropriate based on any changes to the Masterplan or Site uses in future. Any changes to RC should be prepared by a qualified environmental professional, and if changes allow higher concentrations of Chemicals of Potential Concern (CoPC) to remain on Site, be reviewed and endorsed by a Contaminated Land Auditor.

Assumptions

The following key assumptions have been made when deriving the RC and should be noted as limitations when applying the RC:

- NAPL impacts at the Site will be remediated to the extent practicable and therefore risks associated with exposure to NAPL, and volatile contaminants derived from NAPL were not considered in the derivation of the RC.
- Intrusive maintenance work at up to 1 m bgl may be undertaken in all land uses.
- An engineered break layer will be present at the ground surface to mitigate the potential for future Site users (with the exception of maintenance workers) to have direct contact with soils.
- A reticulated water supply will be available, based on the urban setting of the Site, and abstraction of groundwater for any purposes other than remediation or monitoring, or temporary extraction during construction, will not be required. Potential exposure to contaminants in groundwater during any construction, remediation, or monitoring will be managed by task specific safety documentation informed by the SEMP.
- A SEMP will be prepared and put in place to maintain/manage surface cover.
- With regard to basements:
    - Use of any future basements is assumed to be limited to car parking. If basements are constructed for other purposes, a risk assessment specific to the intended use should be conducted.

- Where basements are associated with future residential or commercial buildings, it is assumed that these will be communal areas for multiple properties, for example, as part of a strata scheme that is managed by a body corporate. Private basements will therefore not be associated with individual residences.
- Where there is access to a basement car park, it is assumed that any groundwater seepage collects in floor drains and a physical barrier is present, and therefore, groundwater will not be directly contacted by basement users, with the exception of maintenance workers. It is assumed that individual tenants will not be involved in the maintenance of any associated services, including drainage pumps or sumps.

- For potential future multi-storey car park users, the most sensitive receptor in this scenario would be considered to be a parking attendant present at the Site for a typical eight hour working day. It is considered that RC derived for potential future commercial/light industrial workers (working within a basement) would be protective of all other basement users. This includes multi-storey car park users and residential tenants who access basement car parks and are likely to have lower frequency and duration of exposure, therefore the multi-storey car park users scenario is not evaluated separately in this assessment.
- Adjacent off-Site land uses include open space, commercial/industrial, and residential areas. As these potential land uses have been considered on-Site, the derived RC are considered to also be protective of potential exposures to off-Site receptors (e.g. via groundwater migration beyond the Site boundary), as:
  - Extractive groundwater use is not known to occur within 2 km of the Site, based on review of registered groundwater bores undertaken in 2024 (AECOM, 2025), and the urban setting and reticulated water supply indicate that groundwater extraction and use is unlikely to occur
  - No basements are known to be present in the surrounding buildings, and are considered unlikely due to the additional costs which would be required for basement construction, based on shallow groundwater elevation, hydraulically downgradient of the Site.
- It is considered that potential exposure to workers undertaking remediation and/or development activities can effectively be mitigated through the implementation of an appropriate Construction Environmental Management Plan (CEMP). The CEMP should be prepared during the planning stage for any future remediation and/or development activities.
- A separate assessment of the potential risks to on-Site visitors was not undertaken as it was considered that the chronic exposure duration assessment of commercial/light industrial workers or residents is sufficiently protective of the shorter exposure duration visitor scenario.

Soil

Table 1 below provides the adopted Site specific RC (reported to two significant figures) for soil concentrations which are considered to be protective of human health for proposed future uses.

Table 1 Site Specific Land Use RC for Soil (mg/kg)

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/ Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
Lead	-	-	-	-	-	-	-	620
Benzo(a)pyrene	-	-	-	-	-	-	-	110
Naphthalene	2.7	13	20	12	160	97	>Sat	38,000
Benzene	0.5*	0.5*	0.5*	3	3*	3*	360	170
Toluene	160	200	290	950	2500	1400	>Sat	660,000
Ethylbenzene	57	81**	120**	340	990**	570**	>Sat	290,000
Xylenes (total)	40	67	93	240	830	430	>Sat	530,000
C6-C10 fraction (minus BTEX)(F1)***	12	27	36	67	340	170	-	110000
>C10-C16 (minus Naphthalene)(F2) ***	25	130	170	140	-	770	-	110000
>C16-C34 fraction***	-	-	-	-	-	-	-	65000
>C34-C40 fraction***	-	-	-	-	-	-	-	65000
TPH C6-C8 (Aliphatic)	54	94	120	310	>Sat	570	>Sat	1,000,000
TPH >C8-C10 (Aliphatic)	88*	88*	88*	510	510*	510**	>Sat	270,000

