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

# Site Environment Management Plan

## Macquarie Point Development Project

29-May-2026
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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

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Prepared by Robert Crowe

Reviewed by Paul Carstairs

Revision History

| Rev | Revision Date | Details | Authorised | |
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| | | | Name/Position | Signature |
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| 7 | 29-May-2026 | Updated Final | Robert Crowe Associate 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 I**; 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 I** 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.

For development activities at the Site undertaken under the *State Policies and Projects (Macquarie Point Precinct) Order 2025* (the Order), CEMPs must be prepared in accordance with the SEMP and with the most recent version of the procedures and methodologies within the Corporation's Construction Environmental Management Plan Standard (MPMS-MPDC-MP-ES-05-01).

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 Macquarie Point Development Corporation - Construction Management Plan Standard

Development of the Site is planned to be undertaken in accordance with the *Mac Point Precinct Plan* (the Precinct Plan) (MPDC, 2024), as described in **Section 2.3**. Approval for the Site's development is provided by and must be conducted in accordance with the *State Policies and Projects (Macquarie Point Precinct) Order 2025* (the Order), approved by the Tasmanian House of Assembly on 13 November 2025 and by the Tasmanian Legislative Council on 4 December 2025. The Order has been in force since 4 December 2025.

To support compliance with the Order during development, the Corporation has developed a Construction Environment Management Plan Standard which consists of specific sub-plans and procedures to be followed by Corporation staff, contractors and consultants undertaking work to develop the Site in accordance with the Precinct Plan and the Order. The Construction Environment Management Plan Standard shall be used:

- For any preparatory works undertaken, as defined by Clause B1 of the Order; and
- For preparation of any CEMPs as required by the Order.

In addition, the following documents and procedures from the Construction Management Plan Standard are referenced in the SEMP and **apply to all works** undertaken at the Site. The most recent issue of each document should be provided by the Site owner/occupier and complied with 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.<br>• Manage and/or enforce the SEMP for Site occupiers/ contractors undertaking subsurface works.<br>• Implement and complete corrective actions as required.<br>• Complete and keep up to date all necessary registers and records as required in the SEMP.<br>• Undertake reviews and revision of the SEMP every three years (or more frequently, as deemed appropriate based on-Site activities or changes).<br>• Review evidence of compliance to this SEMP every three years (or more frequently, as deemed appropriate).<br>• Undertake visual inspections of existing controls, such as hardstand areas every three years.<br>• Review and revise the SEMP to reflect changes that occur at the Site.<br>• 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.<br>• Complete all necessary registers and records as required in the SEMP.<br>• Complete all activities at the Site in a safe and environmentally responsible manner.<br>• 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.<br>• 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<br>*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<br>*Addendum to Contaminated Land Audit - Macquarie Point - Audit Area 4 West (The Escarpment)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026 |
| 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<br>*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<br>*Addendum to Contaminated Land Audit -Macquarie Point – Lot B (The Precinct North)*, issued by Tetra Tech Coffey Pty Ltd on 17 February 2026 |
| The Precinct South | 1.40 | *Contaminated Land Audit Report – Macquarie Point Development Project – The Precinct South*, issued by Tetra Tech Coffey Pty Ltd on 22 April 2026 |
| **Site Suitability Statement Not Yet Issued** | | |
| 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.<br>No remaining remediation actions have been identified. The existing Gateway DSI (AECOM, 2024a) has been 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.<br>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. |

| Site Area | Approx. Area (ha) | Contaminated Land Audit Reports or Remaining Actions and Activities |
|---|---|---|
| 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.<br><br>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. |
| 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**).<br><br>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:<br>• 179192/2, consisting of land against the northern border of the Site below the Hobart Cenotaph.<br>• 179192/3, consisting of southern portion of the Site.<br>• 179192/4, consisting of land previously proposed for development as a road/transport corridor between 17919/2 and 17919/3.<br>• 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.<br>• 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:<br>• Commercial and Institutional<br>• Mixed Use<br>• Open Space. |

| Item | Description |
|---|---|
| Current Uses | The following is noted with regard to current Macquarie Point use and features:<br>• 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.<br>• The Goods Shed, a heritage building, is located on the southern boundary of the Site and is subject to intermittent uses including public events.<br>• An office building (8A Evans Street) is located on the western boundary of Macquarie Point and is occupied by the Corporation.<br>• The "Red Shed", located in the south eastern portion of Macquarie Point, is currently used by a microbrewer and includes a public bar.<br>• 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.<br>• 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.<br>• A public car park is present in the south eastern and eastern portion of Macquarie Point.<br>• 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)<br>• 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.<br>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:<br>• Department of Natural Resources and Environment Tasmania (DNRET) Property Services (Potential Property ID 2513934), under Crown lease<br>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:<br>• Commercial<br>• Mixed Use<br>• Open Space |

| Item | Description |
|---|---|
| Current Uses | The following is noted with regard to current Regatta Point use and features:<br>• 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.<br>• 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.<br>• A small two-storey building of unknown use is in this area.<br>• 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.<br>• Sullivans Cove is located approximately 560 m to the south at the closest point.<br>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).<br>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:<br>• Commercial and Institutional<br>• Mixed Use<br>• Open Space.<br>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.<br>• 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.<br>• 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.<br>• 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.

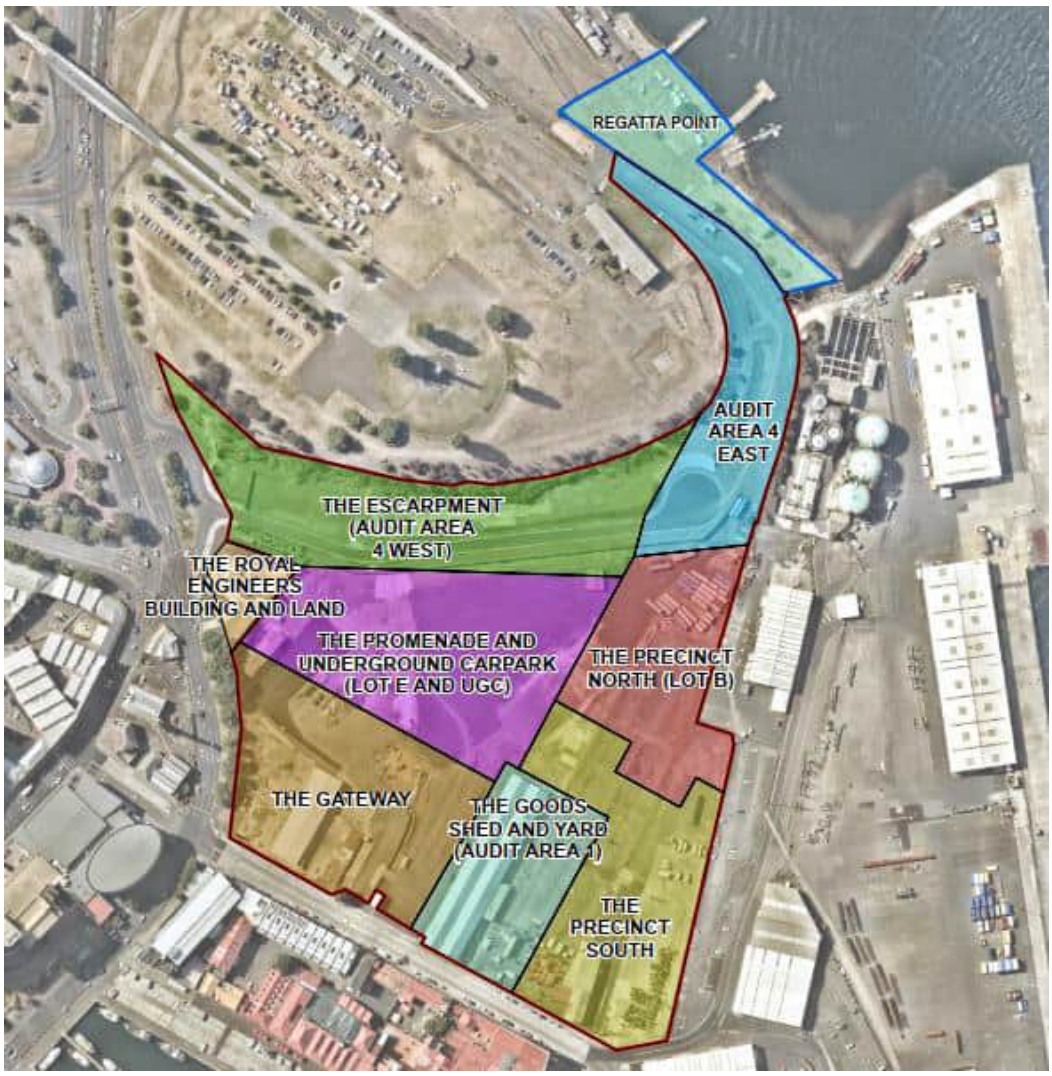


**Figure 1 Site Areas**

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**.