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/ Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
TPH >C8-C10 (Aromatic)	12	27	36	67	340	170	>Sat	110,000
TPH >C10-C12 (Aliphatic)	51	140	>Sat	300	>Sat	>Sat	>Sat	270,000
TPH >C10-C12 (Aromatic)	25	130	170	140	>Sat	770	>Sat	110,000
TPH >C12-C16 (Aliphatic)	330	>Sat	>Sat	1700	>Sat	>Sat	>Sat	270,000
TPH >C12-C16 (Aromatic)	110	>Sat	>Sat	510	>Sat	>Sat	>Sat	110,000
TPH >C16-C21 (Aliphatic)	-	-	-	-	-	-	-	1,000,000
TPH >C16-C21 (Aromatic)	-	-	-	-	-	-	-	65,000
TPH >C21-C34 (Aliphatic)	-	-	-	-	-	-	-	1,000,000
TPH >C21-C34 (Aromatic)	-	-	-	-	-	-	-	65,000
TPH >C34-C40 (Aliphatic)	-	-	-	-	-	-	-	1,000,000
TPH >C34-C40 (Aromatic)	-	-	-	-	-	-	-	65,000

*Notes: # Source = CRC CARE (2011) Appendix F, * Where the soil criteria derived using the infinite source model were more conservative than the CRC CARE (2011) screening values based on a finite source model, the CRC CARE (2011) values are proposed for adoption, ** Adopted RC for ethylbenzene are based on a site specific toxicity assessment (AECOM, 2025e); *** The minimum criteria for aliphatic/aromatic fractions have been adopted for broader TRH fractions; >Sat – greater than saturation concentrations of this CoPC*

Groundwater

Table 2 below provides a summary of Site specific RC (reported to two significant figures) for groundwater concentrations which are considered to be protective of human health for proposed future uses.

Table 2 Site Specific Land Use RC for groundwater (mg/kg)

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
Benzo(a)pyrene	-	-	-	-	-	0.05	-	-
Naphthalene	2	3	7	12	28	6	>Sol	>Sol
Benzene	0.8	0.8	6	5	9	5	>Sol	>Sol
Toluene	>Sol	>Sol	>Sol	>Sol	>Sol	5,500	>Sol	>Sol
Ethylbenzene	>Sol	>Sol	>Sol	>Sol	>Sol	1,600	>Sol	>Sol
Xylenes (total)	>Sol	>Sol	>Sol	>Sol	>Sol	2,800	>Sol	>Sol
C6-C10 fraction (minus BTEX)(F1)**	30	30	>Sol	>Sol	>Sol	79	>Sol	>Sol
>C10-C16 (minus Naphthalene)(F2)**	>Sol	>Sol	>Sol	>Sol	>Sol	40	>Sol	>Sol
>C16-C34 fraction**	-	-	-	-	-	39	-	-
>C34-C40 fraction**	-	-	-	-	-	39	-	-
TPH C6-C8 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	16,000	>Sol	>Sol
TPH >C8-C10 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	79	>Sol	>Sol
TPH >C8-C10 (Aromatic)	30	30 *	>Sol	>Sol	>Sol	360	>Sol	>Sol

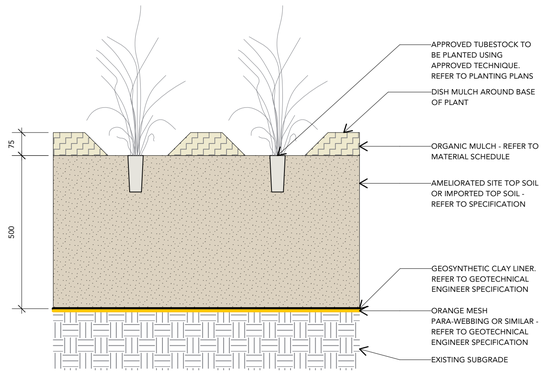
Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
TPH >C10-C12 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	40	>Sol	>Sol
TPH >C10-C12 (Aromatic)	>Sol	>Sol	>Sol	>Sol	>Sol	190	>Sol	>Sol
TPH >C12-C16 (Aliphatic)	>Sol	>Sol	>Sol	>Sol	>Sol	67	>Sol	>Sol
TPH >C12-C16 (Aromatic)	>Sol	>Sol	>Sol	>Sol	>Sol	160	>Sol	>Sol
TPH >C16-C21 (Aliphatic)	-	-	-	-	-	3,300	-	-
TPH >C16-C21 (Aromatic)	-	-	-	-	-	94	-	-
TPH >C21-C34 (Aliphatic)	-	-	-	-	-	3,300	-	-
TPH >C21-C34 (Aromatic)	-	-	-	-	-	39	-	-
TPH >C34-C40 (Aliphatic)	-	-	-	-	-	3,300	-	-
TPH >C34-C40 (Aromatic)	-	-	-	-	-	39	-	-
Dimethylphenol, 2,4-	-	-	-	-	-	1,300	-	-
Methylphenol-2 (cresol, o-)	-	-	-	-	-	4,300	-	-
Methylphenol-3 (cresol, m-)	-	-	-	-	-	4,200	-	-
Methylphenol-4 (cresol, p-)	-	-	-	-	-	4,300	-	-

Chemical	Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Residents (low rise slab-on-grade)	Potential Future Residents (building with a basement car park)	Potential Future Commercial (slab-on-grade with unknown construction or multi-storey building) #	Potential Future Commercial/ Light Industrial Workers (slab-on-grade)	Potential Future Commercial/Light Industrial Workers (Working within a basement car park)	Potential Future Recreational Open Space Users	Potential Future Maintenance Workers
Aniline	-	-	-	-	-	890	-	-
Dibenzofuran	-	-	-	-	-	8	-	-
Styrene	96	99	>Sol	>Sol	>Sol	160	>Sol	>Sol

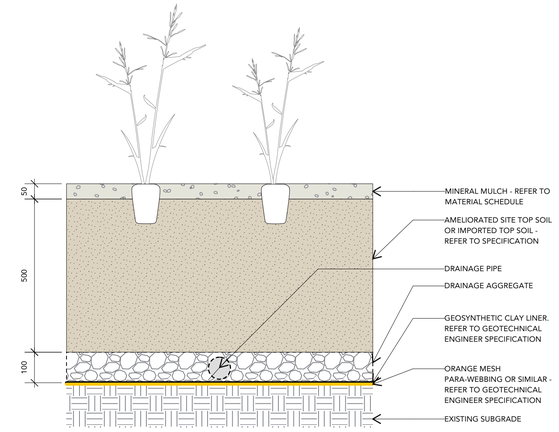
*Notes: # Source = CRC CARE (2011) Appendix F, * Where the soil criteria derived using the infinite source model were more conservative than the CRC CARE (2011) screening values based on a finite source model, the CRC CARE (2011) values are proposed for adoption, ** The minimum criteria for aliphatic/aromatic fractions have been adopted for broader TRH fractions; >Sol – greater than the solubility concentration of this CoPC*

Appendix H

Inground Planting Designs



1 SOIL PROFILE TYPE 01 - GARDEN BED
Scale: 1:10



2 SOIL PROFILE TYPE 02 - SOAK GARDEN
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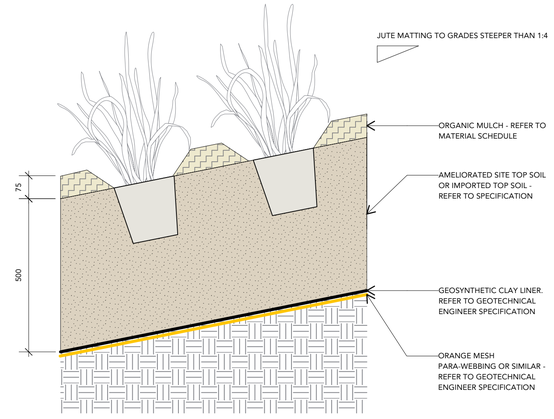