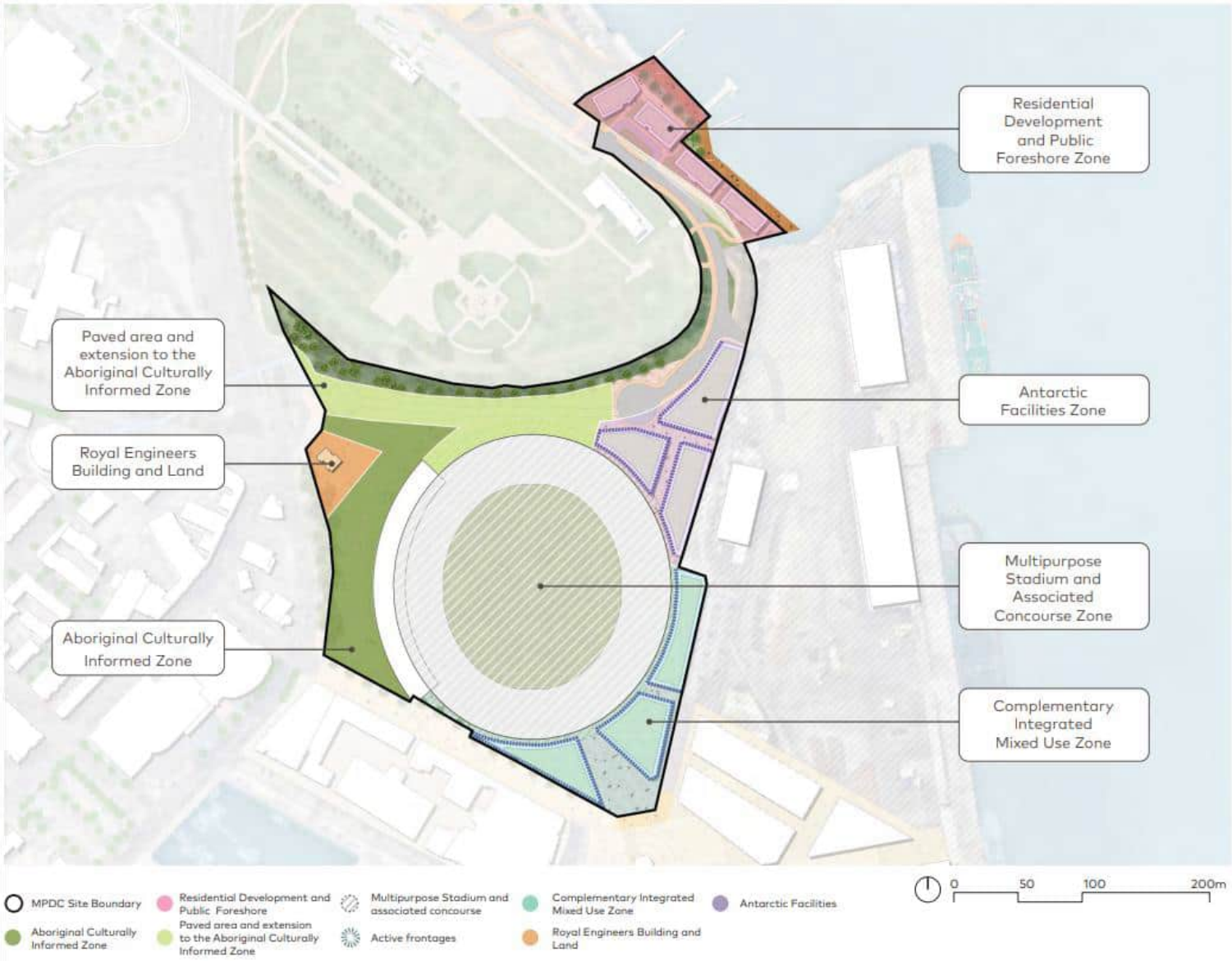


**Figure 2 Mac Point Precinct Plan (MPDC, 2024)**

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.<br>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.<br>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.<br>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.<br>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.<br>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**.<br>• Six USTs were located or suspected to have been historically located to the west of the Goods Shed.<br>- 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.<br>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.<br>No record of the installation or removal of USTs in this area have been identified, however it is considered unlikely that they are present.<br>- UST 6 was excavated and removed in 2019 (AECOM, 2019b), and is confirmed as no longer present on the Site.<br>• 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.<br>• 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.<br>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**.<br>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).<br>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.<br>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.<br>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.<br>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.<br>Engineers Jetty: Constructed on the historical outer edge of the former slaughter yard.<br>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.<br>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).<br>Soil with lead impacts is known to be present within the exclusion zone.<br>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.<br>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**.<br>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.<br>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)**

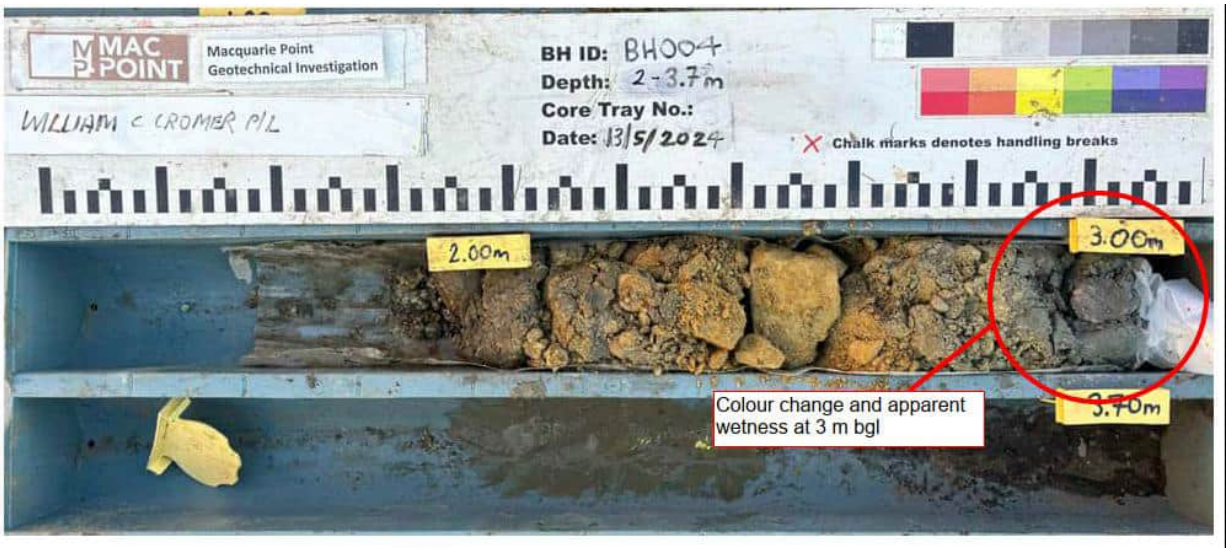


**Plate 2** **PASS Type 2 - Intermittently saturated soil at the water table (BH-004 - Core Log at 2 to 3.7 m bgl) (AECOM, 2025d)**

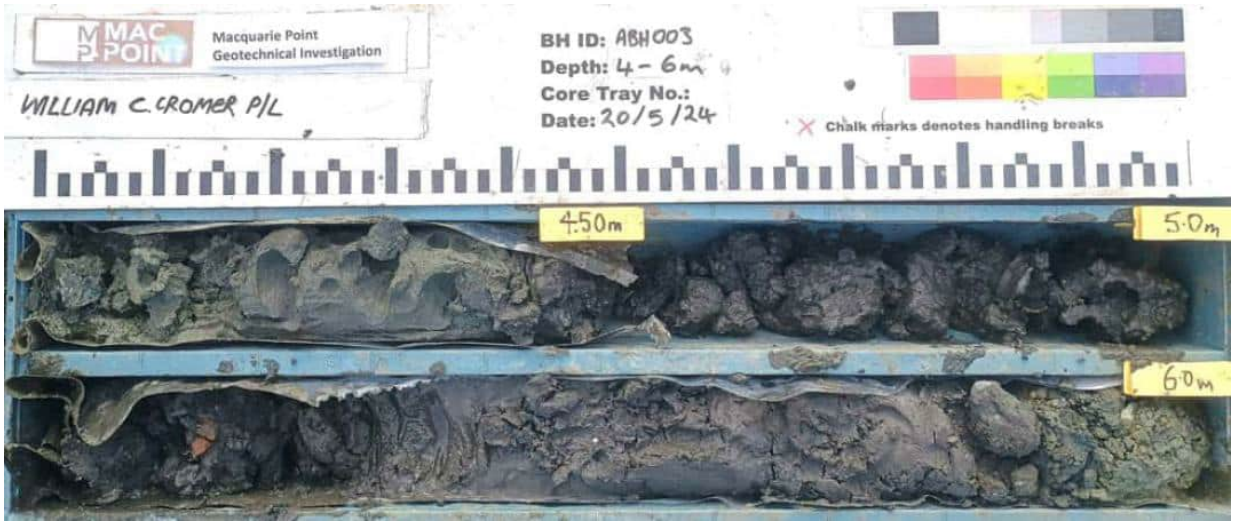


**Plate 3** **PASS Type 2 and Type 3 - Saturated soil below the water table (ABH-003 - core log 4 to 6 m bgl) (AECOM, 2025d)**

## 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 | $5.3 \times 10^{-3}$ | 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<br>• Vehicle Maintenance.<br>• Fuel Storage and Handling<br>• Land Reclamation | • TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities.<br>• Chlorinated solvents associated with vehicle maintenance activities.<br>• 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<br>• Railway maintenance workshop<br>• Rail corridor and fuel transfer infrastructure historically located within the area<br>• Concrete batching plant<br>• Land reclamation | • TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities.<br>• Chlorinated solvents associated with locomotive maintenance activities and the storage of hazardous materials.<br>• Heavy metals, chlorinated solvents and hydrocarbons associated with workshop and maintenance areas.<br>• Phosphorus and sulphur associated with locomotive washing.<br>• ACM sourced from historical structures (i.e. cladding).<br>• Hydrocarbons associated with the truck wash.<br>• Heavy metals, chlorinated solvents and hydrocarbons sourced from the historical incineration of paint/ solvents.<br>• 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.<br>• Locomotive maintenance.<br>• Freight storage and handling.<br>• Land reclamation | • TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel (diesel) storage and transfer activities.<br>• LNAPL has been detected on groundwater.<br>• Chlorinated solvents associated with locomotive maintenance activities.<br>• Heavy metals, asbestos and PAHs sourced from materials used to backfill Roundhouse structures.<br>• 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.<br>• Fuel storage and handing<br>• Land reclamation | • TPHs, BTEXN, PAHs, and phenolic compounds associated with historical fuel (diesel) storage and transfer activities.<br>• Chlorinated solvents associated with locomotive maintenance activities.<br>• LNAPL has been detected on groundwater.<br>• Metals[1] inferred to be due to historic land reclamation have been detected in fill.<br>• PFAS associated with bulk off-Site fuel handing[2] |
| The Precinct South | • Freight storage and handling.<br>• Fuel storage and handling<br>• 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.<br>• LNAPL has been detected on groundwater.<br>• Metals[1] inferred to be due to historic land reclamation have been detected in fill.<br>• 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.<br>• Locomotive refuelling comprising fuel storage and transfer facilities.<br>• Railway maintenance workshop.<br>• Land reclamation | • TPHs, PAHs, BTEXN and phenols sourced from coal tar and tar oils, or from historical fuel storage and transfer activities.<br>• Heavy metals, chlorinated solvents and hydrocarbons associated with workshop and maintenance areas.<br>• Phosphorus and sulphur associated with locomotive washing.<br>• ACM sourced from historical structures (i.e. cladding).<br>• Chlorinated solvents associated with locomotive maintenance activities and the storage of hazardous materials.<br>• Complex cyanides, free cyanides and metals sourced from spent oxides.<br>• TPHs, PAHs and metals sourced from coke, coke breeze, ash and clinker residues.<br>• TPHs and BTEX associated with light and drip oils.<br>• DNAPL has been detected in soil.<br>• Phenols, nitrates, sulphates, sulphides, ammonia and PAHs sourced from ammoniacal recovery wastes.<br>• 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.<br>• Land reclamation | • TPHs, BTEXN, PAHs and phenolic compounds associated with historical fuel storage and transfer activities.<br>• Buried ACM has been identified in a section of Audit Area 4 East and is currently temporally capped with a concrete layer.<br>• Metals[1] inferred to be due to historic land reclamation have been detected in fill |
| Regatta Point | • Public boating, yachting, and port activities.<br>• Rail corridor<br>• Fuel pipeline<br>• Land reclamation<br>• 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.<br>• 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.<br>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.<br>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.<br>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:<br>• On the eastern site boundary<br>• In the soil surrounding the Main Hobart Sewer line<br>• In some soil locations at depths which are anticipated to be removed by Site development.<br>• In one location (N10), lead impacted soil may be present at the base of the excavation following development.<br>• 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:<br>• 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.<br>• In some soil locations at depths which are anticipated to be removed by Site development.<br>• 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.<br>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:<br>• In some soil locations at depths which are anticipated to be removed by Site development.<br>• At depths >2 m below the current Site surface elevation.<br>• 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 groundwater 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.<br>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.<br>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<br>• Proposed structures extending beyond the boundaries of this area introduce vapour risks.<br>• 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.<br>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.<br>• Proposed structures extending beyond the boundaries of this area introduce vapour risks.<br>• 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.<br>• No methane concentrations above criteria have been detected in groundwater in this area. | Yes under the following conditions:<br>- Groundwater present ≤1 m below the bottom of building slabs or any other structural voids.<br>- 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.<br>• Proposed structures extending beyond the boundaries of this area introduce vapour risks.<br>• 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.<br>• Proposed structures extending beyond the boundaries of this area introduce vapour risks.<br>• 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.<br>• Proposed structures extending beyond the boundaries of this area introduce vapour risks.<br>• 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.<br>• 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).
- The *State Policies and Projects (Macquarie Point Precinct) Order 2025* (the Order).

In addition to the measures discussed in **Sections 4.2** to **4.14,** any Site activities conducted under the Order must comply with the most recent version of the Corporation's Construction Environmental Management Plan Standard (MPMS-MPDC-MP-ES-05-01).

## 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).
- Concentrations of sulfate (as $SO_4$) and chloride in groundwater in excess of criteria from Australian Standard 2159-2009 Piling – Design and Installation have been detected in or adjacent to the southern boundary of the Site along Evans street and eastern boundary of the Site near the Waste Water Treatment Plan, and on Regatta Point, and may indicate potential saline intrusion in groundwater. Design construction materials should consider the need to account for possible saline intrusion for any materials potentially in contact with groundwater on or near the southern and eastern boundaries of the Site and on Regatta Point.
- 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**.

- Any Preparatory Works, as defined in Clause B1 of the Order, conducted at the Site must include regular assessment of the changes to the Site condition which result and how they may affect the design and operation of the final development of the Site. The outcomes and any findings of Preparatory Works must be communicated to the persons developing the detailed design, including:

  - Any previously unknown areas of contamination or substantial buried structures identified; or
  - Any potential preferential pathways for groundwater, LNAPL, or vapour flow which may be created; or
  - Any new structures installed, or any modification (such as removal, relocation, or damage) to existing structures.

    Existing structures which should be considered include Site buildings, pipelines, services, conduits, and buried structures such as solidified gasworks waste (**Section 3.4**); or
  - Any other changes which arise from Preparatory Works which are considered to have potential to affect the detailed design and development of the Site.

  Changes will be assessed against the requirements of the current SEMP and Site Suitability Statements by the suitably qualified and experienced environmental professional in accordance with the MPDC accepted Change Management Process. Where the change is assessed to materially impact on requirements of the SEMP and/or SSS, the Contaminated Land Auditor will be consulted and approval sought as required.

## 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 |

| Measure or System Element | Score | Comments |
|---|---|---|
| Reinforced concrete ground-bearing foundation raft slab with limited service penetrations cast into slab | 1.0 | pressure. Breaches in floor slabs, such as joints, have to be effectively sealed against gas ingress to maintain performance |
| 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 |
| **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.<br>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)<br>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).<br>It is noted that this sewer line is being realigned off-Site, and is expected to be removed as part of Site development. |
| Telecommunication Cables<br>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.<br>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.<br>Assets are owned by TasNetworks | 3 m around the HV cable<br>0.5 m around the LV cable<br>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.<br>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**.

The nature and extent of the find should be reviewed by a suitably qualified environmental professional against the Site information considered in the Contaminated Land Audit Reports are the outcomes of the Environmental Audit (**Section 1.6**).

If the find has the potential to materially alter the conditions considered as part of any determination that the Site is suitable for the proposed development or land use, advice should be sought from a Contaminated Land Auditor, certified under Section 39(F) of the *Macquarie Point Corporation Act 2012*, to determine if the Contaminated Land Audit outcomes and Site Suitability Statement remain valid.

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/or Dewatering Management Plan (DWMP), or equivalent documents, 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<br>(Contaminated Soil for Remediation) | • On-Site remediation<br>• Off-Site remediation<br>• Storage pending availability of treatment | • No direct disposal to landfill<br>• EPA Environmental Approval and transport certificates must be used<br>• Vehicles must hold EPA permit (unless exemption issued) |
| Level 3<br>(Contaminated Soil) | • On-Site remediation<br>• Off-Site remediation<br>• Licensed landfill | • Disposal to licensed facility<br>• EPA Environmental Approval and transport certificate system must be used<br>• Vehicles must hold EPA permit (unless exemption issued) |
| Level 2<br>(Low Level Contaminated Soil) | • On-Site remediation<br>• Off-Site remediation<br>• Licensed landfill | • Disposal to licensed landfill<br>• EPA Environmental Approval and transport certificate system must be used<br>• Vehicles must hold EPA permit (unless exemption issued) |
| Level 1<br>(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 contains a requirement that, if not previously notified, occupiers of off-Site land must be informed of:

- Any potential risks arising from the Site and identified from groundwater data; and
- Any assumptions on groundwater use by off-Site occupiers which forms part of the assessment of Site groundwater data and risks.

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 I**. 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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Tasmanian Government *Environmental Management and Pollution Control (Waste Management) Regulations 2020*

Tasmanian Government *Environmental Protection Policy (Noise) 2009*

Tasmanian Government *Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2016*

Tasmanian Government (2012) *Macquarie Point Development Corporation Act* (Updated on 2 December 2020)

TPC (2017), *Tasmanian Planning Scheme – State Planning Provisions*, Tasmanian Planning Commission, 2 March 2017, last updated 11 September 2025

TPC (2025), *Hobart Local Provisions Schedule*, Tasmanian Planning Commission, 22 October 2025

TasWater (2017), *Guidelines for Building near Sewer or Water Pipelines, Version 2.0*, TasWater, 28 March 2017

Victorian State Government (2017) *Environment Protection Act 2017*

# 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 29-May-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.

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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

## List of Attached Figures

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PROJECT ID 60321835
CREATED BY PK
LAST MODIFIED PK 15 JAN 2024

AECOM
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DATUM GDA 1994, PROJECTION MGA ZONE 55

0 100 200 400
metres

1:10,000 (when printed at A3)

## LEGEND

- Regatta Grounds Boundary
- Macquarie Point Site Boundary

## SITE LOCATION

**Macquarie Point Development Corporation**

*Site Environment 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\SRS_24\F1_Site_Location.mxd)

A3 size

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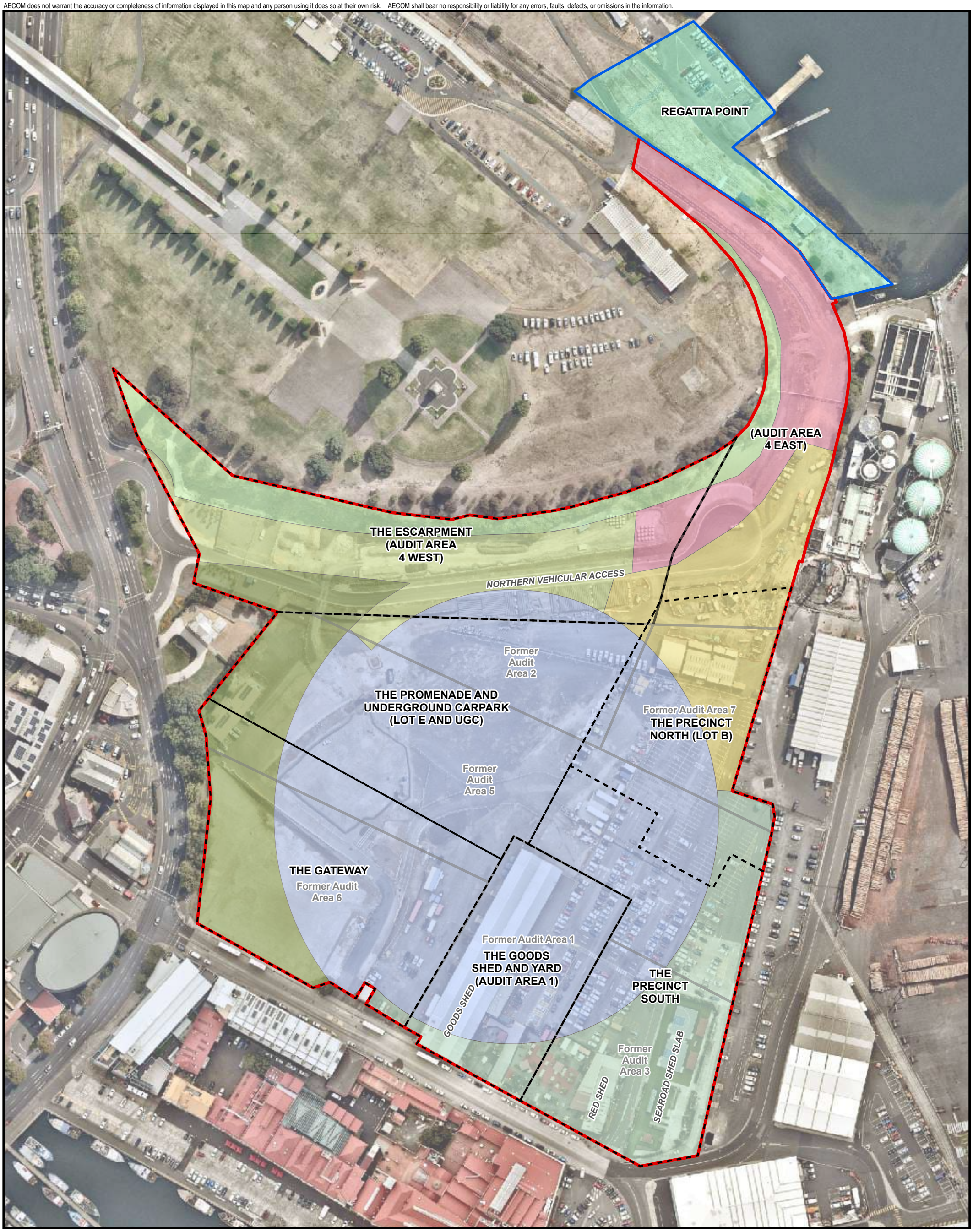