3 SOIL PROFILE TYPE 03 - EMBANKMENT PLANTING
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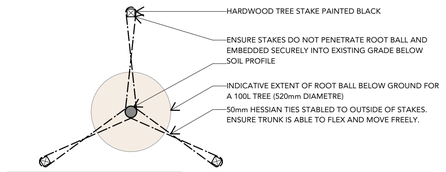
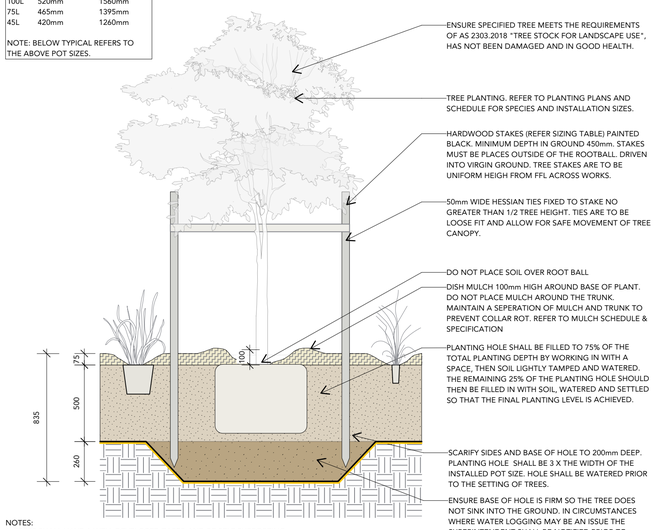


TREE STAKES TABLE TREE SIZE	NO. STAKES	STAKE SIZE (MIN)
100L-200L	3	50 X 50 X 1800MM
45L	1	35 X 35 X 1500MM

4 TREE PLANTING TYPICAL ON EXISTING GRADE
Scale: 1:20

PLANTING HOLE SIZE:		
POT SIZE	ROOT BALL SIZE (DIA)	PLANTING HOLE (MIN)
400L	980mm	2940mm
200L	700mm	2100mm
100L	520mm	1560mm
75L	465mm	1395mm
45L	420mm	1260mm

NOTE: BELOW TYPICAL REFERS TO THE ABOVE POT SIZES.

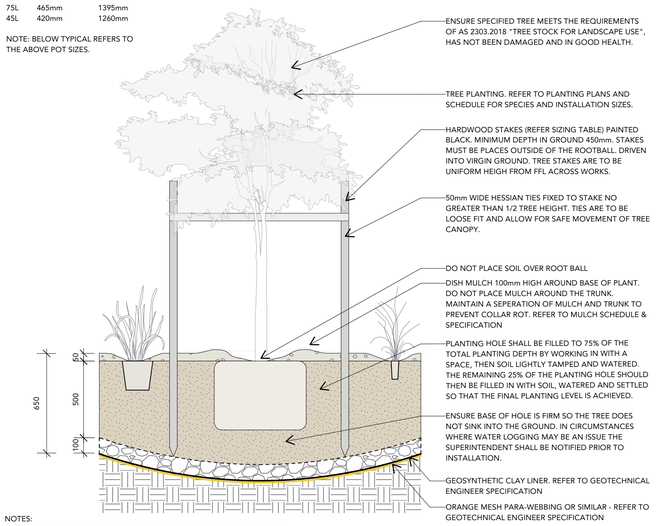


NOTES:
1. TREES SHALL HAVE A WELL DEVELOPED TAPER AND BE SELF SUPPORTING.
2. SPECIFIED TREE TO MEET THE REQUIREMENTS OF AS 2303.2018 "TREE STOCK FOR LANDSCAPE USE"
3. ENSURE ALL LABELS, WIRES, TWINE AND OTHER BINDING MATERIALS ARE REMOVED FROM PLANTING MATERIAL, INCLUDING ROOTBALLS PRIOR TO BACKFILLING.
4. TO PROMOTE LATERAL ROOT GROWTH THE PLANTING HOLE SHALL BE NO LESS THAT THREE (3) TIMES THE DIAMETER OF THE ROOT BALL. IF SPACE RESTRICTIONS EXIST STAKE SPACING SHALL BE REDUDED TO NO LESS THAN TWO (2) TIMES TH DIAMETER OF THE ROOT BALL. SLOPE ALL SIDES AT 45 DEGREES.
5. WATER IMMEDIATELY FOLLOWING PLANTING, SAUCER TO BE FILLED TWICE
6. SITE TO BE LEFT CLEAN AND TIDY ON COMPLETION OF PLANTING, REMOVE WEEDS AND BUILDING SPOIL FROM TREE PLANTING ZONE.
7. REFER SPECIFICATION FOR ALL TREE PLANTING.

5 TREE PLANTING - GARDEN BED
Scale: 1:20

PLANTING HOLE SIZE:		
POT SIZE	ROOT BALL SIZE (DIA)	PLANTING HOLE (MIN)
400L	980mm	2940mm
200L	700mm	2100mm
100L	520mm	1560mm
75L	465mm	1395mm
45L	420mm	1260mm

NOTE: BELOW TYPICAL REFERS TO THE ABOVE POT SIZES.