PROJECT ID 60321835
CREATED BY PK
LAST MODIFIED PK 03 Sep 2025

AECOM
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DATUM GDA 1994, PROJECTION MGA ZONE 55

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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**

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

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

PROJECT ID 60321835
CREATED BY PK
LAST MODIFIED PK 31 Jul 2025

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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**

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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PROJECT ID 60321835
CREATED BY PK
LAST MODIFIED PK 12 Aug 2025

AECOM
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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

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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HOBART RIVULET DIVERSION
(AUDIT AREA 4 EAST)
NORTHERN VEHICULAR ACCESS
THE ESCARPMENT (AUDIT AREA 4 WEST)
THE ROYAL ENGINEERS BUILDING AND LAND
A1
LNAPL Plume A1
THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)
Former LNAPL Plume A3
THE PRECINCT NORTH (LOT B)
A2
LNAPL Plume A2
Tar Plume D
Tar Plume C
Tar Plume A
Tar Plume B
THE GATEWAY
THE GOODS SHED AND YARD (AUDIT AREA 1)
GOODS SHED
THE PRECINCT SOUTH
SEAROAD SHED SLAB
RED SHED
FORMER HOBART RIVULET
B
LNAPL Plume B

PROJECT ID 60321835
CREATED BY PK
LAST MODIFIED PK 30 Sep 2025

AECOM
www.aecom.com

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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 | | | | |
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# SEMP Induction Form

| Date | Name | Company | Position/ Responsibility | Contact No. | Signature |
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# Appendix C

## Area Specific Contamination Fact Sheets

# Macquarie Point Site Environment Management Plan

# Area Specific Contamination Fact Sheets

## Table of Contents

**Tables in Text**



**Plates in Text**

# 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.

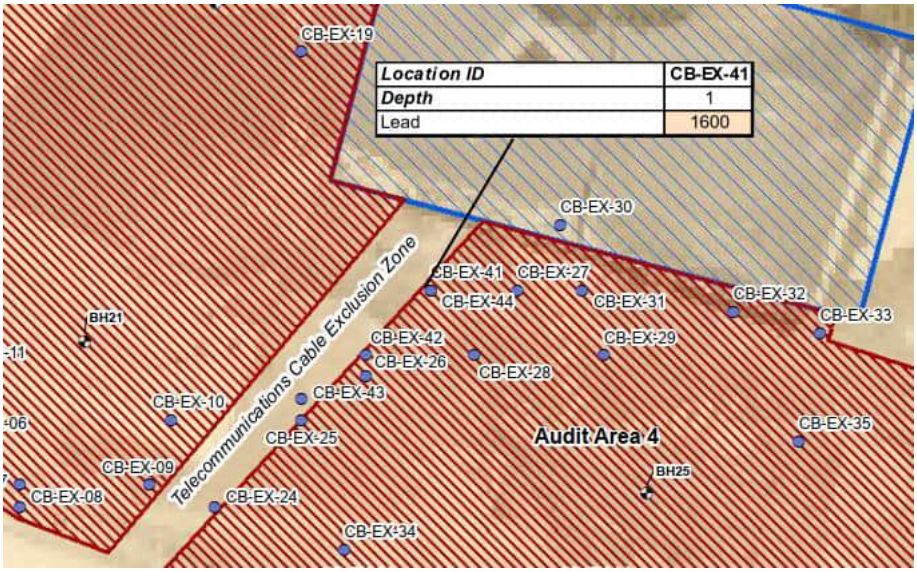


**Plate 1 Location of lead in soil detection in telecommunication cable exclusion zone**

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.

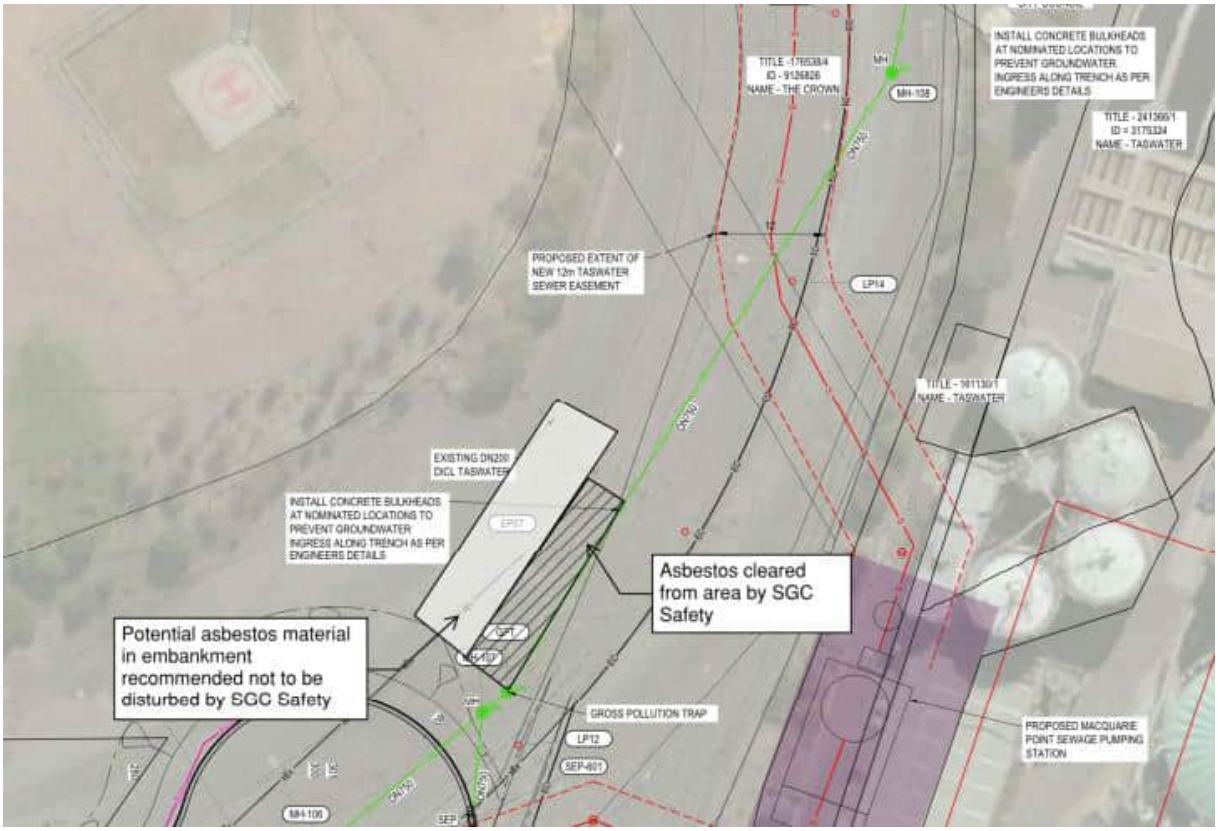


**Plate 3 Audit Area 4 East - Area of ACM Encountered**

## 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 |

# 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 South 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 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.

# 6.0 The Gateway Contamination Summary

Historical activities undertaken within Gateway have resulted in the presence of residual contamination within soil and groundwater. Multiple phases of soil, groundwater, dense non-aqueous phase liquid (DNAPL) 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, DNAPL and soil vapour impacts at the Gateway area.

Soil, groundwater and DNAPL remediation works have been undertaken in or adjacent to this area, as discussed in the *Remediation Validation Report – The Gateway* (AECOM, 2025b)

No further remediation of the Precinct South is planned or considered required at this time.

## 6.1 Identified Soil Impacts

Investigations within the Gateway have identified heterogeneous fill materials up to 10.4 m bgl overlaying a natural sand layer. Fill material beneath the Gateway has been described as generally containing a combination of clays, sands, gravels, cobbles (ranging from 100 mm to 300 mm in size, with larger cobbles and boulders encountered) and bricks. Black staining and odours consistent with gasworks uses were also encountered in fill material at locations between 0.1 to 8.3 m bgl.

The Gateway is underlain by dolerite bedrock. It is noted that the depth to bedrock has ranged from approximately 2.3 m bgl in the western portion of the Gateway area, to approximately 24 m bgl in the eastern portion of the former Cold Store footprint. Based on a review of available historical information, this variable depth to bedrock appears to correlate with the original shoreline (Austral, 2013).

The PEVs for Maintenance of Land Dependant Ecosystems and Species, Human Health, and Aesthetics are precluded based on detected soil concentrations of metals, cyanide (total), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (MAHs), and polychlorinated biphenyls (PCBs), and on observations of soil with aesthetic impacts during assessment programs.

Residual concentrations of contaminants in soil are known to be present in the Gateway in excess of the Site-derived RC for the following uses:

- Commercial / Light Industrial Workers (via potential vapour intrusion):
  - TRH – C6-C10 (minus BTEX), >C10-C16 (minus naphthalene), >C10-C12 (aliphatic), >C8-C10 (aromatic), >C10-C12 (aromatic)
  - MAH – benzene
  - PAH – naphthalene
- Intrusive Maintenance Workers (via direct contact):
  - Metals – lead
  - PAH – benzo(a)pyrene.

Soil within the Gateway was not assessed against the RC for Residential users. Residential use is not proposed within the Gateway as part of future development, and additional assessment, and potentially additional management requirements or remediation, is required if residential use is proposed in future.

**Table 9** below provides the range of CoPC concentrations (or general CoPC groups) identified in or within 20m of the Gateway that have been reported above the adopted Tier 1 criteria and Site Derived RC.

**Table 11 Summary of Soil Analytical Results – The Gateway**

| CoPC | Minimum Concentration (mg/kg) | Maximum Concentration (mg/kg) |
|---|---|---|
| Arsenic | <2 | 170 |

| CoPC | Minimum Concentration (mg/kg) | Maximum Concentration (mg/kg) |
|---|---|---|
| Chromium | <2 | 530 |
| Copper | <5 | 2,280 |
| Lead | <5 | 7,270 |
| Nickel | <2 | 250 |
| Zinc | <2 | 5,000 |
| TRH $C_6$-$C_{10}$ | <10 | 1,370 |
| TRH >$C_{10}$-$C_{16}$ | <50 | 10,800 |
| TRH >$C_{16}$-$C_{34}$ | <100 | 28,000 |
| TRH >$C_{34}$-$C_{40}$ | <100 | 11,800 |
| Benzene | <0.2 | 103 |
| Toluene | <0.1 | 85.2 |
| Total Xylenes | <0.3 | 210 |
| Naphthalene | <0.005 | 1,900 |
| Benzo(a)pyrene | <0.005 | 280 |
| Benzo(a)pyrene Toxicity Equivalence Quotient (Limit of Reporting) | 0.18 | 201 |
| Sum of PAHs | <0.005 | 4,460 |
| Arochlor 1232 | <0.1 | 1.4 |
| Cyanide (total) | <1 | 480 |

Notes: TRH – Total Recoverable Hydrocarbons; PAH – Polycyclic Aromatic Hydrocarbons

### 6.1.1 Shallow Lead Impacted Soil

The presence of shallow lead-impacted soil has been identified at some locations within the Gateway area at depths <2.0 m below ground level (bgl), with some isolated impacts also noted at depths >2.0 m bgl. As a result, there is potential for Intrusive Maintenance workers within the Gateway 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 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

## 6.2 Identified Groundwater Impacts

Groundwater Monitoring Events (GMEs) have been routinely conducted for monitoring groundwater wells located within the Gateway area since January 2015.

Based on the most recent and historic data, the PEVs for Drinking Water (health and aesthetic), Recreation (Primary / Secondary Contact), Ecosystem Protection, Irrigation, Stock Watering, Buildings and Structures, Aesthetics, and Vapour Intrusion are precluded in the Gateway based on detected groundwater concentrations of metals, TPH/TRH, MAHs, PAHs, major ions, cyanide, phenolic compounds, nutrients, anilines, *e.* coli, TDS, and phenolic compounds.

No exceedances of the Site derived RC have been detected in groundwater within the Gateway since 2018.

**Table 10** below provides a range of CoPC concentrations (or general CoPC groups) identified in or within 20 m of the Gateway area that have been reported above the adopted Tier 1 criteria.

**Table 12 Summary of Groundwater Analytical Results – The Gateway**

| CoPC | Unit | Minimum Concentration | Maximum Concentration[1] |
|---|---|---|---|
| Total Dissolved Solids | mg/L | 180 | 32,700 |
| Boron | mg/L | <0.05 | 1.42 |
| Cobalt | mg/L | <0.001 | 0.025 |
| Copper | mg/L | <0.001 | 0.036 |
| Iron | mg/L | <0.05 | 36.2 |
| Lead | mg/L | <0.001 | 0.1 |
| Manganese | mg/L | <0.005 | 8.48 |
| Zinc | mg/L | <0.001 | 0.23 |
| TRH $C_6$-$C_{10}$ (minus BTEX) | µg/L | <20 | 1,400 |
| TRH >$C_{10}$-$C_{16}$ (minus naphthalene) | µg/L | <50 | 7,250 |
| TRH >$C_{10}$-$C_{40}$ | µg/L | <100 | 9,500 |
| Benzene | µg/L | <0.5 | 1,080 |
| Toluene | µg/L | <1 | 121 |
| Ethylbenzene | µg/L | <1 | 573 |
| Total Xylenes | µg/L | <1 | 520 |
| Styrene | µg/L | <1 | 56 |
| 1,2,4-trimethylbenzene | µg/L | <1 | 96 |
| Naphthalene | µg/L | <1 | 975 |
| Anthracene | µg/L | <1 | 20.5 |
| Phenanthrene | µg/L | <1 | 52 |
| Fluoranthene | µg/L | <1 | 6.9 |

| CoPC | Unit | Minimum Concentration | Maximum Concentration[1] |
|---|---|---|---|
| 2-Methylnaphthalene | µg/L | <2 | 975 |
| Benz(a)anthracene | µg/L | <1 | 10 |
| Benzo(a)pyrene | µg/L | <0.5 | 5.9 |
| Indeno(1,2,3-c,d)pyrene | µg/L | <1 | 2.6 |
| Sum of PAHs | µg/L | <0.5 | 1,280 |
| Cyanide (Total) | | <4 | 1,500 |
| Phenol | µg/L | <1 | 600 |
| 2-methylphenol (o-cresol) | µg/L | <1 | 1,700 |
| 2,4-dimethylphenol | µg/L | <1 | 1,100 |
| Nitrate (as N) | mg/L | <0.01 | 70 |
| Ammonia (as $NH_3$) | mg/L | <0.01 | 77.5 |
| Phosphorus (total) | mg/L | 0.9 | 1.0 |
| Aniline | µg/L | <2 | 113 |
| Dibenzofuran | µg/L | <2 | 78 |
| *E. Coli* | CFU/100 mL | <1 | 18,000 |
| Perfluorooctane sulfonic acid (PFOS) | µg/L | <0.02 | 0.03 |
| Chloride | mg/L | 104 | 18,800 |
| Sodium | mg/L | 100 | 8,750 |
| Sulfate (as $SO_4$) | mg/L | <1 | 2,430 |
| Calcium | mg/L | 100 | 2,240 |

**Notes:** TRH – Total Recoverable Hydrocarbons; BTEX – Benzene, Toluene, Ethylbenzene; Xylenes; PAH – Polycyclic Aromatic Hydrocarbons; CFU – Colony Forming Units; 1. Excluding concentrations attributed to DNAPL at the sample point.

## 6.3 Identified DNAPL Impacts

Areas of “bulk” DNAPL, defined as locations where DNAPL has been observed or considered likely to be present in a continuous layer greater than 50 mm thick, have been previous identified within the Gateway, as four areas referred to as Tar Plumes A to D.

Each area is described below and shown on **Figure F5**.

- **Tar Plume A (ISS-treated)**

  Tar Plume A’s source is considered likely to be DNAPL released from the former horizontal retort/oil reformer, present at this location as part of gasworks operations, which did not migrate vertically into dolerite bedrock. 15 $m^3$ of tar impacted soil from a buried brick pit (Brick Pit 1) which

was uncovered during excavation in 2024 was also mixed and solidified as part of ISS-remediation of this plume..

On-Site tar was treated by ISS in 2024, with the exception of portions on the south and west which were located within the exclusion zone surrounding the HV power cable on the Site boundary. The ISS-treated portion of this plume now consists of an estimated 500 $m^3$ of low permeability cement/soil mixture, covering an area of approximately 220 $m^2$ and between 1 and 3 m thick. The treated material rests on top of dolerite bedrock.

Access to areas immediately off-Site to the west and south is limited by sub-surface services and the broader operation of Evans Street and Davey Street, and direct investigative bores have not been able to be advanced to off-Site directly south or west of Tar Plume A. However:

- Potential DNAPL to the west and south of the Site is considered to be sourced from, or co-sourced with, off-Site areas in these directions.

  Approximately 60% of the footprint of the horizontal retort extended off-Site to the west 35 to 40, and the oil reformer was located entirely off-Site (although the eastern edge is estimated less than 10 m from the Site boundary). The horizontal retort and oil reformer also bordered the Hobart Rivulet and may have impacted it through releases or waste disposal during operation of the gasworks. DNAPL in Tar Plume A is considered to be co-sourced both on-Site, and from off-Site areas to the west and south.

- DNAPL in this area is considered likely to be low mobility and solubility, and unlikely to extend beyond the footprints of gasworks infrastructure, as :

  - DNAPL on-Site has not been observed beyond the footprint of the horizontal retort. Soil bore BH212 to the east-southeast and G26_GHD to east of the retort were advanced to dolerite bedrock between 6.9 and did not identify any DNAPL.

  - Groundwater concentrations of TRH and BTEXN compounds in MW196, MW123A, MW123B and MW130_GHD (hydraulically down-gradient of Tar Plume A) have been either LOR, or an order of magnitude below solubility limits provided by CRC CARE (2011) for pure compounds indicating that DNAPL is unlikely to be present in groundwater at these locations or leaching to potentially hazardous levels if so.

- The former Hobart Rivulet is likely to intersect any off-Site DNAPL or dissolved plume from DNAPL, and risks from any such impacts can be assessed by wells within the Rivulet (MW130_GHD to MW133_GHD).

  The route of the Rivulet (shown between seawalls / Rivulet walls beneath Evans Street on **Figure F5**) is south of the Gateway and extends to the west, and is considered a potential preferential pathway for groundwater flow (**Section** Error! Reference source not found.). While the depth of the Rivulet has not been identified, historic photographs (see **Error! Reference source not found.**) show that the Rivulet was in contact with water adjacent to the Site, and as dolerite bedrock becomes shallower to the west, it is considered likely to be in contact with dolerite. The walls of the Rivulet are believed to be intact and buried from 0.75 m bgl (GHD, 2014).

  The Rivulet is likely to intersect any impact to groundwater arising from DNAPL to the west and south of the Site, and preferential flow would be expected to be to the east along the former discharge route of the Rivulet. MW130_GHD, MW131_GHD, MW132_GHD, and MW133_GHD are installed within the inferred route of the Hobart Rivulet beneath Evans Street, and have had detectable TRH and BTEXN concentrations in GMEs conducted between 2016 and 2025, which indicates impacts in groundwater in the Rivulet. These impacts are to be co-sourced from off-Site areas and have not been assessed as an unacceptable risk to receptors. Ongoing groundwater monitoring of the Rivulet is required by the SEMP and considered suitable to assess if this condition changes in the future.

Based on the above considerations, while direct investigation of DNAPL to the west and south of the Gateway has not been able to practicably undertaken, if DNAPL is present it is considered to be co-sourced with those areas, of low mobility and solubility, and risks area able to be assessed

by existing wells within the Hobart Rivulet, which is considered likely to intersect any off-Site impacts to the west.

- **Tar Plume B (ISS-treated)**

  Tar Plume B consists of an estimated 915 $m^3$ of tar/DNAPL material identified within a former tar tank. The base and walls of the tar tank (concrete with steel reinforcement) were encountered buried within Site soil during remediation in 2024, and are considered to have acted as a “cup” containing DNAPL.

  An annulus of soil was excavated around the tank during DNAPL remediation work in 2024 and no breaks or cracks in the tank wall or visible/olfactory indications of leaking were observed in surrounding soil. No CoPC concentrations considered to indicate DNAPL were observed surrounding the tank.

  The former tank base and walls were left *in situ* and all material contained within was remediated via ISS in 2024. The ISS-treated tar now consists of an estimated 915 $m^3$ of low-permeability soil/concrete mixture between 2.5 and 3 m thick, in a circular area with a diameter of 21 m and a surface area of approximately 345 $m^2$.

  Intact internal tank walls were present in the tank base and left in place during ISS-remediation, and the solidified DNAPL is contained in four separate quadrants (NE, NW, SW, SE) within the tank base.

- **Tar Plume C**

  Tar mixed with soil was observed below a concrete slab between 1.4 and 1.6 m bgl at G29_GHD, beneath a concrete slab likely associated with the former vertical retort. Staining and odours noted at 1.2 to 1.5 m bgl at G22_GHD may be associated with or connect to this impact.