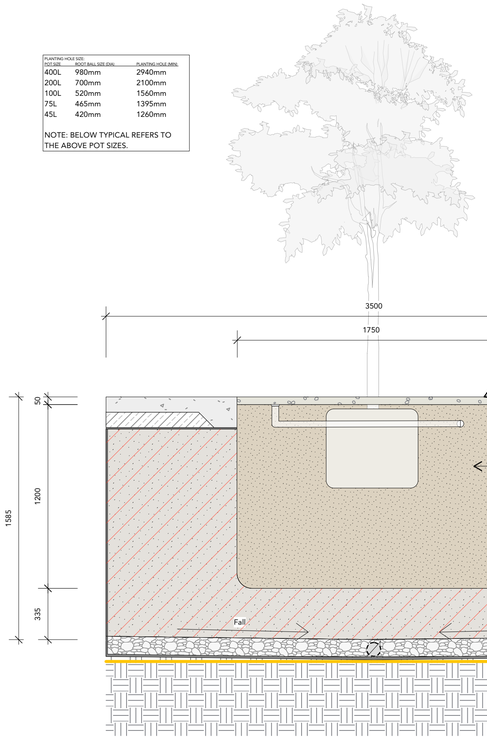


NOTES:
1. TREES SHALL HAVE A WELL DEVELOPED TAPER AND BE SELF SUPPORTING.
2. SPECIFIED TREE TO MEET THE REQUIREMENTS OF AS 2303.2018 "TREE STOCK FOR LANDSCAPE USE"
3. ENSURE ALL LABELS, WIRES, TWINE AND OTHER BINDING MATERIALS ARE REMOVED FROM PLANTING MATERIAL, INCLUDING ROOTBALLS PRIOR TO BACKFILLING.
4. TO PROMOTE LATERAL ROOT GROWTH THE PLANTING HOLE SHALL BE NO LESS THAT THREE (3) TIMES THE DIAMETER OF THE ROOT BALL. IF SPACE RESTRICTIONS EXIST STAKE SPACING SHALL BE REDUDED TO NO LESS THAN TWO (2) TIMES TH DIAMETER OF THE ROOT BALL. SLOPE ALL SIDES AT 45 DEGREES.
5. WATER IMMEDIATELY FOLLOWING PLANTING, SAUCER TO BE FILLED TWICE
6. SITE TO BE LEFT CLEAN AND TIDY ON COMPLETION OF PLANTING, REMOVE WEEDS AND BUILDING SPOIL FROM TREE PLANTING ZONE.
7. REFER SPECIFICATION FOR ALL TREE PLANTING.

6 TREE PLANTING - SOAK GARDEN
Scale: 1:20

PLANTING HOLE SIZE:		
POT SIZE	ROOT BALL SIZE (DIA)	PLANTING HOLE (MIN)
400L	980mm	2940mm
200L	700mm	2100mm
100L	520mm	1560mm
75L	465mm	1395mm
45L	420mm	1260mm

NOTE: BELOW TYPICAL REFERS TO THE ABOVE POT SIZES.



7 TREE PLANTING - CUT OUT IN PAVING
Scale: 1:20

OCULUS
REALM studios

0 1 2 3 4 5
1:100 @ A1
1:200 @ A3

NOTFORCONSTRUCTION

DRAWING
SOFT AND HARD LANDSCAPE DETAILS

PROJECT
MACQUARIE POINT STADIUM

DRAWING NO. SHEET 11
SCALE @ A1 1:250

Appendix I

Change Register

Appendix I Change Register

Any change or modification to the SEMP, or activities or designs which do not conform to the SEMP, but include suitable management of any environmental risks which has been reviewed and accepted by a suitably qualified and experienced Contaminated Land Auditor, should be recorded on **Table I1** below, and evidence of review and Contaminated Land Auditor acceptance should be added to this Appendix.

The change register should be reviewed as part of the regular SEMP review and update process (**Section 5.4**) and incorporated as appropriate into any updates of the SEMP.