  During remediation in 2024 (AECOM, 2024d), three test pits (TP101, TP102 and TP013) were advanced vertically to dolerite at ~1.2 to 1.7 m bgl and laterally to the boundary of the exclusion zone surrounding a HV power cable along the western boundary of the Site, and a trench was advanced to remove gasworks pipelines. No DNAPL was encountered in any of these test pits. Concentrations of TRH/BTEXN in soil samples collected from the test pits, and from validation samples in the remediation trench indicated some gasworks impact, but were not at concentrations considered to indicate potential DNAPL.

  While inferred groundwater elevation indicates that Tar Plume C may be in contact with groundwater, these are based on limited wells and do not include any locations to the west due to services and established trees along Davey Steet. Tar Plume C may not be in contact with groundwater, or contact may be intermittent (i.e., water running along the top of dolerite), and have limited impact to groundwater quality

  Based on the above observations, Tar Plume C is considered to be beneath a former slab, and is considered likely to be resting on underlying dolerite which would form a low hydraulic conductivity barrier to vertical migration.

  The on-Site extent of Tar Plume C is inferred to be within the exclusion zone surrounding the HV cable along the western boundary of the Site, and could not be accessed to remediate in 2024.The vertical retort, previously present in this area as part of gasworks operations and the inferred source of DNAPL in this area, extended approximately 10-15 m west of the Site boundary, with approximately 75% of its footprint outside the Site boundary, and DNAPL impacts are likely to be co-sourced with off-Site areas.

- **Tar Plume D**

  Tar/DNAPL has not directly been observed at this location. However, tar staining, odours and relatively high PID readings (598 ppm) were reported between 3.5 and 4.7 m bgl at G28_GHD. A concrete slab was encountered at 4.70 m bgl and is considered likely to be the base of a former gasholder, was present on the Site boundary and extended off-Site approximately 20 m to the west. Approximately 85% of the gasholder’s footprint was off-Site and impacts are considered co-sourced with off-Site areas.

No DNAPL or tar impacts were observed, or detected in samples from, soil east and on-Site from Tar Plume D, or during excavation of a trench 1.1 m deep over Tar Plume D in 2023, to install HV and LV power cables. Inferred groundwater contours and groundwater depths in MW101 indicate that the detected gasworks impacts are likely to be in contact with groundwater.

Based on the above, it is considered that Tar Plume D consists of residual impacts from a former gasholder in this area and are co-sourced off-Site to the west. The base of the gasholder has been encountered buried in soil and may be acting as an impermeable barrier to vertical migration of impacts.

Indications of limited DNAPL or DNAPL impacts to Site soil and groundwater within the south-west portion of the Gateway, where historic gasworks operations have occurred.

## 6.4 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 and BTEXN may be generated within the Gateway, and methane may be generated in adjacent areas, 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 (PFAS)

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

ABN: 92 657 409 841

Prepared by

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16-Feb-2026

Job No.: 60693007

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# Quality Information

| | |
|---|---|
| Document | Groundwater Quality Management Plan |
| Ref | 60693007 |
| Date | 16-Feb-2026 |
| Originator | Robert Crowe |
| Checker/s | Paul Carstairs |
| Verifier/s | Paul Carstairs |

**Revision History**

| Rev | Revision Date | Details | Approved | |
|---|---|---|---|---|
| | | | Name/Position | Signature |
| A | 11-Feb-2026 | Draft | Paul Carstairs<br>Technical Director - Environment | |
| 0 | 16-Feb-2026 | Final | Paul Carstairs<br>Technical Director - Environment |  |
| | | | | |
| | | | | |

# Table of Contents

## List of Tables in Text



## List of Plates in Text

# 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<br>TDS (mg/L) | A<br>Less than 1000 | B<br>1000-3500 | C<br>3500-13000 | D<br>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<br>• NHMRC Australian Drinking Water Guidelines (amended 2018) Human Health<br>• PFAS NEMP (2025)<br><br>Where no high reliability NHMRC guideline values are available, screening values have been adopted from the following sources:<br>• WHO (2017) Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First Addendum<br>• US EPA RSLs (2020) Tap Water Quality<br>• Health Canada (2020)<br>• 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)<br>• PFAS NEMP (2025) Interim Marine 95% (slightly to moderately disturbed) level of ecosystem protection (interim marine)<br>Where no high reliability guideline values are available in ANZG (2018), screening values have been adopted from the following sources:<br>• ANZG (2018) low to moderate reliability trigger values (marine)<br>• ANZG (2018) 90% level of ecosystem protection (marine water) draft guidelines released for public comment on 29 June 2020<br>• US EPA (2013) Ambient Water Quality Criteria (chronic – Marine)<br>• US EPA (2006a) Region 3 Mid-Atlantic Biological Technical Assistance Group (BTAG) Screening Benchmarks (marine)<br>• RIVM (2001) Dutch Intervention Values (DIV) for TPH<br>• 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:<br>- PFAS<br>- Mercury<br>- PAHs (anthracene, phenanthrene, fluoranthene, and benzo(a)pyrene). |
| Recreation (Primary Contact) | • NHMRC (2008) Guidelines for Managing Risk in Recreational Water<br>• 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.<br>• 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:<br>• Residential - HSL A/B (sand, depth to groundwater 2.0 – <4.0 m bgl)<br>• Recreation/ Open Space - HSL C (sand, depth to groundwater 2.0 – <4.0 m bgl)<br>• Commercial/ Industrial - HSL D (sand, depth to groundwater 2.0 – <4.0 m bgl)<br>• Intrusive Maintenance Worker- HSL: (sand, depth to groundwater 2.0 – <4.0 m bgl)<br><br>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.<br>• 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).<br>• 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:<br>• Field sampling techniques<br>• 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.<br>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.<br>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:<br>- 20% for high level laboratory duplicates (i.e., >20 x LOR)<br>- 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**):<br>• TDS<br>• TPH - $C_{10}$-$C_{36}$ / TRH - $C_{10}$-$C_{40}$<br>• Benzene, naphthalene<br>• 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<br>• Metals – aluminium, arsenic, boron, cobalt, copper, iron, lead, manganese, vanadium, zinc<br>• Ammonia (as N), chloride, sodium, phosphorus, sulphate, cyanide<br>• PFAS – PFOS<br>• Methane<br>• E. Coli and pH[1]<br>In particular:<br>• 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.<br>• 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.<br>• 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:<br>• LNAPL in four plumes:<br>- LNAPL Plumes A1, A2 and A3 in the central portion of the Site.<br>- LNAPL Plume B in the south-east corner of the Site, and inferred to be co-sourced and extend off-Site to the east.<br>LNAPL was remediated by Total Fluids Extraction (TFE) between 2015 and 2017.<br>• 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.<br>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.<br>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.<br>• 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.<br>• Visitors to residences, businesses, or open spaces at the Site or adjacent properties<br>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.<br>• No terrestrial ecosystems have been identified off-Site or are considered likely.<br>• 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.<br>• Assess the potential source and if there is any potential for a new release to have occurred.<br>• Assess for potential changes to the CSM and assess whether there is a potential change in risk profile.<br>• 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.<br>• Evaluate NAPL thickness in adjacent wells and changes in NAPL gradients.<br>• Assess for potential changes to the CSM and assess whether there is a potential change in risk profile.<br>• 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.<br>• Evaluate NAPL thickness in adjacent wells and changes in NAPL gradients.<br>• Assess for potential changes to the CSM and assess whether there is a potential change in risk profile.<br>• 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.<br>• Assess the significance of criteria exceedance to consider whether further actions are necessary<br>• Assess if any on- or off-Site activities can be identified which may have introduced the trigger result.<br>• Assess whether the CSM is still valid.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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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# Appendix A

## Figures

# Appendix A Figures

## List of Attached Figures

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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)

A3 size

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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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LAST MODIFIED PK 09 Nov 2025

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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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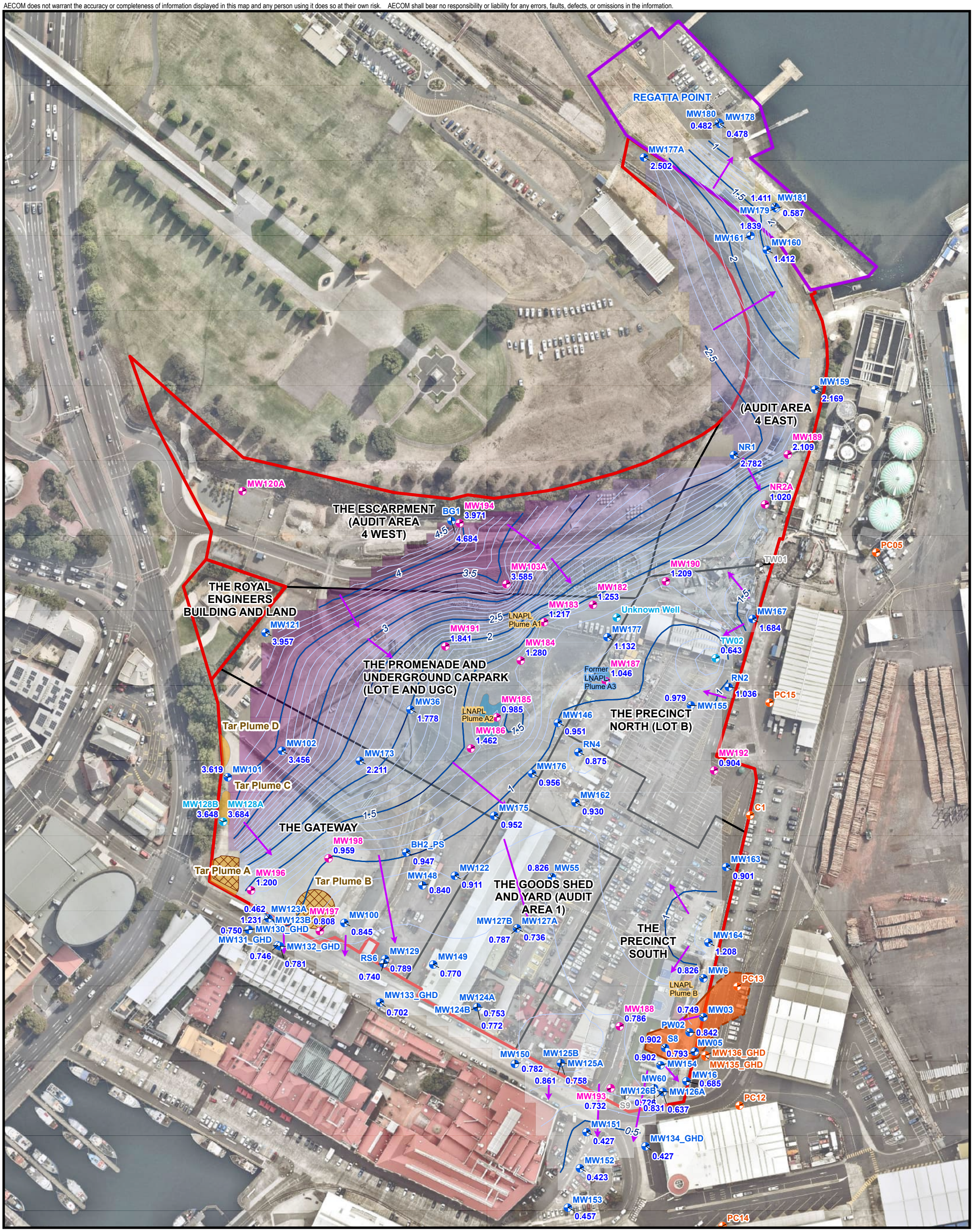