Table I1 Change Register

#	Change	Person who conducted update or change		Record of Contaminated Land Auditor Review and Acceptance	
		Who	Date	Who	Date
1	Issue of SEMP Revision 5 with initial change register attached. Changes from Revision 4 made to: • Incorporate outcomes of *Review of Site Suitability Statements* (AECOM, 2026a). • Inclusion of Change Register • Changes to body text for design variances (**Section 1.2**).	Robert Crowe Associate Director – Environment, AECOM Australia Pty Ltd	16 February 2026	David Lam Contaminated Land Auditor accredited by the Director of EPA under Section 39(F) of the *Macquarie Point Development Corporation Act 2012*, TetraTech Coffey Pty Ltd	16 February 2026
2	Issue of SEMP Revision 6. Updates: • Outcomes of *Acid Sulfate Soil Investigation* (AECOM, 2025d) added. • Additional data on tested hydraulic conductivity added • Outcomes of *The Precinct South - CUTEP Report* (AECOM, 2026b) added • Planning controls for future management of ISS-treated material added • Appendix H – Unexpected Discovery Plan – Aboriginal Artefacts and Relics and Appendix J – Asbestos have been removed from the SEMP. Reference to the Corporation's separate procedures, which must be made available and complied with by anyone undertaking intrusive works, has been added to the relevant sections of the SEMP. • Minor wording changes made.	Robert Crowe Associate Director – Environment, AECOM Australia Pty Ltd	10 April 2026	David Lam Contaminated Land Auditor accredited by the Director of EPA under Section 39(F) of the *Macquarie Point Development Corporation Act 2012*, TetraTech Coffey Pty Ltd	16 February 2026

#	Change	Person who conducted update or change		Record of Contaminated Land Auditor Review and Acceptance	
		Who	Date	Who	Date
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

APPENDIX B – FACT SHEET 'REGISTER OF INTERSTATE CONTAMINATED LAND AUDITORS'

EPA TASMANIA

FACT SHEET

Register of Interstate Contaminated Land Auditors

What is the *Director, EPA's Register of Interstate Contaminated Land Auditors*? (hereafter referred to as the Register)

The Register is a listing of persons qualified to perform contaminated land audits under interstate Legislation and who have successfully applied to the Director, EPA to be included on the Register.

The purpose of the Register is to specify which persons are suitable to act as:

(a) *A person approved by the Director* under the Potentially Contaminated Land Code and thus able to certify that land is suitable for the intended use or to approve a plan to manage contamination and associated risk.
(b) A person able to provide a determination as required on a case by case basis under an Environment Protection Notice served under section 44 of the *Environmental Management and Pollution Control Act 1994* (EMPCA) or a Notice served under Part 5A of EMPCA.
(c) A person able to provide a certification under section 39F(1) of the *Macquarie Point Development Corporation Act 2012.*

Who is placed on the Register?

The Director, EPA determines the requirements for inclusion on the Register.

Principally an applicant must be accredited as a contaminated land auditor under one of the following:

- New South Wales – the site auditor scheme administered by the Environment Protection Authority under Part 4 of the *Contaminated Land Management Act 1997*.
- South Australia – the statutory audit system established in the *Environment Protection Act 1993* and the *Environment Protection Regulations 2009*.
- Victoria – the statutory appointment of environmental auditors established under the *Environment Protection Act 1970*.

- Western Australia – Contaminated sites auditors accredited under the *Contaminated Sites Act 2003*.

- Queensland – Contaminated Land Auditors established under the *Environmental Protection Act 1994* and the code of professional conduct.

Contaminated land auditors are highly experienced consultants accredited under legislation listed above, who are able to provide competent technical advice and increased certainty in regards to the 'sign-off' of contaminated site assessments and remediation. Clients can engage an auditor to independently review a consultant's reports on assessment, remediation and validation work to ensure that the consultant's methodology and interpretation of data are consistent with current regulations and EPA-endorsed guidelines.

An auditor wishing to apply for inclusion on the Register should send their request to the Director, EPA and specify the details of their current accreditation including any disciplinary action they may be subject to. EPA requests that only auditors prepared to undertake such work in Tasmania apply.

What is a contaminated land audit and a Contaminated Land Audit Report?

A contaminated land audit is a formal evaluation of the environmental condition of a described site (generally one or more Land Titles) in terms of risks to human health and/or the environment associated with the presence of soil or groundwater contamination. Each jurisdiction may use different terminology in regards to this audit process but technical requirements are generally consistent. The conduct of a contaminated land audit will result in a Contaminated Land Audit Report. Such a report comprises an unambiguous determination, written and signed by the registered auditor, which describes the suitability of the site for specific uses. Where appropriate, the Contaminated Land Audit Report will describe any management conditions that must be applied to ensure ongoing suitability for certain site uses, and any uses for which the site is unsuitable.