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Legend

- New Groundwater Well
- Existing Groundwater Well
- Lost/Destroyed Well
- Reinstated and Resurveyed Existing Well
- TasPorts Well
- ISS Treated Material
- Inferred Tar Extent
- 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

**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
MW120A
THE ESCARPMENT (AUDIT AREA 4 WEST)
BG1
MW194 3.971
4.684
NR3A 1.020
PC05
TW01
MW190 1.209
Final level - 4.8 mAHD
MW103A 3.585
Final level - 1.7 mAHD
THE ROYAL ENGINEERS BUILDING AND LAND
MW121 3.957
MW182 1.253
MW183 1.217
Unknown Well
MW167 1.684
LNAPL Plume A1
MW191 1.841
MW177 1.132
TW02 0.643
MW184 1.280
THE PROMENADE AND UNDERGROUND CARPARK (LOT E AND UGC)
Former LNAPL Plume A3
MW187 1.046
RN2 1.036
PC15
0.979
MW155
MW36 1.778
MW185 0.985
LNAPL Plume A2
THE PRECINCT NORTH (LOT B)
MW146 0.951
Tar Plume D
MW186 1.462
RN4 0.875
Final level - 3.0 mAHD
MW102 3.456
MW173 2.211
MW192 0.904
3.619 MW101
MW176 0.956
Tar Plume C
MW162 0.930
MW128B 3.648
MW128A 3.684
MW175 0.952
C1
THE GATEWAY
MW198 0.959
BH2_PS 0.947
MW163 0.901
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)
Final level - 3.3 mAHD
0.462 MW123A
MW197
MW100 0.845
1.231 MW123B 0.808
MW127B 0.787
MW127A 0.736
THE PRECINCT SOUTH
0.750 MW130_GHD
MW131_GHD
MW132_GHD 0.781
0.746
MW164 1.208
RS6
MW129 0.789
MW149 0.770
0.740
0.826 MW6
PC13
LNAPL Plume B
MW133_GHD 0.702
MW124A
MW124B 0.753
0.772
MW188 0.786
0.749 MW03
PW02 0.842
0.902 S8 0.793
MW136_GHD
MW150 0.782
MW125B
MW125A 0.758
0.861
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

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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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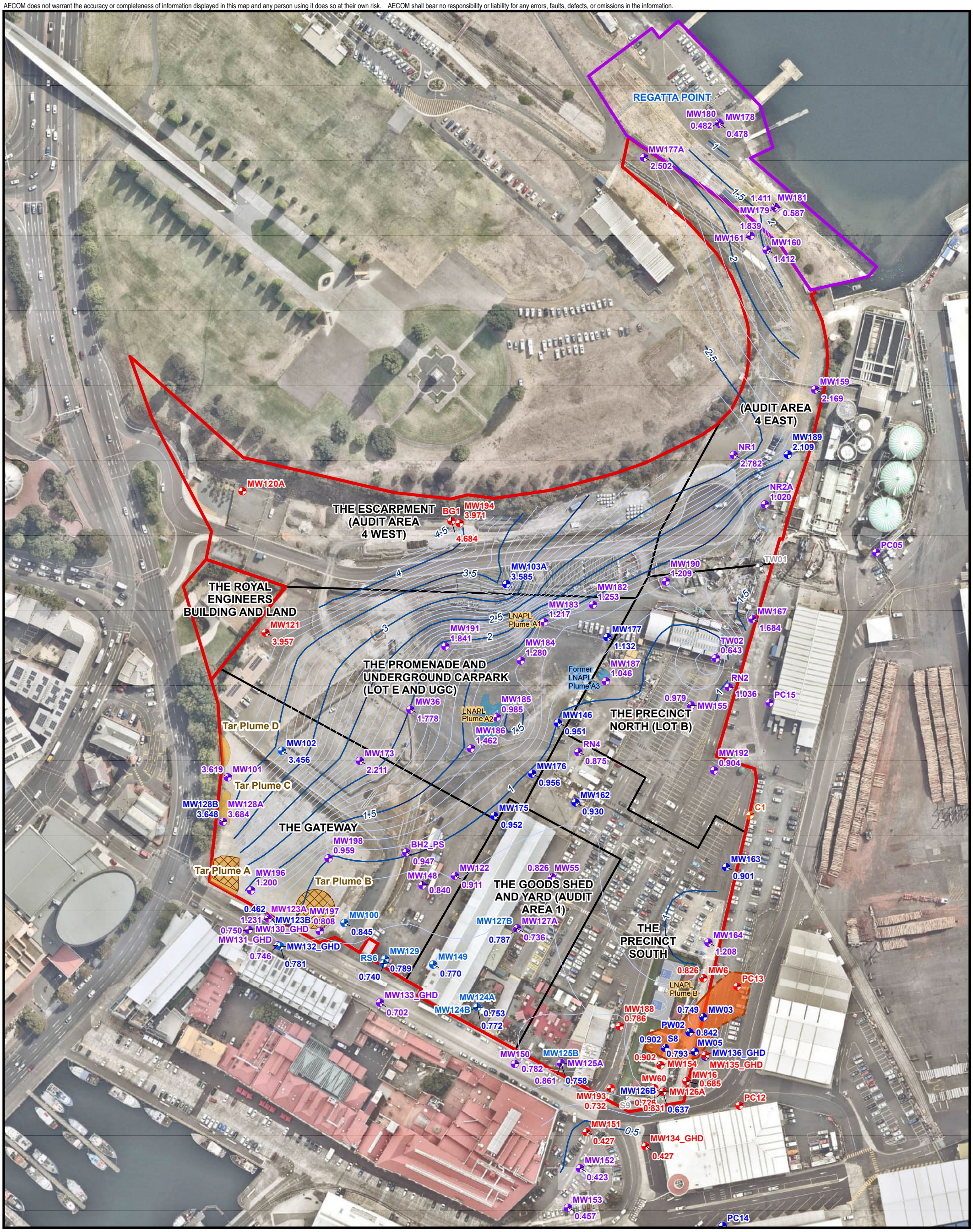


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Legend

- 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

# GROUNDWATER MONITORING EVENT SCOPE OF WORK

**Macquarie Point Development Corporation**

*Groundwater Quality 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\07\Geotech\Soil_GW_SV_2025\Soil_GW_SV_2025.aprx)

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# Appendix B

## Tables

# Appendix B Tables

## List of Attached Tables

# 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.<br>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<br>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.<br>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.<br>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.<br>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.<br>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<br>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<br>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 |

| 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) |

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 |
|---|---|---|---|---|
| 108-60-1 | Bis(2-chloroisopropyl)ether | Water | 7100 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 74-97-5 | Bromochloromethane | Water | 830 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - 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 NOV 2024 - 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 NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 75-00-3 | Chloroethane | Water | 83000 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 74-87-3 | Chloromethane | Water | 1900 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 218-01-9 | Chrysene | Water | 250 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 156-59-2 | cis-1,2-Dichloroethene | Water | 360 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 1476-11-5 | cis-1,4-Dichloro-2-butene | Water | 0.013 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 7440-48-4 | Cobalt | Water | 60 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 72-55-9 | DDE | Water | 0.46 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 132-64-9 | Dibenzofuran | Water | 79 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 84-74-2 | Dibutyl Phthalate | Water | 9000 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 75-71-8 | Dichlorodifluoromethane (Freon 12) | Water | 2000 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 84-66-2 | Diethyl phthalate | Water | 150000 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 117-84-0 | Di-n-octyl phthalate | Water | 2000 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 88-85-7 | Dinoseb | Water | 150 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 122-39-4 | Diphenylamine | Water | 13000 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 86-73-7 | Fluorene | Water | 2900 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 118-74-1 | Hexachlorobenzene (HCB) | Water | 0.098 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 67-72-1 | Hexachloroethane | Water | 3.3 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 193-39-5 | Indeno(1,2,3-cd)pyrene | Water | 2.5 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 78-59-1 | Isophorone | Water | 780 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 98-82-8 | Isopropylbenzene (Cumene) | Water | 4500 µg/L | US EPARSL NOV 2024 - 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 NOV 2024 - Tap Water Quality (AF x 10) |
| 91-20-3 | Naphthalene | Water | 1.2 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 104-51-8 | n-butylbenzene | Water | 10000 µg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 7440-02-0 | Nickel | Water | 3.9 mg/L | US EPARSL NOV 2024 - Tap Water Quality (AF x 10) |
| 14797-55-8(as N) | Nitrate (as N) | Water | 112 mg/L | US EPARSL NOV 2024 - 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 |

Table C5 - Tier 1 Groundwater Criteria - Vapour Intrusion (Intrusive Maintenance Worker)
Groundwater Quality Management Plan
Macquarie Point Development Project

| 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)

$\rho$ = 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 |

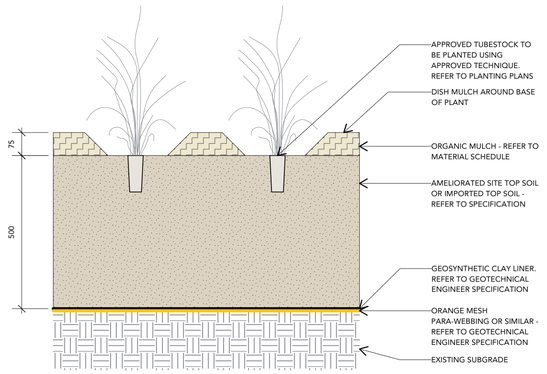
| Chemical | Potential Future Residents (slab-on-grade with unknown construction or multi-storey building) # | Potential Future Residents (low rise slab-on-grade) | Potential Future Residents (building with a basement car park) | Potential Future Commercial (slab-on-grade with unknown construction or 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 |