As part of the auditing process an auditor may, as appropriate, provide written endorsement of plans for remediation and/or management of sites, prior to the final determination of site suitability. Such endorsements may provide greater certainty for stakeholders in relation to the likely requirements for, and outcomes of, on-site works. However, auditors cannot guarantee remediation outcomes, and will only be able to provide formal determination of site suitability for specified uses in a final Contaminated Land Audit Report once remediation and validation are completed, and it is confirmed that no additional remediation is necessary for the proposed uses. Where a site is not remediated such that it is suitable for the proposed uses, but a formal Audit Report is nonetheless required, an auditor may complete a Contaminated Land Audit Report that describes the issues that prevent the use of the site until remediated, and a general description of the anticipated remediation requirements for the site to be made suitable.

Do auditors need to register before undertaking audits in Tasmania?

Yes. Should a client wish to contract an auditor who is not on the Register but does comply with the principal requirement above it will be a simple matter of sending in a request for the

auditor's inclusion and this can be addressed expediently by EPA, subject to the Director, EPA determining the suitability of the candidate auditor.

What starts the process of a contaminated land audit?

A person may choose to commission an Audit Report where they plan to redevelop a site and a determination by a person approved by the Director, EPA is a requirement under the Acceptable Solution in the Planning Code. Specific site legislation (i.e. the *Macquarie Point Development Corporation Act 2012*) or Notices served under EMPCA may also require the use of an auditor approved by the Director.

Who engages the auditor and how are they chosen?

The contaminated land auditor is normally engaged by the person commissioning the contaminated land assessment work. The client should firstly refer to the Register to determine auditors that have expressed interest in Tasmanian auditing work. When contacting an auditor, clients should confirm that the accreditation remains current in their accrediting State. Other auditors may also be contacted, but they would need to successfully apply for inclusion on the Register to be able to conduct auditing work in Tasmania.

Are there fees, and what is the process, to be placed on the Register?

No, there are no fees. The EPA Division requires an "expression of interest" from an auditor to work in Tasmania, to be considered for inclusion on the Register. This request should be made in writing to the Director and include details of the auditor's accreditation including whether any conditions are in place in relation to their accreditation or whether the auditor is subject to any disciplinary action in any State in which they are accredited. If the accreditation is appropriate, inclusion on the list is expedited.

Do I need an Auditor Insurance Certificate to conduct audits in Tasmania?

Yes. The Auditor Insurance Certificate needs to specifically cover audits carried out in Tasmania. Proof of such insurance must be provided to the EPA on request.

Do auditors have to comply with Jurisdictional Guidelines of the State where they hold their primary accreditation?

Auditors must comply with the technical standards and practices that relate to conducting an audit as detailed in the legislation, mandatory guidelines and Codes of Practice that apply to them in the State/s in which they hold appropriate accreditation. Auditors must comply with the standards expressed in the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, which is a State Policy in Tasmania. Where a policy matter seems ambiguous, a determination from the Director, EPA may be requested and the auditor must comply with Director's determination.

Does an auditor have to notify the EPA Division if he or she has been requested to undertake a contaminated land audit?

Yes, but only where this audit is being conducted in response to a regulatory instrument i.e. an Environment Protection Notice or a Notice served under Part 5A of EMPCA or where the audit is being conducted under the *Macquarie Point Development Corporation Act 2012.* Audits being conducted to satisfy planning requirements do not need to be notified to the EPA Division.

The Director requests that an auditor notifies EPA within 2 weeks of being commissioned to undertake an audit, with the details of the site address, client and reason for the audit. Removal from the Director's Register may occur if this request is not complied with.

Does an auditor have to supply the EPA Division with an Audit Report?

Only reports required by a regulatory instrument (as outlined above) should be submitted to the EPA. Audits being conducted to satisfy planning requirements should not be submitted to the EPA.

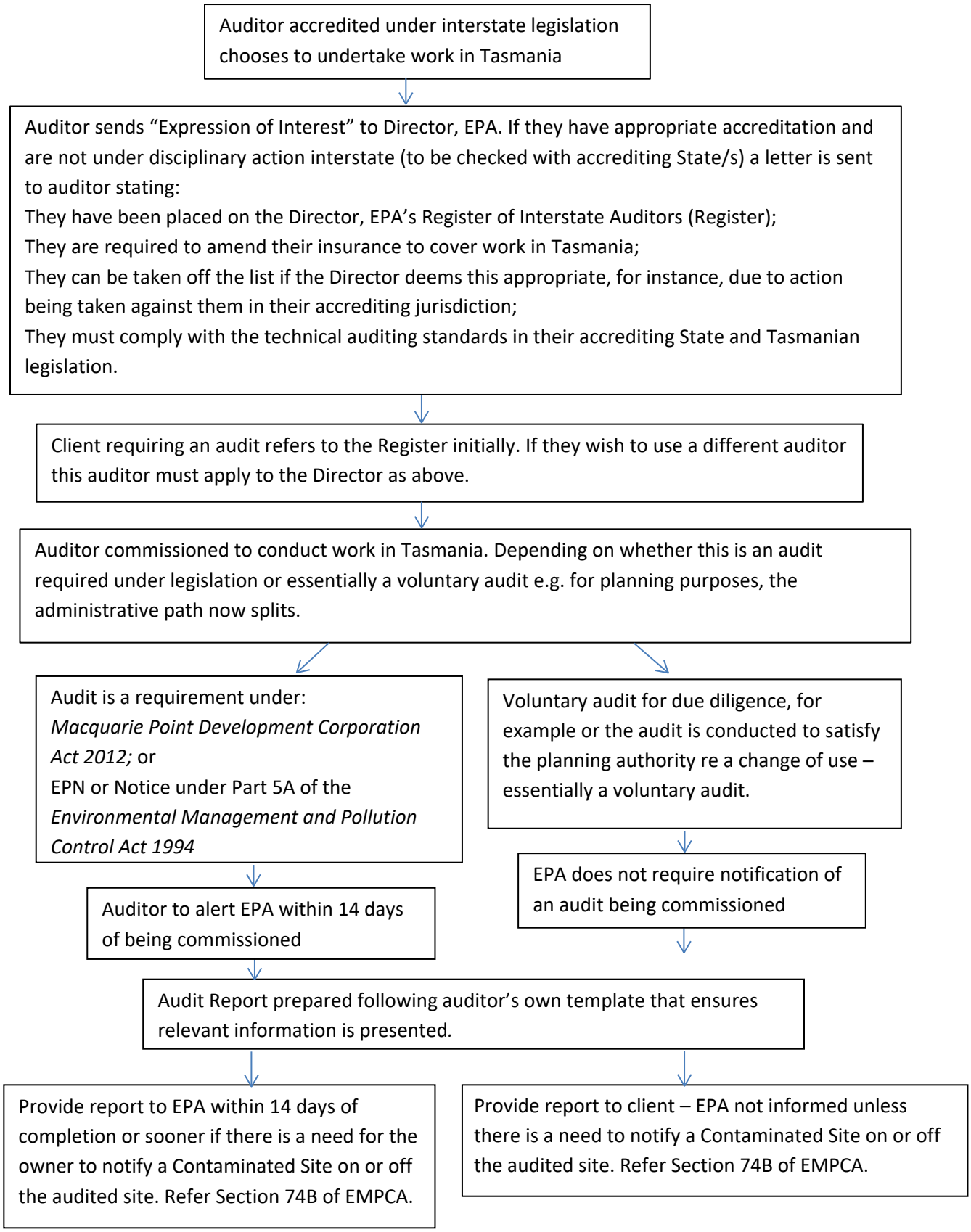
What will EPA Division do with Audit Reports?

Reports submitted to satisfy specific Notice conditions will be reviewed by the EPA Division to determine whether the conditions in the Notice have been satisfied.

Are there procedures for disciplinary action for auditors providing false information?

The accrediting state would be provided with information in relation to such matters and would include this in their reviews of the auditor.

The Director, EPA may remove any person from the Register where this is reasonable, including where an auditor fails to comply with relevant technical guidance or legislation, where the auditor's accreditation is under review in the accrediting State or where such accreditation is no longer current. The *Macquarie Point Development Corporation Act 2012,* Section 39F (6), also specifies that the Director may revoke accreditation if the person fails to comply with any conditions of their accreditation.

Where information has been provided under legislation (i.e. an Environment Protection Notice or a Notice served under Part 5A of EMPCA) there are penalties for false and misleading statements (section 43A of EMPCA).

Flowchart: Administrative Process for conducting a contaminated land audit in Tasmania