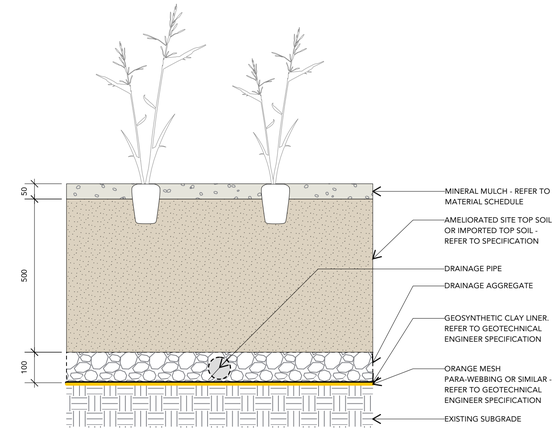
*Notes: # Source = CRC CARE (2011) Appendix F, * Where the soil criteria derived using the infinite source model were more conservative than the CRC CARE (2011) screening values based on a finite source model, the CRC CARE (2011) values are proposed for adoption, ** The minimum criteria for aliphatic/aromatic 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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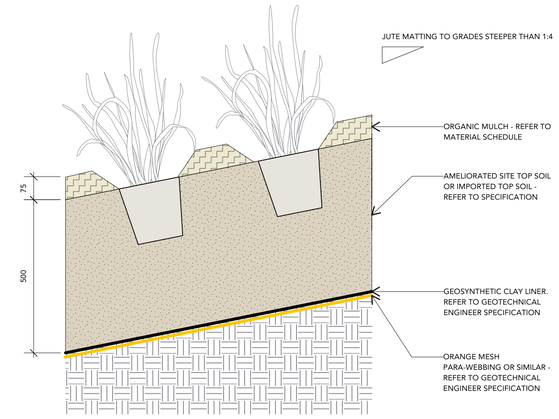
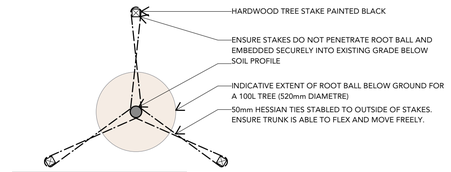



3 SOIL PROFILE TYPE 03 - EMBANKMENT PLANTING
Scale: 1:10

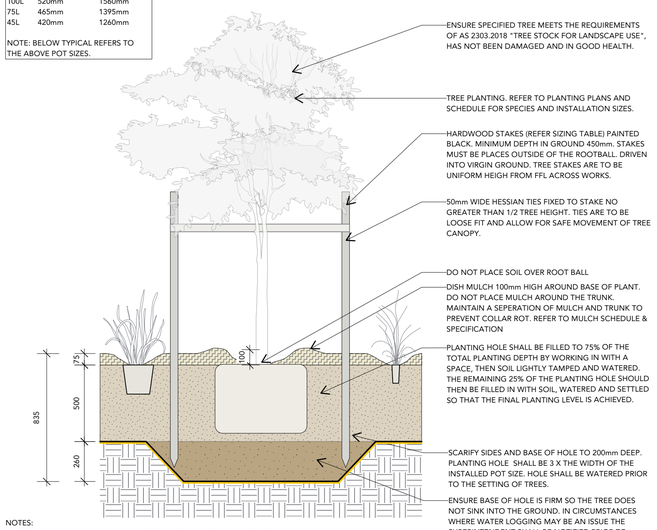



| TREE STAKES TABLE TREE SIZE | NO. STAKES | STAKE SIZE (MIN) |
|---|---|---|
| 100L-200L | 3 | 50 X 50 X 1800MM |
| 45L | 1 | 35 X 35 X 1500MM |

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.

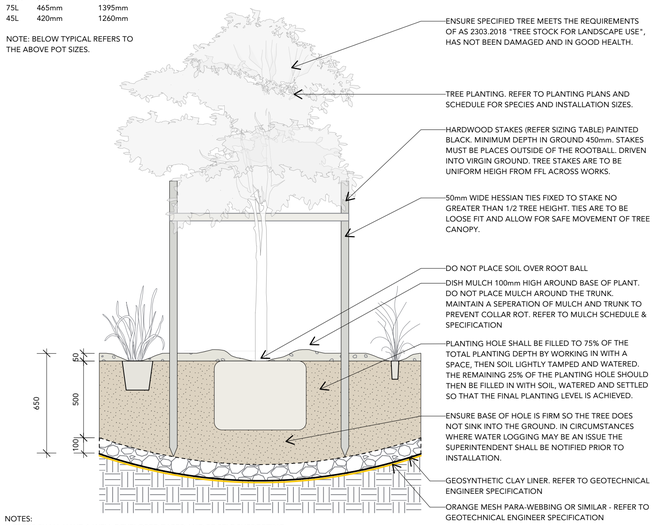



NOTES:
1. TREES SHALL HAVE A WELL DEVELOPED TAPER AND BE SELF SUPPORTING.
2. SPECIFIED TREE TO MEET THE REQUIREMENTS OF AS 2303.2018 "TREE STOCK FOR LANDSCAPE USE"
3. ENSURE ALL LABELS, WIRES, TWINE AND OTHER BINDING MATERIALS ARE REMOVED FROM PLANTING MATERIAL, INCLUDING ROOTBALLS PRIOR TO BACKFILLING.
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:
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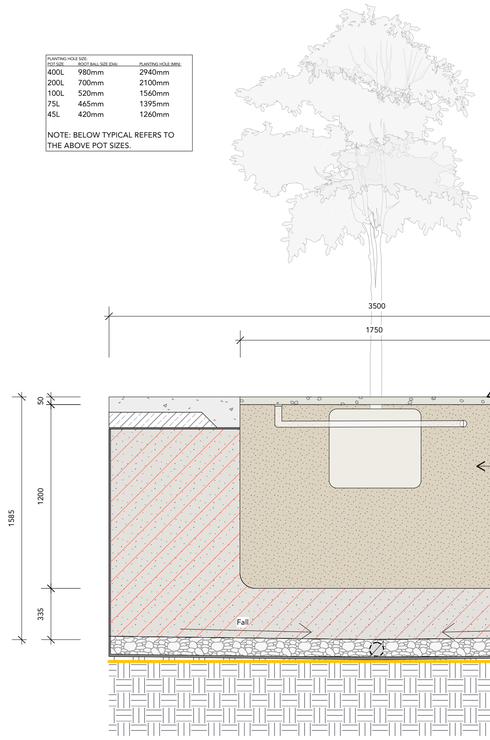
5. WATER IMMEDIATELY FOLLOWING PLANTING, SAUCER TO BE FILLED TWICE
6. SITE TO BE LEFT CLEAN AND TIDY ON COMPLETION OF PLANTING, REMOVE WEEDS AND BUILDING SPOIL FROM TREE PLANTING ZONE.
7. REFER SPECIFICATION FOR ALL TREE PLANTING.

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:<br>• **Section 1.2** – Changes to body text for design variances.<br>• **Section 1.4** – Roles and Responsibilities relating to record keeping updated. Additional requirements around record keeping included in **Sections 5.4** and **5.5**.<br>• **Section 1.6** – Progress of Environmental Audit updated.<br>• **Section 3.2.3** – Areas of Notable Impact updated with outcomes of *Review of Site Suitability Statements* (AECOM, 2026a).<br>• **Section 3.5** – Soil vapour information updated with outcomes of *Review of Site Suitability Statements* (AECOM, 2026a).<br>• **Section 4.4** – Planning controls relating to groundwater below buildings / building slabs updated with outcomes of *Review of Site Suitability Statements* (AECOM, 2026a).<br>• **Section 4.8** – Vapour intrusion mitigation updated with outcomes of *Review of Site Suitability Statements* (AECOM, 2026a).<br>• **Section 4.14** – Reference to the previous Construction Noise and Vibration Management Plan (CNVMP) removed. It is now required that noise and vibration be mitigated by the most recent version of the Corporation's management plan.<br>• **Appendix F** – Previous CNVMP removed and replaced by Groundwater Quality Management Plan (GWMP). **Section 4.13** updated with reference to GQMP.<br>• **Appendix K** – Change Register added to document | 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 |

| # | Change | Person who conducted update or change | | Record of Contaminated Land Auditor Review and Acceptance | |
|---|---|---|---|---|---|
| | | Who | Date | Who | Date |
| 2 | Issue of SEMP Revision 6. Updates:<br>• **Section 1.2** – Additional Macquarie Point procedures referenced in the SEMP listed.<br>• **Section 2.5.2** and **4.12.3** – Outcomes of *Acid Sulfate Soil Investigation* (AECOM, 2025d) added.<br>• **Section 2.6** - Additional data on historic testing of hydraulic conductivity added.<br>• **Section 3.2.3** – Updated with outcomes of *The Precinct South - CUTEP Report* (AECOM, 2026b).<br>• **Section 3.6** – Reference to the Corporation's Asbestos Management Plan (MPMS-IMP-MP-WH-04-01) and Site Asbestos Register (MPMS-ELG-RG-WH-04-01) added, and requirement for the most recent version of these documents to be available and complied with during intrusive works. The previous Asbestos Register and management plan (attached as Appendix J in Revision 5) removed from the SEMP to avoid potentially out-of-date information being referenced.<br>• **Section 4.4** – Future work requirements around ISS-remediated material added.<br>• **Section 4.11.1** – Reference to the Corporation's Unanticipated Discovery Plan - Aboriginal Heritage (MPMS-MPDC-PC-ES-05-01) added, and requirement for the most recent version of this document to be available and complied with during intrusive works. The previous Asbestos Register and management plan (attached as Appendix H in Revision 5) removed from the SEMP to avoid potentially out-of-date information being referenced.<br>• Minor wording changes made for cross-referencing/changes in appendices. | 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 | Issue of SEMP Revision 7. Updates:<br>• **Sections 1.2** and **4.1** – updated to require all preparatory or development works at the Site to be undertaken in accordance with the Corporation's Construction Environment Management Plan Standard.<br>• **Section 4.1** – updated to include reference to the *State Policies and Projects (Macquarie Point Precinct) Order 2025*.<br>• **Section 4.4** – updated with:<br>- Materials selection requirements for any future buildings or structures which are in contact with groundwater to prevent potential degradation from saline intrusion.<br>- Requirements for ongoing monitoring of changes from Preparatory Works conducted under the Order which may affect future development and design.<br>• **Section 4.11** – Updated to include procedures for assessment of whether any unexpected finds may have material effects on the outcomes of the Site Environmental Audit.<br>• **Section 4.13** - been updated to include GQMP requirements relating to communication of groundwater risks, or assumptions used to assess groundwater risks, to occupiers of off-Site land.<br>• **Appendix I** – Additional details and references to updated sections added to previous Change Register entries. | Robert Crowe Associate Director – Environment, AECOM Australia Pty Ltd | 29 May 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 | 29 May 2026 |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |