PROJECT CONSTRUCTION GROUNDWATER MONITORING PROGRAM

Groundwater Monitoring Program

Sydney Metro West – Western Tunnelling Package

ISSUE DATE: NOVEMBER 2025

Document Details

Document Title	**Groundwater Monitoring Program**
Project Name	**Sydney Metro West – Western Tunnelling Package**
Client	**Sydney Metro**
GA Project No.	**00013/13065**
Document Reference No.	**SMWSTWTP-GLO-1NL-EN-PRG-000002**
Principal Contractor	**Gamuda Engineering**
ABN	**36 636 433 522**
Project Address	**L8 60 Station Street, Parramatta, NSW 2150**

Document Authorisation

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		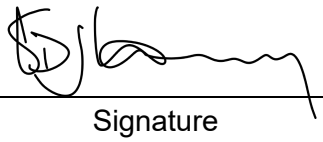
Signature	Signature	Signature
February 2026	February 2026	8 April 2026
Date	Date	Date

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DOCUMENT CONTROL

The current document version number and date of revision are shown in the document footer. All changes made to the Management Plan during its implementation on a live project are to be recorded in the amendment tables below.

Revision History

Revision	Date	Description of changes	Prepared by	Approved by
A	24/03/2022	Early Works Submission	M. Singleton-Fookes D. Harris	Simon Hussey
B	14/06/2022	Draft following stakeholder consultation	S.Mifsud, D. Harris	Simon Hussey
C	29/05/2024	Annual Review + amend site specific trigger criteria based on DCCEEW letter (dated 21 May 2024) Sections updated: Sections 1-3, 5, 7-12, Attachments 1 - 6	Hussain Nilar (GLC) Patrick Carroll (EPIC)	Simon Hussey
D	21/08/2024	Update in response to ER/SM	Patrick Carroll (EPIC) Hussain Nilar (GLC)	Simon Hussey
E	30/10/2025	Annual Review	Jonathan Pickerdon (EPIC) Hussain Nilar (GLC)	Simon Hussey
F	13/01/2026	Update in response to ER/SM	Jonathan Pickerdon (EPIC) Hussain Nilar (GLC	Simon Hussey
G	12/02/2026	Update in response to ER/SM	Jonathan Pickerdon (EPIC) Tahli Moore (GLC)	Simon Hussey

Terms and Definitions

Term	Definition
AHD	Australian Height Datum
ASS	Acid Sulfate Soil
BTEXN	Benzene, toluene, ethylbenzene, xylene, naphthalene
CBD	Central Business District
CCMS	Construction Complaints Management System
CEMF	Construction Environmental Management Framework
CEMP	Construction Environmental Management Plan
Clyde MSF	Clyde Maintenance and Stabling Facility
CoPC	Contaminants of potential concern
CSSI	Critical State Significant Infrastructure
DPHI	Department of Planning Housing and Infrastructure (NSW)
DSI	Detailed Site Investigation
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	Environmental Protection Authority
EP&A	*Environmental Planning and Assessment Act* 1979
EPL	Environmental Protection License
ER	Environmental Representative
ESCP	Erosion and Sediment Control Plan
GLC	Gamuda Engineering – Laing O'Rourke Consortium
GDE	Groundwater Dependent Ecosystem
GWMP	Groundwater Management Plan
GWMoP	Groundwater Monitoring Program
HIR	Hydrogeological Interpretive Report
ISC	Infrastructure Sustainability Council
IS	Infrastructure Sustainability
MCoA	Ministers' Condition of Approval
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soil
PCT	Plant Community Type
PFAS	Per- and Poly-fluoroalkyl Substances
POEO	Protection of the Environment Operations Act 1997 (NSW)
(the) Project	Sydney Metro West - Western Tunnelling Package
REMM	Revised Environmental Management Measures
SMW	Sydney Metro West
SOP	Sydney Olympic Park
SOPA	Sydney Olympic Park Authority
SSI	State Significant Infrastructure
SVOC	Semi-Volatile Organic Compounds

Term	Definition
SWMP	Soil and Water Management Plan
SWQMoP	Surface Water Quality Monitoring Program
TBM	Tunnel Boring Machine
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds
VoC	Verification of Competency
WTP	Western Tunnelling Package

1 INTRODUCTION

1.1 Project Description

The scope of the work being undertaken under the Sydney Metro West Western Tunnelling Package works (WTP) (the Project) includes but is not limited to, the following:

- Westmead Station box excavation, including temporary support, stub tunnels, partially mined station cavern and crossover cavern including permanent lining and support
- Parramatta Station, including excavation of station box and associated support
- Clyde Maintenance and Stabling Facility (MSF), including permanent dive structure, portal, spur running tunnels, spur tunnel junction cavern, bulk earthworks, civil structures, utilities corridor, road crossing and creek diversion
- Rosehill Services Facility, including shaft excavation, permanent lining and lateral support
- A precast segment manufacturing facility at Eastern Creek
- Demolition and site clearance works
- Tunnelling between Sydney Olympic Park (SOP) and Westmead. Tunnelling will be undertaken by placing the tunnel boring machines (TBMs) at the Rosehill Services Facility box and retrieved out at the SOP Station Box and then placed back at the Rosehill Services Facility and retrieved at the Westmead Station Box. Some surface works will be required for site establishment and to facilitate TBM retrieval and relaunching, such as crane set up and plant and material deliveries. Station box works would also be required to facilitate TBM retrieval and re-launching.

Refer to Figure 1 for the location of the WTP project.

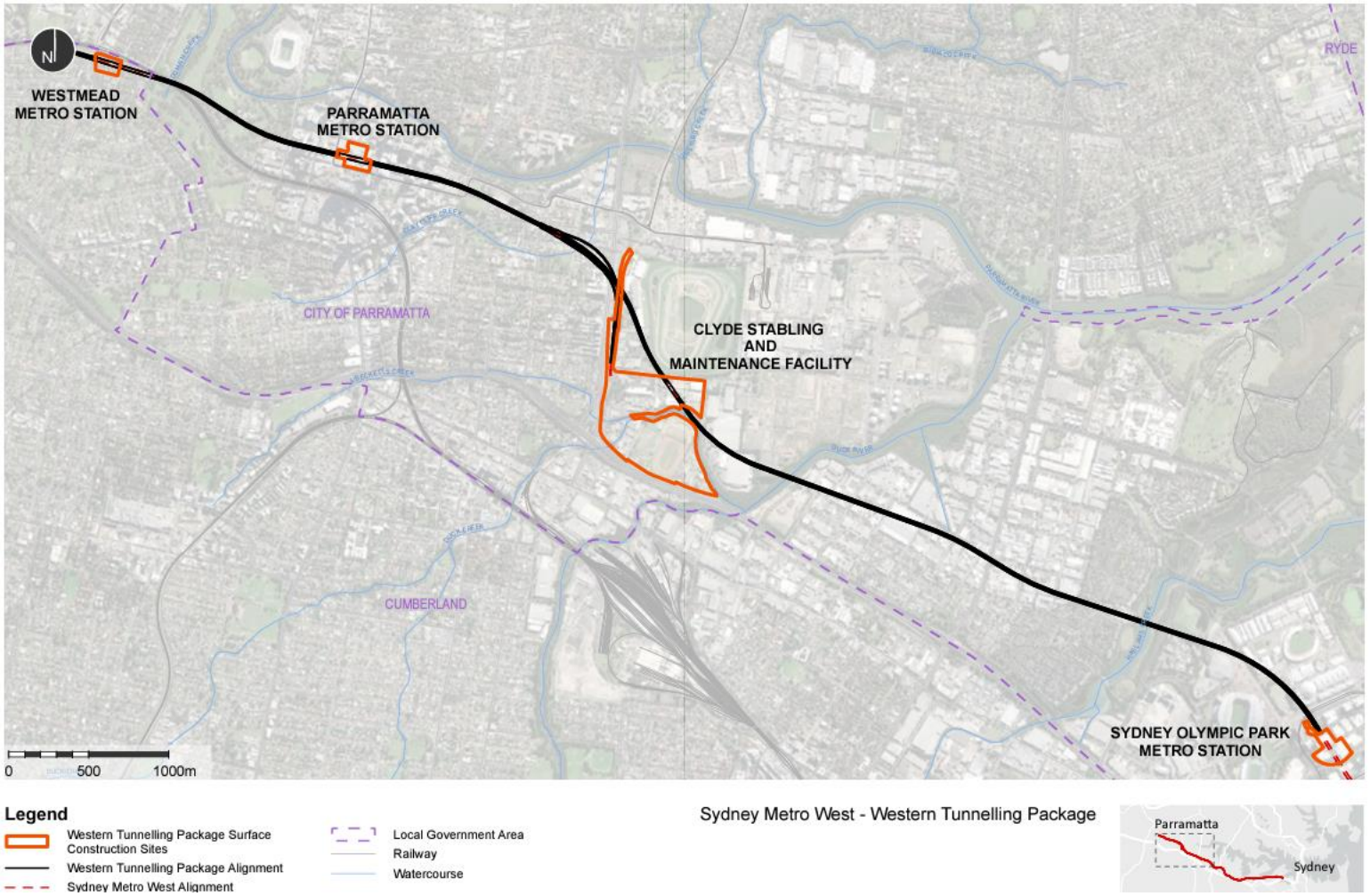

Figure 1: WTP Project Location

1.2 Context

The Construction Environmental Management Plan (CEMP) and sub-plans have been developed for the delivery of the WTP. It will be delivered by Gamuda Australia Laing O'Rourke Consortium (GLC). This Construction Groundwater Monitoring Program (GWMoP) forms part of the Construction Environment Management Plan (CEMP) (SMWSTWTP-GLO-1NL-EV-PLN-000001) for the Project.

Sydney Metro West – Westmead to The Bays Concept and Stage 1 received planning approval on 11 March 2021 (SSI 10038). The Project comprises the WTP, which is the western portion of Stage 1 of SSI 10038, from Sydney Olympic Park to Westmead. This GMP has been prepared to address requirements of the Minister's Conditions of Approval (MCoA) and any modifications to the MCoA, Revised Environmental Management Measures (REMMs) listed in the Sydney Metro West – Submissions Report, dated 20 November 2020, the Construction Environmental Management Framework (CEMF) requirements and all applicable legislation as they relate to the Project.

1.3 Environmental Management System Overview

An overview of the Environmental Management System (EMS) is provided in the CEMP Section 3.

Key interactions for this Monitoring Plan with other management sub-plans in the EMS include:

- Site Establishment Management Plan
- Soil and Water Management Sub-plan
- Groundwater Management Sub-plan
- Waste Management Sub-plan
- Spoil Management Sub-plan
- Flora and Fauna Management Sub-plan.

1.4 Consultation Requirements

This monitoring plan builds on the consultation that had been undertaken during the EIS and Response to Submissions, managed by the project proponent, Sydney Metro.

This program has been provided to DPE Water and Sydney Olympic Park Authority (SOPA) for review and comment, in accordance with MCoA C14(d).

Consultation was undertaken over a 21-day period, commencing on 27 April 2022 with the submission of the GMP. The Consultation approach was applied across all plans and stakeholders and included issuing of the document to stakeholders accompanied by an introductory workshop. Following receipt of comments two weeks later, an offer was made to hold a comment review workshop to discuss and close comments directly with the stakeholder the following week. A second workshop would also be made available should there be any outstanding or technical issues requiring further discussion.

An introductory meeting was held on 1 April with SOPA, which was organised by Sydney Metro and delivered by GLC. At the introductory meeting, GLC introduced themselves, the project team and outlined the scope of the WTP. The consultation approach was presented, and feedback invited on that approach. No issues were raised on the consultation approach during the introductory meetings.

SOPA did not take the offer of a comment review workshop in relation to their review of the Rev B GMP.

Details of issues raised by stakeholders during consultation is provided in Attachment 2, including copies of correspondence in accordance with MCoA A6. The approach to consultation is further outlined in the CEMP.

Ongoing consultation with stakeholders may be undertaken as required during project delivery. In line with MCoA B11, a copy of the Construction Monitoring Reports will be published on the GLC project website.

1.5 Certification and Approval

Sydney Metro West – Westmead to The Bays Concept and Stage 1 was subject to environmental impact assessment under the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). It was also declared a Critical State Significant Infrastructure (CSSI) by the Minister for Planning & Public Spaces (the Minister).

An Environmental Impact Statement (EIS) has been prepared under Division 5.2 of the EP&A Act and in accordance with Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. Following exhibition of the EIS, an Amendment Report and Submissions Report were also prepared. After an assessment was carried out, the Minister determined that the Sydney Metro West – Stage 1 would be approved subject to conditions.

The planning approval (Infrastructure Approval SSI 10038) and related environmental assessment documents are located at: https://www.planningportal.nsw.gov.au/major-projects/project/25631.

The Revision B GMP has been expressly nominated by the Planning Secretary to be endorsed by the ER prior to obtaining Secretary Approval. This GMP was submitted to the ER who provided endorsement on 15 June 2022. Rev B of the GMP was then submitted to and DPHI (formerly DPE) for approval no later than one (1) month before the commencement of construction. Approval from DPHI was provided on 11 July 2022 with construction commencing on 19 July 2022.

The Revision B GMP, as approved by the Planning Secretary or the ER, including any minor amendments approved by the ER, will be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary or the ER (whichever is greater).

Rev D of the GMP was updated based on comments received from NSW department of Climate Change, Energy, the Environment and Water (DCCEEW) related to a recalculation of the groundwater quality performance criteria (trigger values) from a groundwater monitoring bore specific performance criteria to area and aquifer-based groundwater quality trigger values (reference OUT24/7062, dated 21 May 2024). This recalculation was completed by Epic on 12 July 2024 (Attachment 6)..

2 PURPOSE AND SCOPE

2.1 Purpose

The purpose of this GWMoP is to describe the groundwater monitoring approach that will be employed by GLC employees and its subcontractors during construction of the Project. This monitoring program forms an integral part of the Project's CEMP and GLC's EMS. It applies to all works associated with Project works and establishes the environmental management controls to be implemented by GLC employees and its subcontractors.

2.2 Scope

The scope of this GMP is to describe how GLC will monitor groundwater throughout construction of the Project, including how monitoring and reporting may cease or change as project completion and overall risk to groundwater changes/quality are deemed negligible. Monitoring of groundwater will be undertaken to identify potential impacts to groundwater where there is a known risk and ensure an appropriate management regime can be implemented to address those impacts and manage local groundwater conditions.

The program provides details of the groundwater monitoring network, frequency of monitoring, monitoring requirements, and test parameters.

Not considered within this GWMoP are the Eastern Creek precast manufacturing facility or Sydney Olympic Park (S.O.P). The Eastern Creek Pre-Cast Facility is excluded from this program on account it does not form part of the SSI Approval given it was assessed under Part 4 of the EPA Act via a Review of Environmental Factors. S.O.P however, is excluded from this Monitoring Program on account all groundwater monitoring in the vicinity of this station is considered within the Central Tunnelling Package, currently being delivered by the Acciona Ferrovial Joint Venture (AF JV). This package includes all station boxes and tunnels between The Bays and Sydney Olympic Park.

3 OBJECTIVES

The GMP will be utilised to define, address and implement groundwater monitoring requirements. The GMP outlines how GLC will comply and implement the applicable elements of the following documents:

- Sydney Metro Construction Environmental Management Framework (CEMF)
- Minister for Planning and Public Space's Conditions of Approval for the Project (MCoA)
- Revised Environmental Mitigation Measures (REMMs)
- SSI Modifications - Modification 1 Administrative Modification
- SSI Modifications - Modification 2 Clyde Stabling and Maintenance Facility
- SSI Modifications – Modification 3 Administrative Modification
- SSI Modifications – Modification 4 Administrative Modification
- SSI Modifications – Modification 5 Administrative Modification
- SSI Modifications – Modification 6 Administrative Modification
- Infrastructure Sustainability Council (ISC) Infrastructure Sustainability (IS) rating tool.

Specific objectives of the groundwater monitoring program relevant to CEMF, CoA, and REMMs are summarised in Attachment 1.

4 ENVIRONMENTAL REQUIREMENTS

Relevant legislation and guidelines and project specific requirements are detailed herein.

4.1 Legislation and Guidelines

GLC obligations include satisfying the requirements and complying with the provisions of the relevant legislation, guidelines, and policies, as well as international and Sydney Metro's standards. Details are provided in Table 1.

Table 1: Shows the legislation, standards, policies and guidelines relevant to the Project

Legislation	(NSW) *Protection of the Environment Operations Act 1997* (POEO Act) (NSW) *Contaminated Land Management Act 1997* (CLM Act) (NSW) *Water Management Act 2000* (WM Act) (NSW) Protection of the Environment Operations (Waste) Regulation 2014 (the Waste Regulation) *Sydney Water Act 1994* *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW) *Contaminated Land Management Act* 1997 (CLM Act)
Standards	AS/NZS ISO 14001:2016 Environmental management systems - Requirements with guidance for use AS 1940-2017: The Storage and Handling of Flammable and Combustible Liquids AS/NZS 4452-1997: The Storage and Handling of Toxic Substances
Guidelines, Specifications and Notices	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines') (ANZG 2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000) Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (NSW EPA, 2004) Guidelines for the Assessment and Management of Groundwater Contamination (DEC 2007) Maintenance of remediation notice 28040 (EPA 2009) National Environment Protection Council (NEPC) 1999 (amended 2013), National Environment Protection (Assessment of Site Contamination) Measure (NEPM) PFAS National Environmental Management Plan 2.0 (HEPA 2020) Remediated Lands Management Plan (SOPA, 2009) (or revisions that have been accepted by the EPA)

4.2 Approvals, Licenses and Permits

This GWMoP has been developed to satisfy the requirements of MCoA C1. A full list of applicable MCoAs, REMMs, CEMF requirements and EPL condition requirements is provided in Attachment 1. Other legislation relevant to this GWMoP is included in Attachment 2 of the CEMP.

4.3 Smart Principles

In accordance with the requirements of CoA C15(j) the GWMoP is to be developed with consideration of SMART principles. This plan achieves this as follows:

1. Specific – the GWMoP for the WTP includes specific background data, sampling locations, as well as trigger values relating to specific construction sites
2. Measurable – parameters requiring reporting are all measurable
3. Actionable – the methodology for the collection and analysis of data is provided
4. Realistic – the GWMoP is achievable and not overly onerous
5. Timely – specific timeframes for the completion of tasks is provided.

5 EXISTING ENVIRONMENT

A review of the existing environment is included in Section 5 of the Project Groundwater Management Sub-plan (GWMP). Table 2 provides a summary overview of the key geological and hydrogeological conditions relevant to design and implementation of the groundwater monitoring program.

Table 3 provides a summary of the potential groundwater contamination conditions associated with the Project. The Soil and Water Management Plan details the contaminated land management program to be implemented to meet the requirements of the MCoA. This includes the delivery of Detailed Site Investigations across the various construction sites that will include the collection of groundwater data. This data will inform potential contaminants of concern for this program.

Table 2: Characteristics of the groundwater aspects of the WTP

Location	Hydrostratigraphic Units	Groundwater dependent ecosystems present? (High priority ecosystems are in italics)	Groundwater Users
Westmead	• Quaternary deposits – unconfined & semi-confined aquifer (primary porosity). • Mittagong Formation – Unconfined aquifer at outcrop, confined to semi-confined where overlying clays are present. • Ashfield Shale - aquitard • Hawkesbury Sandstone -Unconfined aquifer at outcrop, confined to semi-confined where overlying clays or shale are present. • Faults and dykes may be present throughout Mesozoic sediments	Three GDEs: • Swamp Oak open forest on river flats of the Cumberland Plain and Hunter Valley • Forest Red Gum – rough-barked apple grassy woodland on alluvial flats of the Cumberland Plain along Domain Creek and Toongabbie Creek • *Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain within the construction site footprint*	• 11 Monitoring Bores • 1 industrial supply bore
Paramatta		Four GDEs: • Swamp Oak open forest on river flats of the Cumberland Plain and Hunter Valley along Parramatta River • Forest Red Gum – rough-barked apple grassy woodland on alluvial flats of the Cumberland Plain along Parramatta River • *Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain along Parramatta River* • Mangrove Forests in estuaries of the Sydney Basin Bioregion and southeast corner bioregion along Parramatta River	
Clyde and Rosehill		Three GDEs: • Mangrove Forests in estuaries of the Sydney Basin Bioregion and southeast corner bioregion along Duck Creek • Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and southeast corner bioregion along Duck Creek • Saltmarsh in estuaries of the Sydney Basin Bioregion and southeast corner bioregion along Duck Creek	

Table 3: Summary of potential groundwater contamination sources and associated contaminants of potential concern

Potential Source	Associated Contaminants	Westmead Station	Parramatta Station	Rosehill Shaft	Clyde	Tunnels
Leaks and spills from fuel storage infrastructure (such as service stations, mechanic workshops)	Hydrocarbons, VOCs and heavy metals	✓		✓	✓	✓
Firefighting activities associated with surrounding facilities (such as sub stations or aerodromes)	PFAS		✓	✓	✓	✓
Land reclamation, landfilling and other uncontrolled fill material. (e.g., Sydney Olympic Park).	Metals, hydrocarbons, pesticides, polychlorinated biphenyls (PCBs)			✓	✓	✓
Acid sulfate soils (ASS)	Acidic conditions, sulphides		✓	✓	✓	
Former and current industrial land uses	Hydrocarbons, heavy metals and metalloids, chlorinated hydrocarbons (solvents), phenolics, pesticides, heavy metals, PFAS, polycyclic aromatic hydrocarbons (PAH)		✓	✓	✓	✓
Existing railways and associated activities (including fill material)	Metals, hydrocarbons, pesticides, nutrients, phenols, carbamates, pesticides, herbicides, PAH	✓				
Dry cleaners and solvent use (former printing facility)	Chlorinated hydrocarbons		✓	✓		✓
Application of fertilisers and pesticides	OCP/OPP, nutrients					✓
Former abattoir – inappropriate storage, use, disposals, and burials.	Pathogens, nutrients and pesticides					

6 ENVIRONMENTAL IMPACTS SUMMARY

A review of the environmental impacts relevant to groundwater is included below in

Table 4, which provides a summary overview of the key geological and hydrogeological conditions relevant to design and implementation of the groundwater monitoring program.

Table 4: Characteristics of potential impacts relevant to groundwater from construction stage activities

Location	Drawdown	Contamination
Westmead	• Groundwater drawdown associated with excavations potential to impact GDEs • One groundwater industrial supply bore within predicted radius of drawdown • Drawdown impacts on settlement considered to be limited due to absence of Quaternary alluvium and unconsolidated sediments.	• Migration of groundwater contamination as a result of drawdown (further detail provided in HIR). • Groundwater contamination resulting from site activities.
Paramatta	• Groundwater drawdown associated with excavations potential to impact GDEs • Drawdown impacts on settlement considered to be limited due to control measures to be implemented including diaphragm wall structures extending below final excavation level nominated by SM .	• Migration of groundwater contamination as a result of drawdown (further detail provided in HIR). • Groundwater contamination resulting from site activities.
Clyde	• Eleven groundwater monitoring bores within predicted radius of drawdown • Drawdown impacts on settlement considered to be limited due to control measures to be implemented including tanked structures and cut-off walls.	• Migration of groundwater contamination as a result of drawdown (further detail provided in HIR). • Groundwater contamination resulting from site activities.
Rosehill	• Drawdown impacts on settlement considered to be limited due to control measures to be implemented including diaphragm wall structures extending below final excavation level and Rosehill's base being permanently drained.	• Migration of groundwater contamination as a result of drawdown (further detail provided in HIR). • Groundwater contamination resulting from site activities.
Sydney Olympic Park	• Groundwater drawdown associated with excavations potential to impact GDEs • Drawdown impacts on settlement considered to be limited due to tunnelling methodology (double shield TBM), refer to Section 8 for further details.	• Migration of leachate to groundwater from existing waste containment structures as a result of construction (e.g., drawdown / vibration). • Migration of contaminated groundwater associated with historic impacts around Sydney Olympic Park into tunnels. • Groundwater contamination from leaks and spills within tunnels (contamination incidents). • Groundwater contamination of Quaternary or Mesozoic sediments from migration of leachate or impacted groundwater.

7 GROUNDWATER MONITORING

7.1 Overview

The following sections outline the existing and proposed groundwater monitoring locations and details of the baseline and construction monitoring program. Baseline groundwater level and quality monitoring data has been collected from the Project groundwater monitoring network since 2018.

When GLC undertook works at SOP as part of TBM retrieval, baseline and construction monitoring of groundwater wells was completed by the Central Tunnelling Package (AF JV). GLC's scope at SOP was limited to TBM works including tunnelling and minimal surface works such as minor spoil load out and concreting. Given these activities do not result in significant changes to groundwater level drawdown unlike the station box excavation undertaken by AF JV (Technical Paper 7 Section 5.12.1), all groundwater monitoring at SOP was solely managed by AF JV. Details relating to groundwater monitoring at SOP therefore, are not discussed in great detail within this Monitoring Program.

Note – GLC have confirmed the aforementioned monitoring arrangement with AF JV in October 2023 (personal communication, Anne Anderson (AFJV) to Jason Jung (GLC), October 2023 15:35).

7.2 Existing Groundwater Reports

In addition to the EIS chapters and supporting EIS technical papers, the following documents (identified in Table 5) provide information on groundwater conditions, contamination, and considerations for water treatment plants relevant to the Project.

Table 5: Groundwater Related Reports for the Sydney Metro West Project

Report Title	Content
Golder | Douglas Partners (2018a): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Monitoring Report, November 2018, 1791865-003-R-GWMR-RevA, Issued: 16 October 2018.	Factual results of hydrogeological investigations carried out along the proposed tunnel alignment. This first groundwater monitoring report included the results of well development, slug tests, groundwater sampling and level monitoring.
Golder | Douglas Partners (2018b): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 4, December 2018, 1791865-009-R-GWMR4-RevA, Issued: 11 January 2019.	
Golder | Douglas Partners (2018c): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 3, November 2018, 1791865-005-R-GWMR3-RevA, Issued: 23 November 2018.	Factual results of the ongoing groundwater level monitoring along the proposed tunnel alignment.
Golder | Douglas Partners (2018d): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 2,	

Report Title	Content
November 2018, 1791865-004-R-GWMR2-RevA, Issued: 6 November 2018.	
Golder | Douglas Partners (2019a): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 8, August 2019, 1791865-016-R-GWMR8-RevA, Issued: 6 September 2019.	Factual results of the ongoing groundwater level monitoring along the proposed tunnel alignment
Golder | Douglas Partners (2019b): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 7, June 2019, 1791865-013-R-GWMR7-RevA, Issued: 17 June 2019.	
Golder | Douglas Partners (2019c): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 6, March 2019, 1791865-012-R-GWMR6-RevA, Issued: 20 March 2019.	
Golder | Douglas Partners (2019d): 00013/11180 Sydney Metro West Geotechnical Investigation Groundwater Level Monitoring Report Round 5, January 2019, 1791865-011-R-GWMR5-RevA, Issued: 11 February 2019.	
Golder | Douglas Partners (2020): Contamination Factual Report, Downer EDI, Unwin St, Rosehill, 1791865-019-R-Rev0, Issued: 4 May 2020.	Factual results of the contamination investigations along the proposed tunnel alignment.
GLC (2021a): Technical memo: Assessment of water treatment plant inflow volumes and quality, SMSMW215-GLC-SWD-SW000-CT-TEM-0000003	Technical memo assessing the volumes and quality of inflows to water treatment plants proposed to collect water within sub-surface infrastructure (e.g. stations, the tunnel, dive sites and tunnel spurs) along the Sydney Metro West – western tunnel package during construction and at handover.
GLC (2021b): Sydney Metro West – Western Tunnelling Package – Hydrogeological Interpretive Report (DRAFT). SMSMW210-GLC-SWDSW000-GE-TME-000001000 – Rev A. Issued: 02 June 2021.	Hydrogeological Interpretive Report (HIR) to address the groundwater related aspects of Returnable Schedule 3.2: Technical Solution, requirement 3.2B (2.9) – Geotechnical and hydrogeological design.
Golder | Douglas Partners (2021a): 00013/11180 Sydney Metro West Groundwater Monitoring Report - Stage 3 Locations, 1791865-026-R-GWM Stage 3 RevC, Issued: 23 June 2021.	Factual results of hydrogeological investigations carried out at additional locations along the proposed tunnel alignment. This groundwater monitoring report included the results of well development, groundwater sampling and level monitoring for the additional works completed in February 2021.

Report Title	Content
Golder | Douglas Partners (2021b): Sydney Mero West Geotechnical Investigation Groundwater Monitoring Report – Stage 2 Locations, 1791865-023-R-GWM Stage 2 Rev 1, Issued: 20 May 2021.	Factual results of hydrogeological investigations carried out at additional locations along the proposed tunnel alignment.
Golder | Douglas Partners (2021c): Sydney Mero West Geotechnical Investigation Groundwater Monitoring Report – Stage 2 Locations, 1791865-023-R-GWM Stage 2 Rev A, Issued: 7 October 2020.	Factual results of hydrogeological investigations carried out at additional locations along the proposed tunnel alignment.
GLC (2022): Technical Report: Sydney Metro West – Western Tunnelling Package – Hydrogeological Interpretative Report, SSMWSTWTP-GLO-1NL-NL000-GE-RPT-000001	Technical report developed to address groundwater related aspects of the specifications including key hydrogeological and geotechnical features, assessment of groundwater levels and inflows, hydrogeological conditions and parameters used as a basis for the design.
Epic (2022a) Clyde Zone 3b - Detailed Site Investigation, SC210108.01, Rev0, Issued: 13 September 2022	Detailed Site Investigation (DSI) at Clyde Zone 3b completed for the purposes of environmental audit. DSI undertaken in June / July 2022
Epic (2022b) Factual Groundwater Monitoring Report - Round 0 (July 2022), SC210108.03, Issued: 19 October 2022	Factual monitoring report undertaken as part of the project Groundwater Monitoring Program , presenting data from groundwater monitoring undertaken in July 2022
Epic (2022c) Westmead Station - Detailed Site Investigation, SC210108.01, Rev0, Issued: 12 December 2022	DSI at Westmead Station completed for the purposes of environmental audit. DSI undertaken in July / August 2022
Epic (2022d) Clyde Zone 1 - Detailed Site Investigation, SC210108.01, Rev0, Issued: 16 December 2022	DSI at Clyde Zone 1 completed for the purposes of environmental audit. DSI undertaken in September 2022
Epic (2023a) Parramatta Station - Detailed Site Investigation, SC210108.01, RevB, Issued: 20 Jan 2023	DSI at Parramatta Station completed for the purposes of environmental audit. DSI undertaken in November 2022
Epic (2023b) Clyde Zone 5 - Detailed Site Investigation, SC210108.01, Rev0, Issued: 6 February 2023	DSI at Clyde Zone 5 completed for the purposes of environmental audit. DSI undertaken in July to September 2022
Epic (2023c) Factual Groundwater Monitoring Report - Round 1 (July 2022), SC210108.03, Issued: 29 February 2023	Factual monitoring report undertaken as part of the project Groundwater Monitoring Program , presenting data from groundwater monitoring undertaken in October 2022.
Epic (2023d) Clyde Zone 6 - Detailed Site Investigation, SC210108.01, Rev0, Issued: 19 July 2023	DSI at Clyde Zone 6 completed for the purposes of environmental audit. DSI undertaken in September 2022 to February 2023

Report Title	Content
Epic (2023e) Clyde Zone 4 West - Detailed Site Investigation, SC210108.01, Rev0, Issued: 27 June 2023	DSI at Clyde Zone 4 west completed for the purposes of environmental audit. DSI undertaken in September 2022 to February 2023
Epic (2023f) Clyde Zone 2b/4e - Detailed Site Investigation, SC210108.01, RevC, Issued: 27 June 2023	DSI at Clyde Zone 2b/4e completed for the purposes of environmental audit. DSI undertaken in August 2022 to February 2023
Epic (2023g) Factual Groundwater Monitoring Report – Round 2 (January 2023), SC210108.03, Issued: 15 June 2023	Factual monitoring report undertaken as part of the project Groundwater Monitoring Program , presenting data from groundwater monitoring undertaken in January 2023.
Epic (2023h) Factual Groundwater Monitoring Report – Round 3 (April 2023), SC210108.03, Issued: 29 June 2023	Factual monitoring report undertaken as part of the project Groundwater Monitoring Program , presenting data from groundwater monitoring undertaken in April 2023.

Baseline groundwater monitoring data has been extracted from the reports listed above, summarised and included in **Attachment 4**. The data is discussed further in the following sections.

7.3 Existing Groundwater Monitoring Data

A network of groundwater monitoring bores has been advanced across the Project area (including stations and sections of the tunnel from Westmead up to Sydney Olympic Park) over the course of multiple environmental and geotechnical site investigations.

Monitoring bores and vibrating wire piezometers were designed to target the following hydrogeological units, providing information on groundwater levels and groundwater quality:

- Anthropogenic fill materials
- Quaternary alluvial sediments
- Residual soils
- Ashfield Shale
- Hawkesbury Sandstone

Available groundwater level and water quality monitoring results from existing monitoring bores during the baseline monitoring period is presented in **Attachment 4.**

All vibrating wire piezometers are fitted with continuous dataloggers. A number of standpipe piezometer have also been fitted with transducers and dataloggers for continuous measurement of water pressure.

The status and suitability of the documented groundwater monitoring bores for the purposes of ongoing construction monitoring continuously changed during the monitoring between July 2022 and May 2024 as a result of construction works. The ongoing viability of monitoring bores for monitoring will be assessed during quarterly monitoring events.

7.4 Data Gap Assessment and Additional Investigations

Within the current version of the HIR, data gaps have been identified and recommendations put in place to fill these data gaps. This includes works as part of geotechnical site investigations. Similarly detailed site investigations are currently underway as part of the contaminated land management program. Any new monitoring wells that are advanced as part of upcoming investigations will be assessed for suitability and purpose as monitoring points to be incorporated to the project groundwater monitoring plan as part of an adaptive management strategy. This will be used to consider replacement wells if required by the project. Once the reporting from this program of works has been provided, this plan will be updated as necessary.

7.5 Baseline Monitoring Network and Nominated Monitoring Network

The baseline monitoring dataset includes information collected as part of the EIS stage investigations, tender investigations and during detailed site investigations (Epic 2022 – 2023).

Construction start dates for each of the monitoring zones are presented in **Table 6**. Data collected prior to the start date presented in **Table 6** is defined as the baseline monitoring period. Groundwater level and quality monitoring has been carried out prior to and throughout the construction stages of the project to collect information on baseline conditions and assess any potential impacts to groundwater conditions during construction, including groundwater levels, drawdown, contamination status, and salinity.

Table 6: Construction start dates

Zone	Construction start date	Construction works
Clyde Zone 1 (MSF east)	January 2023	Utilities works - Excavation of bonded asbestos
Clyde Zone 2 / 4e (Rosehill)	August 2022	Diaphragm wall (D-wall) excavation
Clyde Zone 3 (Clyde Dive)	September 2022	Shaft excavation works
Clyde Zone 4w + 5b + 6	June 2023	Piling at Unwin Street Overbridge
Clyde Zone 5a (MSF west)	February 2023	Piling works at WCS
Parramatta	June 2023	D-wall excavation
Westmead	February 2023	Station box bulk excavation

The results of the baseline groundwater monitoring for the project are summarised in **Attachment 4**. This monitoring network is based on monitoring points targeting each of the construction excavation sites (in accordance with MCoA C17(a)).

The baseline monitoring data has been used to:

- Undertake an on-site audit on the condition of monitoring bores and identify any boreholes that have been damaged, destroyed or decommissioned
- Collect samples to assess baseline water quality in order to identify where risks associated with groundwater contamination may be present as a result of construction activities
- Assess groundwater levels across the project to determine if potential impacts from construction activities
- Review the proposed monitoring network and assess whether additional or alternative monitoring points are required
- Determine appropriate performance criteria (trigger values) for groundwater level and quality for project areas

Previously, performance criteria (trigger values) in relation to groundwater quality was determined for each groundwater monitoring bore. Due to ongoing construction activities across the project area, the groundwater monitoring bore network is changing, with a number of groundwater monitoring bores being destroyed. Therefore, groundwater monitoring bore specific trigger values were not feasible. DCCEEW recommended (reference: OUT24/7062, dated 21 May 2024) to calculate area and aquifer specific groundwater quality trigger values. This allows for flexibility in the monitoring network whilst still ensuring that potential changes in groundwater quality can be monitored. Calculated baseline trigger values for selected analytes, along with trigger value determination, are presented in **Attachment 6.**

Nominated bores for ongoing monitoring (as of May 2024) are presented in **Table 7** below. Due to ongoing construction works, the locations of monitoring bores are subject to change. Additional boreholes and replacement bores are to be added as construction works progress and in response to additional site investigations planned to enable construction activities and to provide an adaptive monitoring strategy. Additional monitoring bores will be planned to fill in the identified data gaps with the location and design of monitoring points to be confirmed following third party access, stakeholder and planning approvals processes.

All standpipe piezometers identified in **Table 7** will be manually dipped to record groundwater levels, where possible. A sub-set of the nominated monitoring bores will be installed with digital transducers (dataloggers) to record continuous data on groundwater level, and a separate sub-set have been nominated for groundwater quality sampling.

The following changes have been made compared to the RevD GMP:

- Clyde MSF:
  - Removal of CZ1_BH13 – Bore was destroyed, replacement bore CZ1_D35_MW02 used instead
  - Removal of CZ5_MW09 – Bore was lost, replacement bore CZ5_MW105 used instead
  - Removal of CZ5_MW16 – Bore was destroyed, replacement bore CZ5_MW103 used instead
  - Removal of GALC-MW12 – Bore was destroyed, replacement bore CZ5_MW102 used instead
- Clyde Zone 3
  - Removal of GALC-MW18 – Bore was decommissioned, replacement bore SMW_ENV010_w used instead
  - Removal of SMW_ADD_BH02_w – Bore no longer representative of groundwater conditions, replacement bore GALC_MW16_w used instead. Barometric logging data is stored within GLC site offices
- Parramatta
  - Removal of PM_BH21 – Bore lost due to archaeological works within the site. Only manual water levels taken; therefore, it was decided to not have a replacement bore
  - Removal of PM_BH57 – Bore lost due to archaeological works within the site. Only manual water levels taken; therefore, it was decided to not have a replacement bore

Table 7: Groundwater Monitoring Network – Westmead to Clyde Jul 2025

Monitoring zone	Groundwater monitoring bore ID*	Screen interval (mbTOC)	Target unit	Water quality	Manual water level	Level logger	Logger download
Clyde Zone 1 – 5 (Clyde MSF)	CZ1_D35_MW02	2.9 – 5.8	Clay	✓	✓	LevelSCOUT2X	✓
	CZ5_MW105	4.0 – 10.0	Clay	✓	✓		
	CZ5_MW103	3.0 – 7.0	Clay	✓	✓		
	CZ5_MW102	3.0 – 7.0	Clay	✓	✓		
	SMW_WTP_BH25_s	3.0-6.0	Clay	✓	✓		
	SMW_WTP_BH25_w	7.2-10.2	Clay, Siltstone	✓	✓	Troll 400 level	✓
	SMW_ENV039_w	7.3-10.3	Clay	✓	✓	LevelSCOUT2X	✓
Clyde Zone 2 (Rosehill)	CZ4e_MW02	1.5-4.5	Gravel	✓	✓		
	CZ4e_MW03	3.0-6.0	(Sandy) Clay	✓	✓		
	SMW_BH010_w	23.5-26.5	Siltstone, sandstone		✓	CT2X; Solinst levelogger	✓
	SMW_ENV042_w	7.4-10.4	Clay		✓		
	SMW_ENV145_w	11.0-14.0	Clay	✓	✓	CT2X; Solinst levelogger	✓
	SMW_WTP_BH13_w	1.3-7.3	Clay	✓	✓	GALC telemetry	✓
	GALC-MW16_s	5.0-11.0	-		✓	GALC telemetry	✓

Monitoring zone	Groundwater monitoring bore ID*	Screen interval (mbTOC)	Target unit	Water quality	Manual water level	Level logger	Logger download
Clyde Zone 3 (Clyde Dive)	GALC-MW16_w	16.0-21.0	-	✓	✓	GALC telemetry	✓
	GALC-MW17	12.5-21.5	-		✓	GALC telemetry	✓
	SMW_BH057_s	1.5-5.3	Sand	✓	✓	Solinst levelogger	✓
	SMW_BH057_w	23.3-26.3	Siltstone, Sandstone	✓	✓	CT2X	✓
	SMW_ENV009_w	2.8-7.3	Clayey sand	✓	✓	Solinst levelogger	✓
	SMW_ENV010_w	3.2-6.6	Siltstone, sandstone	✓	✓	-	-
Parramatta	GALC-MW26A	5.0-12.0	Silty clay with sand		✓	GALC telemetry	✓
	GALC-MW26	18.0-30.0	Sandstone		✓	GALC telemetry	✓
	GALC-MW31	18.5-30.5	Sandstone		✓	GALC telemetry	✓
	GALC-MW32	18.0-30.0	Sandstone		✓	GALC telemetry	✓
	GALC-MW33	18.5-30.5	Sandstone		✓	-	-
	PM_BH14	3.5-6.0	Clayey sand	✓	✓	LevelSCOUT2X	✓
	PM_BH15	7.0-10.0	Clay	✓	✓	-	-
	SMW_BH002_w	29.4-32.4	Sandstone		✓	Solinst levelogger	✓
	SMW_BH004_s	6.50-11.50		✓	✓	Solinst levelogger	✓

Monitoring zone	Groundwater monitoring bore ID*	Screen interval (mbTOC)	Target unit	Water quality	Manual water level	Level logger	Logger download
	SMW_BH004_w	20.60-23.60			✓	CT2X; Solinst levelogger	✓
Westmead	GALC-MW38	22.83-34.83			✓	GALC telemetry	✓
	GALC-MW47	10.0-16.0			✓	GALC telemetry	✓
	GALC-MW54	1.0 - 4.0	Sandy Clay/Gravelly Clay	✓	✓	LevelSCOUT2X	✓
	SMW_BH008_w	14.0-17.0	Siltstone, sandstone		✓	Solinst levelogger	✓
	SMW_WTP_BH02_w	14.0-20.0	Siltstone, sandstone	✓	✓	Troll 400 level	✓
	SMW_WTP_BH03A_w	15.0-21.0	Siltstone, sandstone	✓	✓	Troll 400 level	✓

7.6 Groundwater Level and Drawdown Monitoring

Procedures for the collection of continuous and discrete groundwater monitoring data are provided, including all quality assurance / quality control requirements. Specifically, this methodology provides an approach for collection and assessment of the following environmental datasets:

- Groundwater level as mBTOC groundwater and mAHD (measurement and datalogger download)
- Groundwater salinity as electrical conductivity (measurement and datalogger download)
- Groundwater quality at key locations (field measurement and sample collection)

The groundwater sampling methodology has been developed for compliance with the following Australian and International Standards and Guidance:

- AS/NZS 5667.11:1998: Water Quality – Sampling Part 11: Guidance on Sampling of Groundwaters (Reconfirmed 2016).
- 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 (Reconfirmed 2016).
- 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.

The methodology also provides quality assurance / quality control procedures for collecting and managing environmental datasets. All monitoring and sampling will be documented and transferred to a central electronic database under the responsibility of the Construction Environment and Sustainability Lead (or delegate).

7.6.1 Monitoring Program

The standpipe piezometers that have been nominated as part of the project construction stage monitoring program have been specified in **Table 7**.

The monitoring methodology for nominated standpipe piezometers is discussed in the following sections, including methods to be adopted for data collection. Water levels from the network will be monitored quarterly.

The frequency of monitoring was initially specified as monthly. Quarterly monitoring has been undertaken as monthly monitoring is neither practical or necessary to meet the objectives of the monitoring program.

7.6.2 Monitoring Methodology

7.6.2.1 Standpipe Piezometers

Pressure transducers with digital dataloggers will be installed (or maintained from the baseline monitoring phase) in selected standpipe piezometers within and around the predicted radius of drawdown for the project to provide continuous data collection. The dataloggers will be programmed to record at hourly intervals.

Selected standpipe piezometers will include transducers with fitted with EC sensors to record groundwater salinity for monitoring of potential saline intrusion where potential risks exist.

All pressure transducers will be set at a depth lower than the predicted minimum water table elevation, accounting for natural variations and artificially induced drawdown. Any transducers with EC sensors shall be set within the screened interval for accurate assessment of groundwater salinity.

Data loggers will be checked and maintained as necessary before being re-calibrated, decontaminated and then returned to the monitoring bore at a known depth below the top of casing.

The data loggers will be either telemetered or downloaded quarterly. The readings from dataloggers will be calibrated with manual depth to water measurements as part of the quarterly monitoring program.

The static groundwater level will be measured and recorded at each standpipe piezometer each month using an oil/water interface probe to verify the continuous data recorded by dataloggers and identify any non-aqueous phase liquid (NAPL) contamination. Recorded data will be compensated for barometric pressure and converted to a groundwater level measurement.

Measurements will be recorded in metres below top of casing (mbTOC) and converted to metres below ground level (mBGL) and metres Australian Height Datum (mAHD).

Groundwater monitoring will be overseen by personnel with appropriate qualifications and experience. Trained field personnel will complete monitoring rounds using appropriate personal protective equipment (PPE) and calibrated monitoring equipment.

All groundwater level data will be compared to local rainfall records to assess recharge response and identify any potential adverse effects from construction activities.

7.6.2.2 Vibrating Wire Piezometers

The current vibrating wire piezometer (VWP) monitoring network consists of telemetered monitoring bores operated by GLC (prefix GALC), with baseline VWPs being destroyed during the construction works This monitoring network is equipped with telemetry systems, allowing for continuous monitoring of groundwater level.

VWPs are used to monitor porewater pressure. They can also be used to monitor water levels. The VW piezometer converts water pressure to a frequency signal via a diaphragm, a tensioned steel wire, and an electromagnetic coil.

The piezometer is designed so that a change in pressure on the diaphragm causes a change in tension of the wire. An electro-magnetic coil is used to excite the wire, which then vibrates at its natural frequency. The vibration of the wire in the proximity of the coil generates a frequency signal that is transmitted to the readout device.

The readout or data logger stores the reading in Hz. Modern data logger readouts may also automatically convert the reading in Hz to a pressure or level reading when a suitable pre-calibration is used. For non-vented piezometers, barometric pressure corrections are required because the space inside the piezometer isolated and disconnected from the atmosphere. Vented piezometers designed to eliminate barometric effects, and as such barometric pressure corrections are not required.

Further details on using piezometers to monitor water pressure (level) can be found in USBR 6515, along with available instruction manuals for specific VWP sensors.

VWPs will be set to record data at a maximum interval of once every six (6) hours. VWP monitoring data will be downloaded and reviewed on a quarterly basis to assess changes in groundwater levels during the construction stages of the project. .

Results from repeat monitoring rounds will be collated into continuous data graphs to show any trends in groundwater levels over time and infer any trends that may be attributable to construction activities.

7.6.3 Data Analysis

All groundwater level data from standpipe piezometers and vibrating wire piezometers will be uploaded to a central database that will be continuously updated over the course of the baseline and construction stage monitoring program.

Groundwater level data will be converted into digital graphs for each standpipe piezometer and vibrating wire piezometer, which will include predicted maximum drawdown levels from groundwater modelling and NSW Aquifer Interference Policy (AIP) (DPI, 2012) minimal impact considerations as trigger values (performance criteria).

Manual dip measurements will be included for all continuous logging data in standpipe piezometers to ensure no drift or errors have occurred in digital records.

Barometric data loggers will be installed in select monitoring bores to allow for post-correction of water level data from continuous loggers to atmospheric fluctuations.

Atmospheric correction of water level data should be conducted as per the following example:

$$WL_{corr} = WL_{abs} - P_{atm}$$

Where:

WL_{corr} = corrected SWL

WL_{abs} = absolute water level as recorded by the data logger) barometric pressure plus water pressure)

P_{atm} = atmospheric pressure as recorded by the barometric logger

Note that due to the variable salinity (density) of groundwater measured across the Project, measured water level will require correction to account for this difference in fluid density a per the following:

$$hf \times \rho f = hm \times \rho m$$

Where:

hm = measured water column in bore

ρm = density of groundwater in bore based on measured TDS

hf = equivalent freshwater column in the bore

ρf is freshwater density

VWPs are equipped with data loggers, which are to be programmed to record pore pressures at six-hourly intervals. Data will be collected quarterly and converted to equivalent metres of head

7.6.4 Performance Criteria and Trigger Action Response Plan

Seasonal fluctuation considered within the EIS and supplementary reports will facilitate the assessment and comparison between groundwater level decrease and the predicted drawdown from the Project.

The groundwater level monitoring data will be compared to the drawdown levels identified by the Revised Groundwater Modelling Report(s) to determine whether the observed decrease is attributable to the Project and, if so, whether it aligns with approved predictions. The Revised Groundwater Modelling Report(s) will be provided to relevant stakeholder where there is potential for interaction with existing groundwater management / monitoring programs.

Management actions outlined in the GWMP will be initiated if drawdown is identified outside of model predictions through the data analysis process, or if there is evidence of an unacceptable impact to or potential for unacceptable impact to groundwater resource under the AIP.

Management actions may include further investigation including (but not limited to) a review of baseline groundwater levels in surrounding monitoring bores and comparison of results against model predictions, and assessment of potential impacts as a result of the observed drawdown.

If the observed groundwater levels indicate potential for unacceptable impacts to the environment, human health, or built infrastructure then appropriate management measures to remedy the effect will be implemented. Appropriate remedial actions may include measures such as additional grouting or alternative inflow management measures to limit inflows to excavations and reduce dewatering effects.

In accordance with the AIP minimal impact considerations, groundwater level and pore pressures will be assessed against the following criteria where appropriate:

- Less than or equal to 10 % cumulative variation in the water table, allowing for typical climatic ‘post-water sharing plan’ variations, 40 m from any:
    - high priority groundwater dependent ecosystem; or
    - high priority culturally significant site

      listed in the schedule of the relevant water sharing plan.
- A cumulative maximum of 2 m decline in water level or pore pressure at any water supply bore (as per REMM SG02).

If more than 10 % cumulative variation in the water table, allowing for typical climatic ‘post-water sharing plan’ variations, 40 metres from any:

- high priority groundwater dependent ecosystem; or
- high priority culturally significant site

  listed in the schedule of the relevant water sharing plan.

The nearest high priority GDEs (as per Jacobs (2020)) and water supply bores are presented in Table 8.

Table 8: Proximity to high priority GDEs and water supply bores

Site	High priority GDE	Nearest water supply bore
Westmead	Grey Box – Cumberland Plain Woodland 220 m E	GW108378 780 m NNW
Parramatta	Grey Box – Cumberland Plain Woodland 590 m WNW	GW108661 565 m NNW

Site	High priority GDE	Nearest water supply bore
Clyde Dive	Salt Marsh Estuaries of the Sydney Basin Bioregion 1.4 km SE	GW107659 1.9 km WNW
Rosehill	Salt Marsh Estuaries of the Sydney Basin Bioregion 800 m SE	GW107659 1.8 km NW

If registered groundwater users are impacted by a material decline in groundwater supply levels (i.e., >2 m), quality or quantity, make good provisions will be provided to those groundwater users in accordance with the GWMP.

The predicted groundwater drawdowns are used for settlement analysis and predicted effects assessment. Where found to be governing, particularly near sensitive structures with thick alluvium, the groundwater monitoring plan will be updated and incorporated into the report in future revisions, as part of the adaptive management approach to monitoring.

7.7 Groundwater Quality Monitoring

7.7.1 Monitoring Program

Groundwater quality monitoring will be undertaken on a quarterly (3 month) basis thereafter at the monitoring bores (or suitable replacement) identified in **Table 7**.

The sampling programme will retain all parameters listed in **Table 9** as part of the ongoing construction groundwater quality monitoring strategy, to provide ongoing monitoring of groundwater conditions and assess any potential changes in groundwater quality which may have occurred as a result of the construction activities or other local events.

Polycyclic aromatic hydrocarbons (PAHs), pesticides/herbicides and volatile organic compounds / semi-volatile organic compounds (VOC/SVOCs) are to be monitored on a six-monthly basis at selected locations. This is due to results from previous monitoring round not identifying a significant risk from PAH/SVOC/VOC pesticides/herbicides in groundwater. Further, speciated arsenic is not included, due to calculated trigger values determining trigger values that account for this speciation (**Attachment 6**).

Water quality monitoring at the nominated groundwater bores is intended to identify where contaminants are potentially migrating to the station boxes as a result of drawdown and to inform whether contamination has occurred as a result of site activities or local events. Both factors will inform potential risks to compliance with construction water treatment plants and risks to sensitive environmental or human health receivers.

All samples will be submitted for testing at the appropriate limit of reporting (LoR) for comparison against the relevant NEPM / ANZG 2018 trigger criteria.

Table 9: Proposed quarterly groundwater sampling regime

Groundwater Sampling Suite	Rationale	Frequency
General water quality parameters: electrical conductivity, total dissolved solids, alkalinity, hardness.	Assessment of groundwater physico-chemical parameters will be conducted to assess impacts to the beneficial use of the aquifer. Selection of this analytical suite will improve on-going understanding of groundwater conditions and complement the other analytical suites selected.	Quarterly

Groundwater Sampling Suite	Rationale	Frequency
Major Ions: calcium, magnesium, potassium, bicarbonate, sodium, chloride, sulfate.	ASS have been identified in select sites within the Project area. On-going monitoring of this analytical suite will allow for assessment of groundwater quality with respect to the potential reactivation of ASS.	Quarterly
Heavy metals:, As, Cd, Cr (III+VI), Cu, Hg, Pb, Ni, Zn, Mn, Fe.	Concentrations of dissolved metals have been reported in groundwater in excess of the ANZG, 2018 (dissolved metals) guidelines for both fresh and marine water quality. On-going monitoring of these selected metals will be conducted to identify and assess vertical and/or horizontal migration as a result of dewatering and construction activities.	Quarterly
Nutrients: total nitrogen, total oxidized nitrogen, nitrate, nitrite, total ammonia, ammonium, total phosphorous, total reactive phosphorous, total Kjeldahl nitrogen.	Concentrations of nutrients have been reported in groundwater in excess of the ANZG, 2018. Ongoing monitoring of these COPC will be conducted to identify and assess vertical and/or horizontal migration as a result of dewatering activities.	Quarterly
Total petroleum hydrocarbons	Ongoing monitoring of these COPC will be conducted to identify and assess vertical and/or horizontal migration as a result of dewatering activities.	Quarterly
Aromatic hydrocarbons: benzene, toluene, ethylbenzene, xylene, naphthalene		Quarterly
Per- and poly-fluoroalkyl substances (PFAS) (list of compounds per USEPA 527, ASTM X7968)		Quarterly
Polycyclic aromatic hydrocarbons (list of compounds per method USEPA 8270)		Six monthly (select locations)
Pesticides including organochlorine pesticides / organophosphorus pesticides (list of compounds per methods for OCP US EPA8081/8270 and OPP USEPA 8082/8270)		Six monthly (select locations)
Herbicides (list of compounds for phenoxy acid herbicides per USEPA 8151A and triazine herbicides USEPA 8270)		Six monthly (select locations)
Volatile organic compounds / semi-volatile organic compounds (list of compounds for VOCs per method USEPA 8260B and SVOCs per USEPA 8270)		Six monthly (select locations)

Dedicated dataloggers with specifications allowing the measurement of pressure, temperature, and electrical conductivity (EC) have been installed in monitoring bores identified in **Table 7**. These monitoring bores have been selected due to their relative positioning between estuarine sections of local waterways and the radius of drawdown for excavations.

Further adjustments to salinity monitoring bores may be necessary as part of an adaptive management strategy for the project. Electrical conductivity (EC) results will be assessed to detect changes in water quality that may indicate the intrusion of saline water towards the station boxes and shafts.

It is noted that assessments undertaken by GLC as part of the Hydrogeological Interpretive Report have not identified any risk of saline intrusion as a result of the project activities.

7.7.2 Monitoring Methodology

Groundwater quality sampling will be carried out by suitably qualified personnel, in accordance with AS/NZS 5667.11:1998 (Water quality–Sampling), and will follow these general principles:

- Sampling equipment should not change the water quality in any way; particular effort should be made to avoid cross contamination between bores and sampling equipment
- Sufficient water should be removed to ensure the sample is newly derived from the aquifer itself rather than from water that is potentially stagnant in the bore
- Methods of collection, storage bottles and transportation to the laboratory should suit the type of analysis required

Groundwater sampling may produce a potentially large volume of purged water. This water will be captured in containers and treated in the constructions water treatment plant or disposed of in accordance with the Waste Management Plan.

The groundwater monitoring program will adopt a low-flow sampling methodology for the collection of all groundwater samples at all sites identified in Section 7.5. The low-flow sampling methodology employs specifically designed sample pumps. ASTM D6771-21 provides the standard practice for low-flow purging and sampling used for groundwater monitoring.

A Standard Operating Procedure that is compliant with AS/NZS 5667.11:1998 shall be developed and adhered to for all low-flow sampling operations. The Standard Operating Procedure will include requirement for positioning the intake of the low-flow tubing at the depth of the aquifer that is contributing formation water to the standpipe piezometer.

Where low flow-sampling is unable to be undertaken (due to low recharge, low water column or excessive depth), sampling via hydrasleeve or disposable bailer may be adopted as a groundwater sample collection methodology.

7.7.2.1 Sample Collection

In general, groundwater sampling will align with the following procedure:

- All monitoring bores will be gauged to obtain SWL and total depth of each well (prior to purging) using a cleaned / decontaminated electric water level probe. This will provide information regarding purge volumes required for ensuring the collection of representative groundwater samples when using the low-flow method.
- A low-flow Standard operating procedure compliant with AS/NZ 5667.11.1998 will be developed for the project to ensure that samples are taken consistently in the same way and at the same depth.
- Field measurements for physical groundwater parameters will be taken using a calibrated water quality meter fitted with a multi-sensor probe to collect field quality parameters (pH, EC, dissolved oxygen (DO), temperature, and redox potential (Eh)) during purging.
- Groundwater samples will be collected after confirmation of aquifer parameter stabilisation (**Table 10**).
- A physical description of the sample, including colour, turbidity (visual), odour, and presence of film, sheen or foam will be recorded on standardised field sheets.
- Groundwater samples will be stored in clean laboratory prepared bottles containing the appropriate preservatives.

- Samples for dissolved metal analysis will be filtered through a 0.45 µm in-line filter and stored in laboratory prepared bottles containing nitric acid preservative.
- All groundwater samples will be labelled accordingly and placed immediately into an esky containing ice.
- Chain of custody (CoC) documentation will be completed at the time of sampling and will accompany the samples to the laboratory.
- One rinsate blank will be collected from the water level probe and the pump (or other sampling equipment) during each day of sampling. Rinsate samples will be analysed for CoPC to ensure cross-contamination has not occurred.
- Samples will be submitted to a National Association of Testing Authorities (NATA)- accredited laboratory for analysis.

Some physicochemical parameters cannot be reliably measured in the laboratory as their characteristics change over a very short time scale. Parameters that should thus be measured in the field include pH, electrical conductivity (EC), temperature, dissolved oxygen (DO), redox potential (Eh) and alkalinity.

Other observations including odour, colour and indications of gross contamination will also be recorded on field logging sheets.

Field parameters should be measured in a flow cell using a multiparameter probe (water quality metre) to avoid contact between the groundwater and the atmosphere. Readings of field parameters should be recorded at a minimum of every three (3) minutes (where sampling rate is 100 ml/minute or more) or five minutes (if flow rate is less than 100 ml/minute) until parameters have stabilised.

Once the SWL stabilises wait for three successive stable parameter readings (at 3-to-5-minute interval between each successive reading) before sampling. Criteria for the acceptance of stable water quality parameters are summarised in Table 1010.

Table 10: Example Criteria Defining Stabilisation of Water Quality Parameters

Field Parameter	Control limit
Dissolved Oxygen	±10% of reading or ±0.2mg/L
Temperature	±0.2°C
pH	±0.2 pH units
Electrical Conductivity	±3% of reading
Redox Potential	±20 mV

The pump tubing should be disconnected from the flow-through-cell, following stabilisation and prior to sample collection, so that the samples are collected from the pump's discharge tubing without contact with the flow-through-cell. Air pressure on the gas cylinder can be turned down so samples can be filled with minimal turbulence (if applicable).

A Standard Operating Procedure that is compliant with AS/NZS 5667.11:1998 shall be developed and adhered to for all low flow sampling operations, including the collection of field parameters.

7.7.2.2 Sample Filtration and Preservation

Sample Filtration and Preservative Requirements

The proposed sample filtration and preservative requirements for the laboratory testing parameters are presented in **Table** *11*. Filtration should be carried out in the field for all samples unless otherwise specified so that results are representative of dissolved concentrations. All samples

should be maintained at approximately 4 degrees Celsius as part of the preservation protocols before being transferred to the laboratory.

Table 11: Sample Filtration and Preservative Requirements

Analyte Suite	Field Filtration	Chemical Preservative
General Water Quality	Not Required	Not required
Nutrients	0.45µm	Sulfuric acid (H_2SO_4)
Dissolved Metals	0.45µm	Not required
Dissolved Iron Species	0.45µm	Hydrochloric acid (HCl)
Dissolved Hexavalent Chromium (where applicable)	0.45µm	Sodium hydroxide
Petroleum Hydrocarbons	Not Required	Not required
Aromatic hydrocarbons (BTEXN)	Not Required	Not required
Polycyclic aromatic hydrocarbons	Not Required	Not required
Volatile organic compounds	Not Required	Sulfuric acid
Semi-volatile organic compounds	Not Required	Not required
Organochlorine pesticides	Not Required	Not required
Organophosphorus pesticides	Not Required	Not required
PFAS	Not Required	Not required

7.7.2.3 Salinity Measurement

As described in **Section 7.6** dedicated water level data loggers, which can measure both depth-to-water and EC, will be installed in select standpipe piezometers between the project and the closest saline water bodies. Salinity results will also be determined from field total dissolved solids measurements from sampled groundwater monitoring bores.

EC results will be assessed to detect changes in water quality that may indicate the intrusion of saline water towards the project. Where groundwater quality monitoring is also proposed, the field EC data will be assessed in conjunction with the laboratory data. Performance criteria for assessment of saline intrusion is included in **Section 7.7.4**.

7.7.2.4 Quality Assurance and Control Samples

The following quality assurance and control samples are proposed for the monitoring program. It is noted that per the PFAS NEMP (HEPA, 2020), where PFAS samples are collected, the frequency of analysis for QA/QC samples should be increased from what is defined in ASC NEPM (NEPC, 2013). This has been considered below.

7.7.2.4.1 Rinsate Blanks

Rinsate blanks are used to estimate the amount of contamination introduced during the re-use of sampling equipment. Rinsate blank samples are obtained by pouring laboratory supplied deionised water over decontaminated sampling equipment (e.g., groundwater interface probe) and collecting the water in laboratory supplied bottles. Rinsate blank sample should be included at a rate of one per day of sampling or wherever uncertainty may arise regarding the potential for contamination. Where PFAS is proposed for analysis, rinsate blanks should be collected at a rate of at least for every ten primary samples (10%).

7.7.2.4.2 Intra-Laboratory Duplicates

Intra-laboratory (blind) duplicate samples used to identify variation in the analyte concentration between samples from the same sampling point. Intra-laboratory duplicates should be analysed at a rate of one per ten primary samples (10%).

7.7.2.4.3 Inter-Laboratory Duplicates (Triplicates)

Inter-laboratory (split) duplicate samples provide an indication of the repeatability of the results between laboratories. Inter-laboratory duplicates should be analysed at a rate of one per ten primary samples (10%).

7.7.2.4.4 Trip Blanks / Trip Spikes

A sample of laboratory supplied deionised water should accompany the primary samples over the course of the fieldworks and should be submitted to the laboratory for analysis. Trip blanks provide an indication of contamination introduced during sample transport and handling, and also ensure that the testing laboratory is not reporting “false positives”. Trip blanks should not indicate concentrations of the contaminants of potential concern (CoPC) above the laboratory detection limits. A trip blank sample should be included at a rate of one per batch.

Similarly, a laboratory provided trip spike should be submitted at a rate of one per batch. The trip spike will provide an indication of whether contaminant loss was possible during sample transport and handling. The results be used to identify the potential for false negatives.

7.7.2.5 Sampling Records

Results for each quality sample will be recorded on appropriate field sheets (hard copy or digital) using unique sampling identification nomenclature consisting of the sample identification, parent sample identification, sample date, location, and sampler details.

Details of all quality samples will be recorded on an internal database.

7.7.2.6 Decontamination

Equipment will need to be cleaned periodically and between sampling locations to prevent a build-up of dirt and cross-contamination.

The following methodology will be followed:

- Rinse the equipment in tap water
- Clean with Decon 90 (a phosphate free detergent), or Liquinox (or similar) where PFAS is analysed for
- Rinse with tap water
- Thorough rinse with laboratory supplied de-ionised water
- Allow to dry away from dust and direct sunlight

De-ionised and tap water will be available for washing equipment in the field, if required.

7.7.2.7 Laboratory Analysis

Laboratory analysis procedures for groundwater samples are discussed in Section 10.

7.7.3 Data Analysis

Data analysis procedures for groundwater quality will involve collating and assessing results from the following sources:

- Stabilised readings from field parameter measurements
- Laboratory analytical results
- Transducers fitted with salinity sensors

Field and laboratory data will be collated into a master database that will be updated with new information on completion of each monitoring event to include raw data and statistical summaries. Raw data results and statistical summary data collated in spreadsheets will be compared against the performance criteria for groundwater quality and salinity to assess whether further investigations or management responses are required.

7.7.4 Performance Criteria and Trigger Action Response Plan

The key performance criteria (trigger values) for groundwater quality are discussed in the following section.

Trigger values comprising NEPM GILs and ANZECC (2000) / ANZG (2018) 95-99% species protection criteria and calculated baseline trigger values (**Attachment 6**) have been adopted as the indicator values of the performance criteria for groundwater quality. Any changes in groundwater quality will be measured relative to these trigger values.

For measuring performance criteria for potential saline intrusion, these will be assessed from continuous loggers fitted with salinity sensors, and TDS concentrations from sampled groundwater monitoring bores.

A reportable change in groundwater quality will be defined as:

- A parameter exceeding either the NEPM GIL, ANZECC (2000) or ANZG (2018) value over a sustained period (i.e., for at least 3 consecutive monitoring rounds), which has been recorded during baseline monitoring as non-detect or below the NEPM GIL, ANZECC (2000) or ANZG (2018) value, or
- A parameter increasing in concentration over a sustained period (i.e., for at least 3 consecutive monitoring rounds) to more than 2x the baseline trigger value, where the baseline trigger value exceeds the NEPM GIL value, or
- A parameter increasing in concentration over a sustained period (i.e., for at least 3 monitoring rounds) to more than 2x the baseline trigger value, where the baseline trigger value exceeds the ANZECC (2000) or ANZG (2018) value, or
- An increase of salinity (measured as total dissolved solids, TDS, and through continuous salinity transducers) over a sustained period (i.e., for at least 3, consecutive monitoring rounds) to more than 2x the recorded 95th percentile value prior to construction

Once a reportable change for groundwater quality and salinity has been identified, statistical analysis (via Mann Kendall trend analysis or other means) will determine whether it is a significant change in groundwater quality.

7.7.4.1 Groundwater Quality

Where a significant trend in groundwater quality is identified (defined in **Section 7.7.4**), this will trigger further desktop investigation. The objectives of the desktop investigation are to determine if:

- The contaminant concentrations are likely to present a potential immediate risk to human health or the environment which have previously not been identified (e.g. concentration significantly exceeds site concentration maximums), or
- The contaminants have potentially been introduced to groundwater directly as a result of construction activities (e.g. TRH introduced from site leaks and spills), or
- Contaminant migration is potentially occurring resulting in degradation of groundwater quality within and around sensitive receptors (including GDEs and groundwater supply bores)

Additional monitoring and management responses are to be undertaken in circumstances where the desktop review demonstrates that any of the above mentioned scenarios are likely. Monitoring frequency is to increase to monthly to further assess the potential requirements for management responses.

Desktop investigation may include but not be limited to:

- Assessment of potential sources of contamination
- Comparison to existing site data
- Investigation of recent site activities (eg. unexpected finds, incidents)
- Assessment of contaminant migration pathways

This process is shown schematically in **Figure 2.**

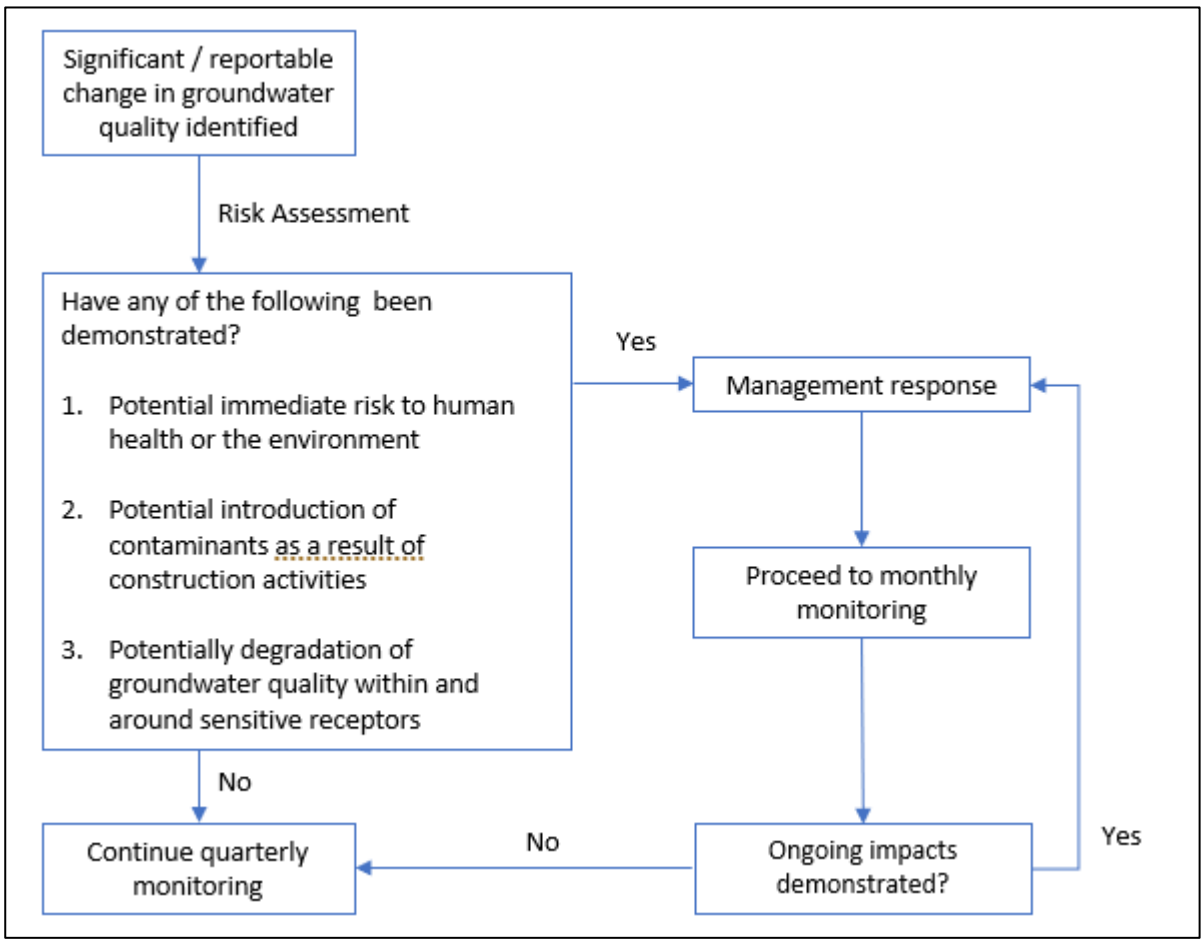

Figure 2: Trigger value exceedance flowchart.

7.7.4.2 Groundwater Salinity

Where a significant trend in groundwater salinity is identified (defined in **Section 7.7.4**), this will trigger further desktop investigation. The objective of the desktop investigation will be to determine if increases in salinity have the potential to impact groundwater extractive users and aquifer beneficial uses. The review will assess the historical and surrounding monitoring bore data, and modelling predictions.

Additional monitoring and management responses are to be undertaken in circumstances where the desktop review demonstrates that the above mentioned scenario is likely. Monitoring frequency is to increase to monthly to further assess the potential requirements for management responses.

This process is shown schematically in **Figure 2**.

It should be noted that saline intrusion has not been identified as a significant risk factor for groundwater quality in the context of the project activities. Despite this performance criteria to assess potential for saline intrusion have been adopted as part of a best management practice approach.

7.7.4.3 Acid Sulfate Soils/Groundwater Aggressivity

Assessment of the activation of Acid Sulfate Soils (ASS) will involve plotting major anion and cation compositions and pH on a Schoeller diagram to identify deviations in the concentration of base cations before (i.e., baseline conditions) and during dewatering. Total alkalinity decreasing below 30 mg/l as $CaCO_3$ is considered to represent a reduction in the acid buffering capacity of the soil. If pH reduces by a unit as compared to the baseline pH range prior to excavation, this indicates that ASS have been activated.

The estimated groundwater aggressivity (tendency for corrosion) pre- and during construction will be assessed following the Langlier Saturation Index (LSI). The following definitions for interpretation of LSI will be used to determine groundwater aggressivity and implementation of mitigation measures:

- LSI <0.5 (potential for scaling)
- Log Cl/CO3 >2 (potentially corrosive)
- pH (for bedrock) = 4.5 – 5.5 (moderately aggressive)
- pH (for bedrock) = 5.5 – 6.0 (mildly aggressive)
- SO4 (for bedrock) = 0 – 1,000 mg/l (mildly aggressive)
- SO4 (for bedrock) = 1,000 – 3,000 mg/l (moderately aggressive)
- Cl (for bedrock) = 0 – 3,000 mg/l (non-aggressive)
- Cl (for bedrock) = 3,000 – 6,000 mg/l (mildly aggressive)

In addition to ecosystems risk due to discharge of groundwater, volatile organic compounds (VOCs) in groundwater can also present a potential vapour intrusion risk in an urban environment. Baseline groundwater monitoring completed has not identified significant VOCs.

If VOCs are detected and assessed as a potential risk, a risk monitoring framework for vapour intrusion will be adopted and SSTVs developed to identify where existing conditions have been changed by project activities, and an adverse change in risk may have occurred.

No existing potential vapour intrusion risks have been identified based on baseline data previously collected, and therefore no SSTVs for VOCs have been developed.

Any SSTVs developed will include three response levels:

- Alert – increase in monitoring frequency

- Action – adverse trend due to construction activity, with action and/or additional assessment of risk required
- Not to exceed level

Should unexpected groundwater conditions be encountered, or groundwater monitoring indicate groundwater quality alteration due to contaminant migration then the following corrective actions / measures could be evaluated and implemented as appropriate:

- Reduction in the open area being dewatered, to reduce the rate of groundwater ingress, groundwater gradients (towards the tunnel(s)) and contaminant migration potential
- Pump and treat from the vertical groundwater bores, to allow for the capture of possible contaminants migrating in groundwater prior to entering Project work areas.
- Groundwater will then be treated, to meet discharge criteria, before disposal
- Assessment and revision of project environmental management procedures
- Preparation of a Remedial Management Plan
- If activation of ASS occurs the immediate response should be to investigate further to confirm change in conditions and assess the need to dose with lime or to determine if action needs to be taken (e.g., commence groundwater recharge, alter dewatering practice etc / continue monitoring)
- Make good provisions for groundwater users will be provided in the event of a material decline in water supply levels, quality or quantity from registered existing bores associated with groundwater changes from either construction and/or ongoing operational dewatering caused by the Project.

7.8 Cessation of groundwater Monitoring

Typical construction activities known to affect groundwater levels and quality are limited to excavation (station box and Tunnelling) activities which may directly affect groundwater levels, and/or influence groundwater quality. It is important to note that groundwater quality is heavily influenced by external environmental and human induced factors independent of construction of the Sydney Metro West Tunnelling project, including but not limited to:

- existing geological conditions (soil profile)
- existing contamination within the soil and groundwater profile
- rainfall within the immediate vicinity of the GWMW's and in the wider catchment area
- existing groundwater users and other major developments.

In light of the above considerations, GLC would follow a risk-based approach in its determination for ceasing monitoring and reporting in accordance with the GWMoP. GLC would cease quarterly sampling of GWMWs and subsequent reporting of these wells when the following criteria are fulfilled.

Criteria for ceasing monitoring:

a) Completion of construction activities which could affect groundwater quality and levels, both within the site and immediately upstream of the GWMW. This would generally be limited to tunnelling, cross passage and station box excavation, as well as lining and waterproofing activities. and,
b) Obtaining two consecutive results for the same GWMWs which could demonstrate either:
    a. There has been no deterioration of the hydrogeological environment, and/or
    b. There has been a stabilisation of the hydrogeological environment and there is no additional risk to the environment.

If at any point GLC identifies that there has been significant deterioration of the hydrogeological environment, then appropriate remediation works would ensue in accordance with the MCoA and REMMs.

Where cessation of groundwater monitoring is proposed, the results leading to this outcome would be discussed in the relevant six-monthly construction monitoring report.

Cessation of any groundwater monitoring would only occur once the monitoring results are reviewed and confirmed by a GLC Consultant and/or subject matter expert (i.e., Project Hydrogeologist). Any cessation will require authorisation from Sydney Metro (in the form of a technical memorandum) which is reported in the six-monthly reports.

7.8.1 Access constraints following Substantial Construction completion and contractual handover.

Completion of site works on WTP and handover to Sydney Metro as part of contractual completion may occur progressively as specific portions or a site, and not necessarily for a whole site itself (Parramatta, Clyde MSF, Westmead etc). With portions of site being progressively handed back to Sydney Metro, there is potential for GLC to encounter access constraints given GLC may not have Principal Contractor presence any further. Similarly, where portions have been returned to Sydney Metro, there is potential for Sydney Metro to undertake other works within these portions which could further inhibit access for monitoring or potentially render monitoring points redundant. Where this occurs, monitoring at these GWMW's may cease periodically or permanently, however GLC would detail these constraints within the relevant six-monthly construction monitoring report.

8 EXCAVATIONS / TUNNEL INFLOWS

8.1 Excavations

Station boxes are expected to be open for extended periods of time with variable inflow rates dependent on hydrogeological conditions and inflow control measures.

During construction groundwater inflows to excavations will be collected in sumps / collection points and transferred via pumping to the construction water treatment plants (CWTPs) located at:

- Rosehill
- Parramatta
- Westmead

Volume 4B (Particular Specification) Sydney Metro West Western Tunnelling Package Schedule C1 (Version 6 Sydney Metro, 2022b) provides the design criteria for the assessment on inflow and drawdown. The inflow criteria are discussed further in Section 8.2.4.

The specification (Sydney Metro 2022a) Section 4.2.2 (n) requires the provision of two sumps for groundwater and stormwater collection at the base of each station excavation. One sump is expected to be required at each end of the station and each of the sumps will collect both groundwater and surface water.

At Clyde MSF groundwater is expected to be intersected by the retention basin. While inflows are expected to be low due to the presence of predominantly low permeability clays they will need to be managed accordingly. Given the location of the retention basin in an industrial area there is likely to be groundwater contamination management issues associated with the groundwater seepage. Estimation of inflows will support the design and construction planning and will be completed for following stages of works.

Groundwater will also be intersected during the construction of the water conveyance structures on A'Becketts Creek and Duck Creek.

8.1.1 Monitoring Program

Groundwater inflow monitoring will be undertaken at all excavations for station boxes. Given station box excavation at SOP was completed by AF JV, monitoring of groundwater wells in the vicinity of this site will be managed by AF JV and not GLC.

Observations of inflows during construction will be undertaken to characterise contributions from surface water and groundwater into the excavations and to meet CoA C17 (e) and (j). Assessment of relative inputs from rainfall/ runoff and groundwater would be supported by the installation of a site-specific rain gauge.

8.1.2 Monitoring Methodology

The inflow volume will be determined through the use of flow meters on the intake into each of the construction water treatment plants when they are established. Flow meters can also be installed on individual pumps within excavations where more focused inflow data is required.

Assessment of relative inputs from surface water and groundwater would be supported by the installation of a site-specific rain gauge.

8.1.3 Data Analysis

The groundwater inflow monitoring register will be compiled quarterly to account for groundwater take from the Sydney Basin Central Groundwater Source in accordance with MCoA C17(j). Results of this accounting will be included in the six-monthly monitoring reports.

8.1.4 Performance Criteria

The tunnelling contractor must comply with the following for the drainage of stations, junctions, shafts, and non-tunnel structures / assets:

- Station caverns– undrained
- Station excavations – drained
- Shaft excavations – drained
- Clyde Junction – undrained
- Portal structure – drained
- Clyde Dive Structure – drained
- Parramatta Station Excavation above the soil retention system toe level – undrained
- Parramatta Station Excavation below the soil retention system toe level – drained
- Rosehill Excavation – drained
- Rosehill Structure – undrained structure with drained base

The groundwater seepage within each station excavation must not exceed:

- 15,000 Litres in any 24-hour period, measured over any square with an area of 10 m^2, at any and all locations within the sides and bases of the excavations; and
- The volumes identified below in any 24-hour period:
    - Westmead Station Excavation – 100,000 litres
    - Parramatta Station Excavation – 134,000 litres
    - Further, the groundwater seepage through the drained base slab of the Rosehill Structure must not exceed 45,000 litres in any 24-hour period.

There is also a requirement to ensure groundwater seepage through the Clyde Dive structure does not exceed 5.0 ml per hour per m² of wall and base surfaces. As the Clyde Dive will be permanently drained and the permanent structure will be handed over to Sydney Metro by GLC, this criterion relates to the design of the permanent structure which is outside the scope of this investigation. The predicted total inflows for this assessment informs the design of the permanent infrastructure for this specification.

The above drainage criteria relate to the condition of the infrastructure at ‘handover’ to Sydney Metro for subsequent construction on internal station features. Handover is expected to approximate a period of two years (at Westmead and Parramatta) after commencement of the construction works as indicated in the final tender program (dated 16 Feb 2022).

Where inflows are found to exceed the above inflow criteria, targeted grouting and/or alternative management measures may be undertaken to reduce inflow rates to excavations and achieve the required inflow criteria. A reduction in inflow rates over time is expected due to the gradual loss of storage in connected surface aquifers over the course of the construction period.

In the event of adverse inflows being encountered, management measures may be required to minimise long term groundwater inflows. The Rosehill Services Facility shaft structure is to be constructed with its perimeter walls socketed into the sandstone. As such there will be limited groundwater ingress through the embedded walls below the D-Wall and through the drained base of the excavation. One sump is provided for this excavation, with long term discharge flows expected to be monitored with flow meters.

The specification (Sydney Metro 2022a) Section 4.2.2 (n) requires the provision of two sumps for groundwater and stormwater collection at the base of each Station excavation, in contrast to other ancillary structures. One sump is expected to be required at each end of the station and each of the sumps will collect both groundwater and surface water. Where suitable pumps will be fitted with flowmeters to record the flow rates from station excavations to construction water treatment plants to ensure design criteria on inflows are achieved.

The construction process adopted at Clyde MSF for water conveyance structures will provide the primary means of reducing inflows. After diversion of surface water flows from the excavation, options that could be considered to manage groundwater seepage include:

- Wet construction techniques.
- Methods that reduce inflows such as impermeable/low permeability walls (such as piles) or the use of small excavation areas.
- Dewatering systems such as effective sump/well abstractions systems within the excavation or spear dewatering systems outside the perimeter of the excavation.

Given the location of the retention basin in an industrial area there is likely to be groundwater contamination management issues associated with the groundwater seepage.

8.2 Tunnels

TBM tunnelling is proposed from Rosehill to the Sydney Olympic Park Station initially. The TBMs will then be relocated to Rosehill and tunnelling to proceed westwards to Westmead.

As a result of the tunnelling methodology (double shield TBM), the internal tunnel wall will only be exposed for a very short time period (i.e., less than one hour) before being enclosed (i.e., sealed to groundwater inflow) behind pre-cast concrete units. Due to this, the groundwater level drawdown associated with Tunnelling is therefore believed to be insignificant in comparison to other activities such as station box excavation.

During tunnel construction groundwater inflows will be collected in sumps / collection points at regular intervals within the tunnel. Collected water will be transferred via pumping or gravity drains to the construction water treatment plant located at Rosehill.

The estimated inflows at the tunnel boring machine face are presented on the hydrogeological long section in Attachment 1 of the revised Hydrogeological Interpretive Report. The inflows rely on bulk formation hydraulic conductivities. Localised high hydraulic conductivity rock features may be encountered that result in higher incidental inflow.

Tunnelling towards Parramatta is more likely to experience conditions of delamination, opening of fractures and therefore a greater potential for higher initial inflows.

Mean inflow rates approximate 9 m^3/day for open (unlined) 17 m assumed section of tunnel prior to placement of the permanent lining, as the TBM progresses. The highest and lowest rates estimated are 50 m^3/day and 2 m^3/day respectively.

8.2.1 Monitoring Program

Groundwater inflow monitoring is required in tunnels during progression of the tunnelling sections. The inflow monitoring program will continue throughout the construction period with cumulative flow records from the main tunnel sump being used to provide information on groundwater inflow conditions for overall tunnel progression.

8.2.2 Monitoring Methodology

The inflow volume will be determined through the use of flow meters on the intake into each of the construction water treatment plants when they are established. Flow meters can also be installed on individual pumps throughout the tunnel where more focused inflow data is required.

8.2.3 Data Analysis

The groundwater inflow monitoring register will be compiled quarterly to account for groundwater take from the Sydney Basin Central Groundwater Source in accordance with MCoA C17(j). Results of this accounting will be included in the six-monthly monitoring reports.

8.2.4 Performance Criteria

Volume 4B (Particular Specification) Sydney Metro West Western Tunnelling Package Schedule C1 (Version 6 Sydney Metro, 2022b) provides the design criteria for the assessment on inflow and drawdown.

The potential for groundwater drawdown impacts is relatively low compared to other tunnelling methodologies (i.e., primary use of roadheaders), noting that roadheaders are being used for caverns, spur tunnels and stub tunnels. Due to the short timeframe between the tunnel excavation and sealing, the inflow rates and resulting drawdown is not anticipated to be a significant issue for the WTP.

There are criteria specified for watertightness, which relate to the seepage of groundwater through finished internal walls of infrastructure that is undrained at handover. The tunnelling contractor must comply with the following for the drainage of tunnel assets:

- Running tunnels – undrained
- Cross-passages – undrained
- Cross-passages with sump – undrained
- Nozzle enlargements – undrained
- Cross-over caverns – undrained

As the spur tunnel access shaft was not detailed in the particular specification, it has been assumed to be drained up until lining of the spur tunnel at which time it will be backfilled such that it will be undrained.

The above drainage criteria relates to the condition of the infrastructure at ‘handover’ to Sydney Metro for subsequent construction on internal station features. Handover is expected to approximate a period of two years (at Westmead and Parramatta) after commencement of the construction works as indicated in the final tender program (dated 16 Feb 2022). The handover timeframes differ slightly for Clyde (2.6 years) and are detailed in Section 7.4.4 of the technical memorandum (SMWSTWTP-GLO-TJ550-GE-MEM-001101 Rev A.1).

9 WATER TREATMENT PLANTS

9.1 Water Treatment Plant Monitoring

9.1.1 Monitoring Methodology

9.1.1.1 In-Line Monitoring

The construction water treatment plant will be designed to include in-line monitoring sensors to monitor pH and turbidity prior to every discharge. The in-line sensors will be set-up to stop discharge if either parameter is out of range, and an alert will be sent to the water treatment plant operator. Where either parameter is out of range, water will be re-treated, and discharge won't recommence until the water is within range for these parameters.

9.1.1.2 Sample Collection

Grab samples will be collected manually from the water treatment plant locations once a month to verify that water from the treatment plants remain below the trigger values for parameters. The volume of sample to be collected will need to be sufficient for the required physio-chemical (field) parameter analysis set by the EPL using a multi-probe water quality meter(s).

9.1.1.3 Field Measurements

Field physico-chemical parameters including temperature, EC, pH, DO, and turbidity will be measured at each sampling location using a fully calibrated multi-probe hand-held water quality meter at the same time that lab samples are taken. Other observations including odour and colour will also be recorded.

The multi-probe field water quality meter(s) will be calibrated against known standards (that are within the use-by date), as supplied by the manufacturer, at the start of each sampling round of water quality sampling. Calibration records will be maintained in accordance with the appropriate standard.

9.1.1.4 Recording of Field Results

Results for each monitoring location will be recorded on appropriate field sheets (hard copy or digital) using unique sampling identification nomenclature consisting of the sample identification, sample date, location, and sampler details.

9.1.2 Data Analysis

Monthly water quality samples from the water treatment plants will be analysed, along with an overview of corrective actions. Analytes to be monitored will be determined through the Discharge Impact Assessment (water pollution impact assessment) process for the EPL with reference to identified CoPC (and as a minimum as per those listed in Table 3) and associated ANZECC/ARMCANZ (2000), ANZG (2018) and draft ANZG (2020) default guidelines for 95% species protection and 99% species protection (refer Attachment 5). If water quality monitoring from water treatment plants identifies a potential compliance issue with the relevant performance criteria, the following actions will be taken:

- Higher frequency monitoring will be undertaken to verify the compliance issue is persistent and not a result of a transient event or reporting error
- If compliance issues persist, then
    - A pollution incident will be reported to NSW EPA
    - Appropriate management actions will be taken, including but not limited to discharge to sewer under a trade waste agreement, and/or transport of effluent by tanker to an offsite licenced liquid waste disposal facility.

Field and laboratory data will be collated into a master database that will be updated with new information on completion of each monitoring event to include raw data and statistical summaries. Raw data results and statistical summary data collated in spreadsheets will be compared against the performance criteria for water treatment plants (EPL and ANZG / ANZECC criteria) to assess whether further investigations or management responses are required.

All data from construction water treatment plants will be reported in the six-monthly water monitoring report.

9.1.3 Performance Criteria

Water quality parameters identified in the Water Quality Objectives would be adopted for groundwater as it is proposed that intercepted groundwater will be discharged into local waterways after treatment. Details around the surface water quality monitoring are included in the SWQMP.

Water treatment plants will be sized to meet predicted inflows to ensure groundwater is not required to be stored in excavations or the tunnels, which would otherwise affect the progress of the excavation. Contingency within the water treatment plants will be built in, where practical and feasible, otherwise additional measures such as water tanks may be used to store water where additional contingency is required.

In line with CoA D117, D118 and REMM SSWQ5, Groundwater discharges must be compliant with the discharge criteria prescribed in the Project EPL (21676) and presented below in Table 12. The Project EPL also identifies a number of registered discharge locations, denoted as ‘Points’ into which treated water can be discharged. These points are as follows:

- Point 1: Eastern Creek Pre-Cast Yard stormwater discharge point.
- Point 3: Discharge from the Westmead permanent Water Treatment Plant to Domain Creek
- Point 4: Discharge from the Rosehill permanent Water Treatment Plant to Duck River
- Point 5: Discharge from the Parramatta construction Water Treatment Plant to Parramatta River

Table 12 - Water Treatment Plant - discharge to stormwater parameters.

Parameter	Unit	Point 1	Point 3	Point 4	Point 5
Oil and grease	Visible?	No	No	No	No
pH	pH	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total suspended solids	mg/L	<50 mg/L			
Turbidity	NTU		20		10
Ammonia	µg/L		200	910	790
Arsenic	µg/L		13		13
Cadmium	µg/L		0.2		0.7

Parameter	Unit	Point 1	Point 3	Point 4	Point 5
Chromium (hexavalent)	µg/L		1.0	15	4.4
Chromium (trivalent)	µg/L		27		4.4
Cobalt	µg/L		1.4	5	1
Copper	µg/L		1.4	1.3	1.3
Electrical Conductivity	µS/cm		2200		
Iron	µg/L		300		300
Lead	µg/L		3.4		1
Manganese	µg/L		1900		1900
Mercury	µg/L		0.06		0.4
Nickel	µg/L		11		35
Nitrate + nitrite (oxidised nitrogen)	µg/L		200	1200	300
Nitrogen (total)	µg/L		350	1200	1200
Perfluoro octane sulphonate (PFOS)	µg/L		0.13	0.13	0.0091
Phosphorus (total)	µg/L		25	90	90
TPH C10-C36 Fraction	µg/L		100		100
TPH C6-C9 Fraction	µg/L		100		100
Zinc	µg/L		8	12	12

9.1.4 Water Treatment Plant Commissioning

During commissioning of each of the water treatment plants, a minimum of two rounds of commissioning sampling will be undertaken to confirm their efficacy at removing contaminants. All of the parameters listed in Table 8 will be tested during this commissioning phase. The main objectives of the commissioning testing will be to determine:

- If the water treatment plants perform to meet the proposed discharge criteria of 95% species protection for toxicants and 99% species protection for bioaccumulating toxicants and what (if any) design or operational modifications may be required in order for each treatment plant to meet the required specifications
- Whether an environmental protection licence with alternative pollutant concentration limits is required in accordance with practical limitations of the construction water treatment plant and Section 45 of the POEO Act.
- The relationship between TSS and turbidity to allow turbidity to be measured as a proxy for TSS — this will require more samples than for the other parameters and may continue into the post-commissioning phase

The water treatment plant will not be deemed “commissioned” until two subsequent rounds of testing confirm compliance with the criteria and the water treatment plant is operating at the correct performance level.

9.1.5 Water Treatment Plant Post Commissioning

In addition to the commissioning sampling, the water treatment plant discharge will be sampled for the parameters listed in Table 8. Sampling will be undertaken in accordance with the EPL requirements. The results will be reviewed by trained personnel to ensure that the discharged water meets discharge criteria.

Monthly sampling of the design performance criteria will be undertaken to ensure that each of the water treatment plants continue to meet design specifications.

Where in-line sensors or monitoring identify treatment plant performance drift outside of the required criteria, the treatment plant may be shut down (if necessary) and/or measures will be implemented to return the plant performance back into the required range. In these instances, water will be discharged to trade waste (where permitted), recycled or disposed offsite at an appropriate licenced liquid waste facility. Once measures are implemented to return the treatment plant performance back to the required range, the treatment plant will be re-commissioned as per the steps outlined in Section 9.1.5 before the water treatment plant is considered to be operational again.

Water quality results and an overview of corrective actions will be reported in the six-monthly monitoring report.

9.1.6 Water Treatment Plant Discharge Volumes

The volume of water discharged from the construction water treatment plants will be recorded using flow metres at the discharge point.

The volume of water discharged will be recorded daily and included in the water discharge records. The volume of water discharged will also be compared to the Water Reuse Strategy (Finalised in December 2022) developed in accordance with CoA D79. The Water Balance Study will be updated throughout construction as needed.

10 LABORATORY TESTING – WATER QUALITY

10.1 Quality Assurance / Quality Control

The ASC NEPM (NEPC 2013) and PFAS NEMP (HEPA, 2020) outline the approaches to be adopted for QC verification of field procedures.

Field results will be checked for accuracy before leaving the site and errors or discrepancies will be cross-checked and further investigation initiated if required.

10.2 Laboratory Selection and Water Quality Testing Parameters

10.2.1 Laboratory Selection

The primary and secondary laboratories used for this project will be NATA-accredited for the analyses being undertaken.

Laboratory Testing Parameters

All water quality samples will be scheduled for analysis of the parameters at the nominated NATA accredited testing laboratory, at the specified testing frequency. Sampling frequencies for quarterly parameters will be increased to monthly sampling in the event that laboratory testing results identify any exceedances of the adopted trigger values. Increased sampling frequencies will only apply to boreholes where the criteria exceedances are recorded.

Quality assurance / quality control samples will be scheduled for testing of all parameters except for the general water quality suite and major ions.

10.2.2 Laboratory Quality Assurance / Quality Control

Laboratory methods to be used by the primary and secondary laboratories are to be suitable for environmental contaminant analysis and are based on established internationally recognised procedures. The laboratories will be NATA accredited for the proposed analyses.

Laboratory Data Quality Indicators

Laboratory duplicate samples

Laboratory duplicate sample analysis is the analysis of a laboratory derived duplicate sample from the process batch, at a rate equivalent to one in 10 samples per analytical batch, or one sample per batch if less than 10 samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the analytical results.

The permitted ranges for the RPD of laboratory duplicates are dependent on the magnitude of the results in comparison to the level of reporting as summarised below:

- Result is < 10 x limit of reporting (LOR): No limits
- Result is 10 - 20 x LOR: 0% - 50%
- Result is > 20 x LOR: 0% - 20%

Method blank samples

Method or blank sample analysis are the analyses of a sample that is as free as possible of the analyte(s) of interest, but has been prepared the same as the samples under investigation. The analysis is to ascertain if laboratory reagents, glassware and other laboratory consumables contribute to the observed concentration of analytes in the process batch. If below the maximum acceptable method blank (below practical quantification limit), the contribution is subtracted from the gross analytical signal for each analysis before calculating the sample analyte concentration. The method blank should return analyte concentrations as 'not detected'.

Laboratory control samples

Laboratory control spike analysis is the analysis of either a reference material or a control matrix fortified with analytes representative of the analyte class. The purpose of laboratory control spike samples is to monitor method precision and accuracy independent of the sample matrix. Typically, the percentage recovery of the laboratory control spike sample is compared to the dynamic recovery limits based on the statistical analysis of the processed laboratory control spike sample analysis. Recoveries should lie between 70% and 130%.

Matrix spike samples

Matrix spike sample analysis is the analysis of one or more replicate portions of samples from the batch, after fortifying the additional portion(s) with known quantities of the analyte(s) of interest. The percentage recovery of target analyte(s) from matrix spike samples is used to determine the bias of the method in the specific sample matrix. Recoveries should lie between 70% and 130%.

Surrogate spike samples

Surrogate spike samples are samples with known additions of known amounts of compounds, which are similar to the analytes of interests in terms of extractability, recovery through clean-up procedures and response to chromatographic or other measurement. Surrogate compounds may be alkylated or halogenated analogues or structural isomers of analytes of interest. The purpose of surrogate spikes, which are added immediately before the sample extraction step, is to provide a check for every analysis that no gross processing errors have occurred, which could have led to significant analyte loss or faulty calculation. Recoveries should lie between 50% and 150%.

Internal standards

Internal standards are known additions of known amounts of compounds which are not found in real samples, will not interfere with quantification of analytes of interest and may be separately and independently quantified. The purpose of internal standards in instrumental techniques is to provide independent signals, which serve to check the consistency of the analytical step.

10.3 Suitability of Sampling Results

10.3.1 Duplicate RPDs

Blind and split duplicate samples are assessed by calculating the relative percentage difference (RPD) between the primary, blind and split samples.

RPD values are calculated using the following equation.

$$RPD(\%) = \frac{(C_o - C_s)}{\left(\frac{C_o + C_s}{2}\right)} \times 100$$

Where C_0 = reported concentration from primary sample
C_S = reported concentration from duplicate sample

According to AS 4482.1 – 2005 (Standards Australia, 2005), typical RPDs are expected to range between 30% and 50%; however, this may be higher for concentrations which are close to the laboratory LOR. Considering this, the following RPD limits are acceptable, based on standard industry practice:

- 200% for concentrations within one to ten times the analyte LOR
- 50% for concentrations within ten to 30 times the analyte LOR
- 30% for concentrations greater than 30 times the analyte LOR

10.3.2 Suitably Qualified Staff

Specific targeted training will be developed by the Environmental and Sustainability Lead (or delegate) to ensure that individuals involved in water quality monitoring are appropriately trained in sample collection, decontamination procedures, quality assurance sampling, and the correct use of equipment.

10.3.3 Calibration Records

All instruments will be calibrated in accordance with manufacturers specifications or relevant Australian Standards. Records of monitoring equipment calibration will be maintained by GLC throughout delivery of the Project.

Monitoring and calibration records will be maintained in accordance with the appropriate standard.

10.3.4 Monitoring Program

10.3.4.1 Flow Rates and Water Quality

Inflows to the construction water treatment plants will be derived primarily through groundwater inflows to excavations that extend below the water table, minor inflows into tunnels and cross passages, incidental rainfall over the excavation footprints, process water from tunnelling activities, and any washdown activities within the catchment of the water treatment plants.

Water treatment plants will be located at each station excavation. Rosehill water treatment plant will treat inflows to the Rosehill excavation along with inflows and process water associated with construction of the mainline tunnels.

The anticipated discharge rates from construction water treatment plants will be between 0.1 megalitres per day (ML/d) during early stages of construction and approximately 3 ML/d during later stages of construction in response to increased inflow rates to excavations and tunnels.

The water treatment plants will include multiple processes to treat water quality back to EPL pollutant limits for discharge.

Further details on the inflow volumes to construction water treatment plants is provided in the Discharge Impact Assessment (water pollution impact assessment) for the Project.

GLC are proposing to undertake a program of ongoing water quality monitoring at each construction water treatment plant to provide an ongoing assessment of effluent water quality and potential risks to the Water Quality Objectives in receiving waterways.

The proposed monitoring program will provide monitoring data for effluent water quality retained within the storage tank prior to discharge, including:

- Live continuous monitoring of pH and Turbidity
- Field monitoring of electrical conductivity
- Monthly and quarterly sampling and laboratory testing for the parameters listed in Table 9 against the relevant ANZECC/ARMCANZ (2000) / ANZG (2018) 95% and 99% species protection criteria.

All laboratory testing will be undertaken to quantify contaminants at levels commensurate with comparison against the adopted discharge criteria and ANZECC/ARMCANZ (2000) and ANZG (2018) default guideline values. Contaminants for which practical quantification limits (PQL) are greater than default guideline values will be noted within the monitoring report.

The water discharged from the water treatment plants will be recorded using flow meters at the discharge point. The data will be recorded in water discharge records and compared with the EPL discharge limits.

10.4 Calibration, Quality Assurance and Competency

Specific targeted training will be developed by the Environmental and Sustainability Lead (or delegate) to ensure that officers involved in water quality monitoring are appropriately trained. Refer to the CEMP for full details on environmental training.

All instruments will be calibrated in accordance with manufacturers specifications or relevant Australian Standards. Records of monitoring equipment calibration will be maintained by GLC throughout delivery of the Project.

Field results will be checked for accuracy before leaving the site and errors or discrepancies will be cross-checked, and further investigation initiated if required.

Monitoring and calibration records will be maintained in accordance with the appropriate standard.

Quality assurance and control protocols during sampling and recording of physio-chemical (field) parameters will be undertaken monthly (each sampling event) in accordance with ANZECC/ARMCANZ (2000) to ensure the integrity of each dataset.

As part of sampling the following will be undertaken:

- Rinsate blanks (one per sampling event only)
- Blind duplicates (at a rate not less than 20% of total samples)
- Split duplicates (at a rate not less than 20% of total samples)

Samples are to be transported to a NATA-accredited laboratory under documented chain-of custody protocols.

11 GROUNDWATER MANAGEMENT STRATEGIES

The majority of groundwater on the project will be collected and treated at project construction water treatment plants and discharged into local waterways. This will be undertaken in consultation with relevant stakeholders where there is potential for interaction with existing groundwater management programs.

Where this is not possible, groundwater will also be reused on site or disposed of as liquid waste in line with the waste classification guidelines.

If groundwater is proposed to be reused on site, the water will be tested to ensure the water is suitable for reuse and does not result in a human health or environmental risk from any contaminants of concern.

A full discussion on groundwater management strategies is provided in the project Groundwater Management Plan. The performance criteria for beneficial reuse of groundwater are discussed in the SWMP.

Groundwater reinjection is not currently being considered as a groundwater disposal option or management strategy.

12 COMPLIANCE MANAGEMENT

12.1 Roles and Responsibility

The GLC Project Team's organisational structure and overall roles and responsibilities are outlined in Section 7 of the WTP CEMP. Specific responsibilities for the implementation of environmental controls relevant to groundwater are detailed in Table 13.

Table 13: Responsibility Matrix

Role	Authority and Responsibility
Environmental and Sustainability Lead	• Develop and implement the Groundwater Monitoring Program • Oversee water quality and groundwater monitoring in accordance with this program • Oversee compliance reporting and tracking • Oversee the keeping of all environment records • Engage suitably qualified consultants to support implementation of this program • Regularly engage with key stakeholders and other interface contractors to achieve environmental alignment (e.g., discharge points and premises areas) in according with the interface management plan
Senior Environmental Advisor	• Prepare ECMs to outline the controls in this program relevant to each work activity • Delivery toolbox/prestart presentation (or other specific training) to inform work crews of the controls documented in the ECMs • Respond to environmental incidents and non-conformances
Environmental Advisor	• Prepare site-specific action management plans for Groundwater inflow, groundwater recharge, surface water impacts, GDE impact and groundwater quality
Construction Manager	• Review and provide resources to implement the controls identified in the ECMs
Project Hydrogeologist	• Prepare and update groundwater management control plans in accordance with this program and the GWMP including calculations for groundwater inflow, drawdown and quality
Site Supervisor	• Install and maintain environmental control in accordance with ESCPs and ECMs • Attend inspections with the Environmental Coordinator, Sydney Metro/ER or other stakeholders • Implement corrective actions raised during Environmental inspections in agreed timeframes • Obtain and comply with Water Discharge Permits prior to any groundwater discharge from the site • Work in conjunction with the Soil and Water Quality Management Plan within the CEMP to notify the environmental coordinator of any observations in water quality or any signs of potential groundwater contaminants

Role	Authority and Responsibility
All personnel	• Notify Site Supervisor of any observations of visual difference in groundwater quality in conjunction with the Soil and Water Quality Management Plan

12.2 Monitoring Records

All monitoring records will be kept on-file in a central electronic water quality monitoring register that will be stored on the Project file management system.

Data from the in-line monitoring sensors will be reviewed by the water treatment plant operators and all monitoring data will be kept in the water quality monitoring register.

Field measurement results for each monitoring location will be recorded on appropriate field sheets (hard copy or digital) using unique sampling identification nomenclature consisting of the sample date, location, and sampler details.

For each monitoring event, the following information shall be recorded:

- Date and time of measurements
- Name of person undertaking the measurements
- Type and model number of instruments and relevant calibration certificates
- Time of sample collection
- Map of area showing measurement location
- Measurement location details and number of measurements at each location
- Weather Conditions including rainfall in the past 24 hours

Laboratory samples will be collected at the same time as the field measurements are taken.

Laboratory results will be kept on-file and recorded in the water quality monitoring register

12.3 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this program, MCoA and other relevant approvals, licenses, and guidelines. These audits will be undertaken at planned intervals to provide information on whether the Project:

- Is meeting its compliance obligations
- Conforms to this program
- Determines if this program is effectively implemented and maintained.

The approach to internal and independent audits, including auditing schedule, is outlined further in Section 11.3 of the CEMP.

12.4 Reporting

During construction, groundwater monitoring data will be collected, tabulated and assessed against baseline conditions and performance criteria. Reporting requirements associated with the Projects construction phase are summarised below.

Separate from the Construction Monitoring Reports detailed below, additional records relating to groundwater monitoring training, toolbox talks, monitoring results and audit results will be

prepared, maintained, and stored in line with the CEMP. The complaints management and reporting procedure is described in the CEMP.

Sydney Water Trade Waste agreements

Where Sydney Water assets are required to be used to receive discharged water from the Project, as part of a trade waste agreement or similar, monitoring and reporting requirements would be undertaken as agreed with Sydney Water.

At the time of October 2025, consent to discharge to Industrial Trade Wastewater was obtained from Sydney Water for the Parramatta Construction Site on 29th April 2025. All surface and groundwater processed by the Water Treatment Plant at Parramatta would be discharged to sewage and be tested, monitored and reported in accordance with the Consent.

Pre-construction Groundwater Monitoring Data

- Groundwater monitoring data to be provided to the NSW EPA and DPHI and the Natural Resources Access Regulator (NRAR)
- To be undertaken prior to construction that would interact with groundwater.

Groundwater Construction Monitoring Reports (every six months)

- Data summary reports presenting tabulated groundwater monitoring data collected during the reporting period including water quality data, groundwater levels, inflow and any actions and responses. Groundwater levels, quality, and inflow results will be presented, and performance criteria exceedances will be highlighted. Additionally, water treatment plant discharge results would also be presented.
- Applicable management responses will also be documented.
- Six monthly monitoring reports will be provided to the relevant authorities (SOPA, EPA (if requested), DPHI and NRAR) Once finalised.

In accordance with MCoA C23, each 6-Monthly Groundwater Monitoring Reports will be submitted to the Planning Secretary, ER and regulatory agencies for information within 60 business days of the end of the relevant monitoring period.

GLC combine all Monitoring Reports into a single consolidated Construction Monitoring Report prior to publishing on their Project Website. Due to the slight variation in the reporting timeframes between the Surface Water Quality, Noise and Vibration and Groundwater Monitoring Reports, GLC will publish the consolidated Construction Monitoring Report on the Project website within one week of submitting the last Monitoring report for that period to DPHI via the Major Projects Portal in accordance with MCoA B11.

Where the Project EPL has additional requirements for reporting results, these will be added to the Monitoring Program, once available.

Groundwater Modelling Report

In accordance with MCoA D122, a stand-alone Groundwater Modelling Report (GMR) was produced for the WTP (August 2022). GLC submitted a revised Groundwater Modelling Report in association with Stage 1 of the CSSI to the Planning Secretary for information before bulk excavation at the relevant construction location. The project wide GMR and the Rosehill GMR have since been published on the WTP Project website.

13 REVIEW AND IMPROVEMENT

13.1 Continuous Improvement

Continuous improvement of this GMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives, and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any nonconformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

13.2 Document Updates

The processes described above may result in the need to update or revise this GMP. This GMP will be reviewed and updated annually as a minimum or as as needed, and may only be approved by the Environment and Sustainability Director, or their delegate.

Where minor amendments are required to this GMP, the revised GMP will be issued to the ER for review and endorsement in accordance with MCoA A30(j).

13.3 Distribution

A copy of the updated Program and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure, detailed in the CEMP.

All GLC personnel and contractors will have access to this GMP via the project document control management system. The approved GMP will be published on the GLC website within one week of being approved and be publicly available until the end of the Construction Period.

A copy of the GMP will be published and maintained on the Project website, in accordance with MCoA B11. The GMP will be published within one week of its approval or before the commencement of any work to which they relate or before their implementation.

The document is uncontrolled when printed.

ATTACHMENTS

Attachment 1 – Compliance Matrix

The MCoA, REMMs, CEMF requirements and EPL requirements that relate to this GMP are detailed in the following tables.

MCoAs

ID	Conditions of Approval	Document Reference
C14 (d)	C14 The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies identified for each to compare actual performance of construction of Stage 1 of the CSSI against the performance predicted in the documents listed in Condition A1 of this schedule or in the CEMP: d) Groundwater – In consultation with: DPE Water and SOPA (in respect of Sydney Olympic Park)	This GMP Section 1.4 Attachment 2
C15	Each Construction Monitoring Program must provide:	
	(a) details of baseline data available including the period of baseline monitoring	Section 7.2 - 7.3
	(b) details of baseline data to be obtained and when	Section 7.5 – 7.7
	(c) details of all monitoring of the project to be undertaken	Section 7.5 – 7.7
	(d) the parameters of the project to be monitored	Section 7.5 – 7.7
	(e) the frequency of monitoring to be undertaken	Section 7.5 – 7.7
	(f) the location of monitoring	Section 7.5 – 7.7 Attachment 3
	(g) the reporting of monitoring results and analysis results against relevant criteria	Section 12.4
	(h) details of the methods that will be used to analyse the monitoring data	Section 7.5 – 7.7
	(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts	Section 7.5 – 7.7
	(j) a consideration of SMART principles	Section 4.3
	(k) any consultation to be undertaken in relation to the monitoring programs; and	Section 1.4

ID	Conditions of Approval	Document Reference
	(l) any specific requirements as required by Conditions C16 to C17 of this schedule.	Attachment 1
C17	Groundwater Construction Monitoring Program must include:	
	(a) groundwater monitoring networks at each construction excavation site	Section 7.5 – 7.7
	b) detail of the location of all monitoring bores with nested sites to monitor both shallow and deep groundwater levels and quality	Section 7.5 – 7.7, Attachment 3
	(c) define the location of saltwater interception monitoring where sentinel groundwater monitoring bores will be installed between the saline sources of the estuary or river and that of the stations or shafts	Section 7.5 – 7.7
	d) results from existing monitoring bores	Attachment 5
	(e) monitoring and gauging of groundwater inflow to the excavations, appropriate trigger action response plan for all predicted groundwater impacts upon each noted neighbouring groundwater system component for each excavation construction site	Section 7.6.4
	(f) trigger levels for groundwater quality, salinity and groundwater drawdown in monitoring bores and / or other groundwater users	Section 7.5 – 7.7
	(g) daily measurement of the amount of water discharged from the water treatment plants	Section 9
	(h) water quality testing of the water discharged from treatment plants	Section 9
	(i) management and mitigation measures and criteria	Section 7.5 – 7.7 Section 8 Section 9
	(j) groundwater inflow to the excavations to enable a full accounting of the groundwater take from the Sydney Basin Central Groundwater Source	Section 8
	(k) reporting of groundwater gauging at excavations, groundwater monitoring, groundwater trigger events and action responses	Section 8 Section 12.4
	(l) methods for providing the data collected to Sydney Water where discharges are directed to their assets.	Section 12.4
C18	With the exception of any Construction Monitoring Programs expressly nominated by the Planning Secretary to be endorsed by the ER, all Construction Monitoring Programs must be submitted to the Planning Secretary for approval.	Section 1.5

ID	Conditions of Approval	Document Reference
C19	The Construction Monitoring Programs not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all undertakings made in the documents listed in Condition A1 of this schedule. Any of these Construction Monitoring Programs must be submitted to the ER for endorsement at least one (1) month before the commencement of construction or where construction is phased no later than one (1) month before the commencement of that phase.	Section 1.5
C20	Any of the Construction Monitoring Programs which require Planning Secretary approval must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month before the commencement of construction or where construction is phased no later than one (1) month before the commencement of that phase.	Section 1.5
C21	Unless otherwise agreed with the Planning Secretary, construction must not commence until the Planning Secretary has approved, or the ER has endorsed (whichever is applicable), all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 1.5
C22	The Construction Monitoring Programs, as approved by the Planning Secretary or the ER has endorsed (whichever is applicable), including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary or the ER (whichever is applicable), whichever is the greater.	Section 1.5
C23	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, ER and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.	Section 12.4
D117	Stage 1 of the CSSI must be designed and constructed so as to maintain the NSW Water Quality Objectives (NSW WQO) where they are being achieved as at the date of this approval and contribute towards achievement of the NSW WQO over time where they are not being achieved as at the date of this approval, unless an EPL in force in respect of the CSSI contains different requirements in relation to the NSW WQO, in which case those requirements must be complied with.	Section 9 – An EPL has been obtained for the WTPs for the project
D121	Make good provisions for groundwater users must be provided in the event of a material decline in water supply levels, quality or quantity from registered existing bores associated with groundwater changes from construction.	Section 7.6

ID	Conditions of Approval	Document Reference
D122	The Proponent must submit a revised Groundwater Modelling Report in association with Stage 1 of the CSSI to the Planning Secretary for information before bulk excavation at the relevant construction location. The Groundwater Modelling Report must include: (a) for each construction site where excavation will be undertaken, cumulative (additive) impacts from nearby developments, parallel transport projects and nearby excavation associated with the CSSI (b) predicted incidental groundwater take (dewatering) including cumulative project effects (c) potential impacts for all latter stages of the CSSI or detail and demonstrate why these later stages of the CSSI will not have lasting impacts to the groundwater system, ongoing groundwater incidental take and groundwater level drawdown effects (d) actions required after Stage 1 to minimise the risk of inflows (including in the event latter stages of the CSSI are delayed or do not progress) and a strategy for accounting for any water taken beyond the life of the operation of the CSSI (e) saltwater intrusion modelling analysis, from estuarine and saline groundwater in shale, into The Bays metro station site and other relevant metro station sties; and (f) a schematic of the conceptual hydrogeological model.	The information requested is found within the standalone Groundwater Modelling Report Referred to in Sections 7.6 and 12.4.

REMMs

ID	Revised Environmental Management Measure	Document Reference
SSQW5	The water treatment plants would be designed so that wastewater is treated to a level that is compliant with the ANZECC/ARMCANZ (2000) and ANZG (2018) and draft ANZG (2020) default guidelines for 95% species protection and 99% species protection and 99% species protection for toxicants that bioaccumulate unless other discharge criteria are agreed with relevant authorities.	Section 9
GW4	Monitoring of groundwater levels and quality at the site area would occur before, during and after construction. This would also include monitoring of potential contaminants of concern. Groundwater level data would be regularly reviewed during and after construction by a qualified hydrogeologist. Groundwater monitoring data would be provided to the NSW Environment Protection Authority and Department of Planning, Industry, Environment, Water and the Natural Resources Access Regulator for information prior to commencement of construction.	Section 7.6 Section 7.7 Section 12

CEMF Requirements

Clause	Requirement	Document Reference
7.2 (b)	Principal Contractors will develop and implement a Groundwater Management Plan for their scope of works. The Groundwater Management plan will include as a minimum:	
i.	The groundwater mitigation measures as detailed in the environmental approval documentation	Detailed in the Groundwater Management Plan
ii.	The requirements of any applicable licence conditions	Detailed in the Groundwater Management Plan
iii.	Details of proposed extraction, use and disposal of groundwater, and measures to mitigate potential impacts to groundwater sources, incorporating monitoring, impact trigger definition and response actions for all groundwater sources potentially impacted by the SSI	Detailed in the Groundwater Management Plan
iv.	Evidence of consultation with relevant government agencies	The Groundwater Monitoring Program has undergone consultation in accordance with MCoA C14(d). Evidence of consultation has been included in Attachment 2.
v.	The responsibilities of key project personnel with respect to the implementation of the plan	
vi.	Procedures for the treatment, testing and discharge of the groundwater from the site	
vii.	Compliance record generation and management	
viii.	Details of groundwater monitoring if required	

Environment Protection Licence

An Environmental Protection License (EPL) will apply for the Project. The EPL typically prescribes water quality parameters to be measured and associated discharge criteria from licensed discharge points. They also detail the monitoring and analytical requirements by reference to authority publications (e.g., Methods for sampling and analysis of water pollutants in NSW (EPA 2004).

In some cases, a trade waste agreement may be sought from Sydney Water for disposal of wastewater into the sewer system, however this is currently not the preferred method of groundwater management, and no agreement has been sought at this time.

The Project construction activities are designated as '***Railway activities—railway infrastructure construction'*** under Schedule 1 of the POEO Act. Scheduled activities under clause 48 of the POEO Act, require an Environmental Protection Licence (EPL) for the premise at which a scheduled activity is carried on.

The EPL for the project is EPL 21676. A copy can be found on the public register.

Attachment 2 – Stakeholder Consultation

Engagement Log

Stakeholder	Date of Engagement/ Attempted Engagement
DPE Water	• Sydney Metro sent DPE Water an invitation to review and comment on the GMP on 02/05/2022, which included a cover letter and the GMP as a PDF document • DPE Water did not provide comments within the 21-day consultation period • DPE Water comments were provided to Sydney Metro on 01/06/2022.
SOPA	• Sydney Metro sent SOPA an invitation to review and comment on the GMP on 29/04/2022, which included a cover letter and the GMP as a PDF document • SOPA provided comments on 27/04/2022

Comments Register

Stakeholder	Comment Raised	GLC Response	Where Addressed
DPE Water	Additional information is required in the Construction Groundwater Monitoring Program (CGMP) to address the requirement of condition of consent C17 for groundwater trigger levels and a Trigger Action Response Plan.	**Comment was made on Rev A.** Additional details regarding groundwater trigger levels and proposed response mechanisms have been incorporated. The revised Groundwater Modelling Report(s) will further inform this.	Section 7.6
	Attachment 1 of the CGMP states that condition of consent D122 has been addressed in this report; however no revised groundwater modelling has been provided. This may be provided as a separate report rather than in the CGMP.	**Comment was made on Rev A.** The program outlined herein is based on currently available information including the Hydrogeological Interpretive Report (HIR) and associated monitoring and modelling. Revised Groundwater Modelling Report(s) are required prior to bulk excavation in accordance with MCoA D122. This	Section 12.4

Stakeholder	Comment Raised	GLC Response	Where Addressed
		plan commits to that and as such is addressed within this report. The revised Groundwater Modelling Report(s) will be provided as a separate report(s) as completed.	
	It is understood final decisions on groundwater monitoring locations and trigger levels will be made based on updated groundwater modelling. As this is likely to result in further revisions of the CGMP, it is recommended the revised groundwater modelling is completed and the CGMP updated for further comment.	**Comment was made on Rev A.** Locations and trigger levels for groundwater monitoring program will be further informed by several factors including initial baseline monitoring events and ongoing technical investigations and reporting including the revised Groundwater Modelling Report(s) required prior to bulk excavation in accordance with MCoA D122. GLC have committed to an adaptive monitoring strategy with updates to this Groundwater Monitoring Program where required and as a result of additional revised Groundwater Modelling Report(s).	Section 7.5, 7.6, 12.4 and 13.
	Further detail is needed on the nature on make good provisions under condition of consent D121.	**Comment was made on Rev A.** Based on currently available information, material decline in water supply levels, quality or quantity at registered existing bores is not anticipated as a result of project construction. Where monitoring or revised Groundwater Modelling Report(s) indicate potential for material decline, make good provisions will be implemented on a case-by-case basis in consultation with the affected party with reference to the NSW Department of Primary Industries Office of Water (2012) Aquifer Interference Policy (AIP).	Currently addresses at Section 7.6.4 and 7.7.4.

Stakeholder	Comment Raised	GLC Response	Where Addressed
SOPA	s7.9.1, it affirms that groundwater will be treated and discharged to the local waterways. Here is the need for ensuring that such waterways should be decided in consultation with SOPA because many waterways/wetlands are sensitive habitats (eg Northern Water Feature or Lake Belvedere). Also, given the presence of landfills and leachate, groundwater monitoring and management will have to be of high standard.	**Comment was made on Rev A.** Added: "This will be undertaken in consultation with relevant stakeholders where there is potential for interaction with existing groundwater management programs." It is noted that No waterways that are within SOPA management will receive discharge from the project.	Section 11.
	Tunnelling under the landfill may create pathways for Kronos Hill landfill gas ingress into the tunnel presenting a risk to workers. Gas generation can be low flow but high concentration, and may occur within the lower explosive limits. The risk must be addressed as part of both the tunnelling and box excavation CEMPs and include landfill gas monitoring within the tunnel and appropriate response protocols. – Where will this be captured?	**Comment was made on Rev A.** Gas monitoring is not part of this groundwater management plan. This will be covered under a separate appropriate safety management plan, developed by a suitably qualified and experienced professional as part of the tunnelling risk assessment and in accordance with WorkCover NSW (2006) Tunnels Under Construction Code of Practice. The risk assessment process will be informed by noise and vibration assessment (as required) and an appropriate ground gas monitoring program will be developed and implemented. This process is outlined within the Project Work Health and Safety System documentation. Where the gas monitoring program and / or this groundwater monitoring program indicates potential pathways of landfill gas / leachate ingress mechanisms exists within the Deed and Project CEMP and associated subplans for the investigation and management of contamination where it is caused by the Project.	N/A

Stakeholder	Comment Raised	GLC Response	Where Addressed
	Section 7.9.2 0- Groundwater Level and Drawdown - lowering of ground water levels may result in an increase in landfill gas generation which may travel outside the waste containment area either laterally and / or vertically including into the tunnelling and box excavation works. Where will this risk be assessed and addressed? It should also be included as part of the Revised Groundwater Modelling Report assessment for the SOP Station box exaction with appropriate monitoring, and mitigation measures identified / developed as part of the relevant section of the CEMP.	**Comment was made on Rev A.** It is beyond the scope of a groundwater monitoring program to address landfill gas risk. Where there is overlap between the two disciplines, the groundwater monitoring plan will only inform the amount of groundwater drawdown as a comparison against performance criteria and whether the performance criteria have been exceeded. The performance criteria will be set out in the Hydrogeological Interpretive Report and included in this management plan when they become available. Refer previous comments regarding the identification and management of landfill gas ingress risk. Refer subsequent comments regarding future stakeholder review of the HIR.	N/A
	Section 7.7 – Groundwater Quality – does not appear to include any data loggers / key monitoring locations within SOP. Groundwater quality monitoring along this section of the alignment should be included to monitor for any change in groundwater quality that may indicating a possible connection between the waste containment cells and the surrounding groundwater.	**Comment was made on Rev A.** BH070 and BH121 have been nominated as part of the groundwater monitoring network (section 7.5). These both include loggers and sampling. The status and construction details of these bores is currently unknown.	Section 7.5
	Section 7.6 – Groundwater Level and Drawdown - The revised Groundwater Modelling Report to be developed for the Sydney Olympic Park station box excavation should be provided to SOPA for review / comment as groundwater drawdown may	**Comment was made on Rev A.** Added “The Revised Groundwater Modelling Report(s) will be provided to relevant stakeholder (e.g. SOPA) where there is potential for interaction with existing groundwater management programs.”	Section 7.6.4.

Stakeholder	Comment Raised	GLC Response	Where Addressed
	directly impact the Authority's ability to manage the remediated landfill. Groundwater drawdown impacts must address potential impacts on natural estuarine areas north of Kronos Hill Landfill, Former Gold Driving Range and Bicentennial Park Landfills.	Updated Groundwater Modelling Report will be included in the Hydrogeological Interpretive Report. It is important that this is addressed, and feedback will be provided to modeller (GHD) for further consideration.	
	Section 6 Environmental Impacts summary – Must include consideration of the potential impacts (including risk that the vibrations from tunnelling works may result in a connection between the existing waste containment and surrounding groundwater through fractures in rock and/or collapse of gravity drains) specific to tunnelling under SOP and the Kronos remediated landfill.	**Comment was made on Rev A.** Added Sydney Olympic Park and discussed potential risks. Note above comments regarding Landfill Gas Risk not being addressed within this plan.	Table 3.
	Table 3 – Characteristics of the groundwater – does not include Sydney Olympic Park. As the site is a former uncontrolled landfilling site and the tunnelling package includes the section of the alignment beneath SOP Kronos Hill Landfill the groundwater condition around SOP and potential contaminates should be included and considered in the groundwater monitoring program. The risk associated with the tunnelling works beneath SOP landfills need to be specifically addressed and be considered as part of the tunnelling Groundwater Management Plan for the WTP.	**Comment was made on Rev A.** Added Sydney Olympic Park and discussed potential risks. Note above comments regarding Landfill Gas Risk not being addressed within this plan.	Table 2.
	Section 4.1 – legislation – as the tunnelling alignment is directly beneath the regulated landfills the Contaminated Lands Management Act should be included as relevant legislation and the relevant	**Comment was made on Rev A.** The following has been incorporated: • (NSW) Contaminated Land Management Act 1997 (CLM Act)	Section 4.1.

Stakeholder	Comment Raised	GLC Response	Where Addressed
	guidelines should include the remediated Lands Management Plan. The tunnelling package goes under the Kronos Hill landfill and residual waste are known to occur outside waste containment areas across the site. Tunnelling works may result in a connection between the groundwater of the waste containment cell and surrounding groundwater and consequently present a risk of leachate intrusion into the tunnel. All groundwater that comes into contact with waste is leachate and must be managed as such in accordance with the POEO Waste Regulations, CLM Act Notice No 28040 issued in relation to the remediated landfills and the RLMP referenced by the Notice. The POEO should also be referenced as relevant legislation relevant to the project works.	• (NSW) Protection of the Environment Operations (Waste) Regulation 2014 (the Waste Regulation) • Maintenance of remediation notice 28040 (EPA 2009) • Remediated Lands Management Plan (SOPA, 2009) (or revisions that have been accepted by the EPA)	

Comments Register – Outstanding Issues

Stakeholder	Comment Raised	GLC Response	Proposed Action
		N/A	

Meeting Minutes

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Attachment 3 – Proposed Monitoring Locations

Note – monitoring locations presented in the figures presented in Attachment 3 may be subject to change however remain accurate as of July 2025. (

Monitoring zone	Groundwater monitoring bore ID	Screen interval (mbTOC)	Target unit	Water quality	Manual water level	Level logger	Logger download
Clyde Zone 1 – 5 (Clyde MSF)	CZ1_D35_MW02	2.9 – 5.8	Clay	✓	✓	LevelSCOUT2 X	P
	CZ5_MW105	4.0 – 10.0	Clay	✓	✓		
	CZ5_MW103	3.0 – 7.0	Clay	✓	✓		
	CZ5_MW102	3.0 – 7.0	Clay	✓	✓		
	SMW_WTP_BH25_s	3.0-6.0	Clay	✓	✓		
	SMW_WTP_BH25_w	7.2-10.2	Clay, Siltstone	✓	✓	Troll 400 level	✓
	SMW_ENV039_w	7.3-10.3	Clay	✓	✓	LevelSCOUT2 X	✓
Clyde Zone 2 (Rosehill)	CZ4e_MW02	1.5-4.5	Gravel	✓	✓		
	CZ4e_MW03	3.0-6.0	(Sandy) Clay	✓	✓		
	SMW_BH010_w	23.5-26.5	Siltstone, sandstone		✓	CT2X; Solinst levelogger	✓
	SMW_ENV042_w	7.4-10.4	Clay		✓		
	SMW_ENV145_w	11.0-14.0	Clay	✓	✓	CT2X; Solinst levelogger	✓
	SMW_WTP_BH13_w	1.3-7.3	Clay	✓	✓	GALC telemetry	✓
Clyde Zone 3 (Clyde Dive)	GALC-MW16_s	5.0-11.0	-		✓	GALC telemetry	✓
	GALC-MW16_w	16.0-21.0	-	✓	✓	GALC telemetry	✓
	GALC-MW17	12.5-21.5	-		✓	GALC telemetry	✓
	SMW_BH057_s	1.5-5.3	Sand	✓	✓	Solinst levelogger	✓
	SMW_BH057_w	23.3-26.3	Siltstone, Sandstone	✓	✓	CT2X	✓
	SMW_ENV009_w	2.8-7.3	Clayey sand	✓	✓	Solinst levelogger	✓
	SMW_ENV010_w	3.2-6.6	Siltstone, sandstone	✓	✓	-	-
Parramatta	GALC-MW26A	5.0-12.0	Silty clay with sand		✓	GALC telemetry	✓
	GALC-MW26	18.0-30.0	Sandstone		✓	GALC telemetry	✓
	GALC-MW31	18.5-30.5	Sandstone		✓	GALC telemetry	✓
	GALC-MW32	18.0-30.0	Sandstone		✓	GALC telemetry	✓
	GALC-MW33	18.5-30.5	Sandstone		✓	-	-
	PM_BH14	3.5-6.0	Clayey sand	✓	✓	LevelSCOUT2 X	✓
	PM_BH15	7.0-10.0	Clay	✓	✓	-	-
	SMW_BH002_w	29.4-32.4	Sandstone		✓	Solinst levelogger	✓

Monitoring zone	Groundwater monitoring bore ID	Screen interval (mbTOC)	Target unit	Water quality	Manual water level	Level logger	Logger download
	SMW_BH004_s	6.50-11.50		✓	✓	Solinst levelogger	✓
	SMW_BH004_w	20.60-23.60			✓	CT2X; Solinst levelogger	✓
Westmead	GALC-MW38	22.83-34.83			✓	GALC telemetry	✓
	GALC-MW47	10.0-16.0			✓	GALC telemetry	✓
	GALC-MW54	1.0 - 4.0	Sandy Clay/Gravelly Clay		✓	LevelSCOUT2X	✓
	SMW_BH008_w	14.0-17.0	Siltstone, sandstone		✓	Solinst levelogger	✓
	SMW_WTP_BH02_w	14.0-20.0	Siltstone, sandstone	✓	✓	Troll 400 level	✓
	SMW_WTP_BH03A_w	15.0-21.0	Siltstone, sandstone	✓	✓	Troll 400 level	✓

Attachment 4 – Groundwater Quality Monitoring Data

Table 14 - Golder Douglas Partners (2020) Contamination Factual Report Downer EDI Unwin St Rosehill

Table 14 - Golder | Douglas Partners (2021) Groundwater Monitoring Report - Stage 3 Locations

Table 15 - Golder | Douglas Partners (2022) Interim Factual Contamination Assessment Report

Table 16 - Epic (2022 - 2023) Groundwater Monitoring Program and Detailed Site Investigation Data

Attachment 5 – Default Guideline Values (DGVs) for Discharges to Waterways and Groundwater Quality

Pollutant Group	Pollutant	DGV for freshwater ecosystems (ANZG, 2018, ANZECC, 2000)*	Freshwater % Species Protection	DGV for marine ecosystems (ANZG, 2018, ANZECC, 2000)*	Marine Water% Species Protection
Physical and Chemical Stressors (µg/L)	pH (units)	6.5 - 8.0	-	7.0 - 8.5	-
	Turbidity (NTU)	6 - 50	-	0.5 - 10	-
	Dissolved oxygen (%)	85 - 110	-	80 - 110	-
	Electrical conductivity (µS/cm)	125 - 2,200	-	-	-
	Nitrate	2400	-	2400	-
	Ammonia (as N)	900	-	910	-
	Nitrogen (Total)	350	-	300	-
	Reactive Phosphorous (as P)	20	-	5	-
	Total Phosphorus (as P)	25	-	30	-
Non-Metallic Inorganic (µg/L)	Chlorine	3	95	3	Unknown
	Cyanide	7	95	4	95
	Hydrogen sulfide	1	95	1	Unknown
Trace Metals (µg/L)	Aluminium (pH >6.5)	55	95	24	Unknown
	Antimony	9	Unknown	270	Unknown
	Arsenic (III)	24	95	2.3	Unknown
	Arsenic (V)	13	95	4.5	Unknown
	Cadmium (B-Mw)	0.2	95	0.7	99
	Chromium (CrIII)	3.3	Unknown	27	95
	Chromium (CrVI)	1	95	4.4	95
	Cobalt	1.4	Unknown	1	95
	Copper	1.4	95	1.3	95
	Iron	300	Unknown	300	Unknown
	Lead	3.4	95	4.4	95
	Manganese	1900	95	80	Unknown
	Mercury (inorganic) (B)	0.06	99	0.1	99
	Nickel	11	95	70	95
	Zinc	8	95	8	95
Organochlorine Pesticides (µg/L)	Aldrin (B)	0.001	Unknown	0.003	Unknown
	Chlordane (B)	0.03	99	0.001	Unknown
	DDT (B)	0.006	99	0.0004	Unknown
	Dicofol (B)	0.5	Unknown	0.1	Unknown
	Dieldrin (B)	0.01	Unknown	0.01	Unknown
	Endosulfan (B)	0.03	99	0.005	99
	Endrin (B)	0.01	99	0.004	99

Pollutant Group	Pollutant	DGV for freshwater ecosystems (ANZG, 2018, ANZECC, 2000)*	Freshwater % Species Protection	DGV for marine ecosystems (ANZG, 2018, ANZECC, 2000)*	Marine Water% Species Protection
	Heptachlor (B-Fw)	0.01	99	0.0004	Unknown
	Lindane	0.2	95	0.007	Unknown
	Methoxychlor (B)	0.005	Unknown	0.004	Unknown
	Mirex (B)	0.04	Unknown	0.04	Unknown
	Toxaphene (B-Fw)	0.1	99	0.0006	Unknown
Organophosphate Pesticides (µg/L)	Azinphos methyl	0.02	95	0.01	Unknown
	Chlorpyrifos	0.01	95	0.009	95
	Diazinon	0.01	95	0.01	Unknown
	Dimethoate	0.15	95	0.15	Unknown
	Fenitrothion	0.2	95	0.001	Unknown
	Malathion	0.05	95	0.05	Unknown
	Parathion	0.004	95	0.004	Unknown
	Profenofos	0.02	Unknown	0.002	Unknown
	Temephos	0.05	Unknown	0.05	95
Other Pesticides (µg/L)	Carbofuran	1.2	95	0.06	Unknown
	Deltamethrin	0.0001	Unknown	0.0001	Unknown
	Esfenvalerate	0.001	Unknown	0.001	Unknown
	Methomyl	3.5	95	3.5	Unknown
	S-Methoprene	0.2	Unknown	0.2	Unknown
Herbicides (µg/L)	2,4,5-T	36	95	36	Unknown
	Acrolein	0.01	Unknown	0.01	Unknown
	Atrazine	13	95	13	Unknown
	Diquat	1.4	95	1.4	Unknown
	Diuron	0.2	Unknown	0.2	Unknown
	Glyphosate	320	95	320	Unknown
	MCPA	1.4	Unknown	1.4	Unknown
	Metolachlor	0.46	95	0.46	Unknown
	Metsulfuron-methyl	0.018	95	0.018	Unknown
	Molinate	3.4	95	3.4	Unknown
	Paraquat	0.5	Unknown	0.5	Unknown
	Simazine	3.2	95	3.2	Unknown
	Tebuthiuron	2.2	95	2.2	Unknown
	Thiobencarb	2.8	95	2.8	Unknown
	Thiram	0.2	95	0.2	Unknown
	Trifluralin (B-Fw)	2.6	99	2.6	Unknown
Perfluorinated Compounds (µg/L)	Perfluorooctane sulphonate (PFOS)	0.13	95%	0.13	95%
	Perfluorooctanoic acid (PFOA)	220	Unknown	220	Unknown
Phenols and Xylenols (µg/L)	2,3,4,6-Tetrachlorophenol (B-Fw)	10	99	20	Unknown

Pollutant Group	Pollutant	DGV for freshwater ecosystems (ANZG, 2018, ANZECC, 2000)*	Freshwater % Species Protection	DGV for marine ecosystems (ANZG, 2018, ANZECC, 2000)*	Marine Water% Species Protection
	2,3,5,6-Tetrachlorophenol	0.2	Unknown	0.2	Unknown
	2,3-Dichlorophenol	31	Unknown	31	Unknown
	2,4,6-Trichlorophenol (B-Fw)	3	99	3	Unknown
	2,4-Dichlorophenol	160	95	160	Unknown
	2,4-Dimethylphenol	2	Unknown	2	Unknown
	2,6-Dichlorophenol	34	Unknown	34	Unknown
	2-Chlorophenol	490	95	490	Unknown
	4-Chlorophenol	220	95	280	Unknown
	Pentachlorophenol (B)	3.6	99	11	99
	Phenol	320	95	400	95
	2,4,6-Trinitrophenol	250	Unknown	250	Unknown
	2,4-Dinitrophenol	45	95	45	Unknown
	4-Nitrophenol	58	Unknown	58	Unknown
Chlorobenzenes and Nitrobenzenes (µg/L)	1,2,3,4-Tetrachlorobenzene (B)	2	99	2	99
	1,2,3,5-Tetrachlorobenzene (B)	3	99	3	99
	1,2,3-Trichlorobenzene (B)	3	99	10	Unknown
	1,2,4,5-Tetrachloro-3-nitrobenzene	0.3	Unknown	0.3	Unknown
	1,2,4,5-Tetrachlorobenzene (B)	5	99	3	99
	1,2,4-Trichlorobenzene (B)	85	99	20	99
	1,2-Dichlorobenzene	160	95	160	95
	1,3,5-Trichlorobenzene (B)	8	99	8	99
	1,3,5-Trinitrobenzene	4	Unknown	4	Unknown
	1,3-Dichlorobenzene	260	95	350	Unknown
	1,4-Dichlorobenzene	60	95	75	Unknown
	1,3-Dinitrobenzene	13	Unknown	13	Unknown

Pollutant Group	Pollutant	DGV for freshwater ecosystems (ANZG, 2018, ANZECC, 2000)*	Freshwater % Species Protection	DGV for marine ecosystems (ANZG, 2018, ANZECC, 2000)*	Marine Water% Species Protection
	1,4-Dinitrobenzene	0.6	Unknown	0.6	Unknown
	1-Chloro-3-nitrobenzene	12	Unknown	12	Unknown
	1-Methoxy-2-nitrobenzene	130	Unknown	130	Unknown
	Hexachlorobenzene (B)	0.05	99	0.05	99
	Monochlorobenzene (B-Fw)	55	95	55	95
	Pentachlorobenzene (B)	1.5	99	1.5	99
	Nitrobenzene	550	95	550	Unknown
Nitrotoluenes and Nitroanilines	2,4,6-Trinitrotoluene	140	95	140	Unknown
	2,4-D	280	95	280	Unknown
	2,4-Dichloroaniline	7	95	7	Unknown
	2,4-Dinitrotoluene	65	95	65	Unknown
	2-Nitrotoluene	110	Unknown	110	Unknown
	3,4-Dichloroaniline	3	95	150	95
	3-Nitrotoluene	75	Unknown	75	Unknown
	4-Nitrotoluene	120	Unknown	120	Unknown
Polycyclic Aromatic Hydrocarbons (µg/L)	Anthracene (B)	0.01	99	0.01	99
	Benzo(alpha)pyrene (B)	0.1	99	0.1	99
	Fluoranthene (B)	1	99	1	99
	Naphthalene	16	95	70	95
	Phenanthrene (B)	0.6	99	0.6	99
Total Petroleum Hydrocarbons (µg/L)	TPH C10-C36 Fraction	600	Unknown	600	Unknown
	TPH C6-C9 Fraction	150	Unknown	150	Unknown
Chloroethanes and Chloropropanes (µg/L)	1,1,1-Trichloroethane	270	95	270	95
	1,1,2,2-Tetrachloroethane	400	95	400	95
	1,1,2-Trichloroethane	6500	95	1900	95
	1,2-Dichloroethane	1900	95	1900	95
	Hexachloroethane (B-Fw)	290	99	360	Unknown
	Pentachloroethane	80	95	80	95
	Carbon Tetrachloride	240	95	240	95
	Chloroform	770	95	770	95

Pollutant Group	Pollutant	DGV for freshwater ecosystems (ANZG, 2018, ANZECC, 2000)*	Freshwater % Species Protection	DGV for marine ecosystems (ANZG, 2018, ANZECC, 2000)*	Marine Water% Species Protection
	Dichloromethane	4000	95	4000	95
Chloropropanes and Chloropropenes (µg/L)	1,1-Dichloropropane	500	95	500	95
	1,2-Dichloropropane	900	95	900	95
	1,3-Dichloropropane	1100	95	1100	95
	3-Chloropropene	3	Unknown	3	Unknown
Chlorinated Alkenes	Chloroethylene	100	95	100	95
	1,1,2,2-Tetrachloroethylene	70	95	70	95
	1,1,2-Trichloroethylene	330	95	330	95
	1,1-Dichloroethylene	700	95	700	95
Anilines (µg/L)	Aniline	250	95	250	Unknown
Phthalates (µg/L)	Di(2-ethylhexyl)phthalate	1	Unknown	1	Unknown
	Dibutylphthalate (B-Fw)	10	99	10	Unknown
	Diethylphthalate	1000	95	1000	Unknown
	Dimethylphthalate	3700	95	3700	Unknown
Polychlorinated Biphenyls (PCBs) & Dioxins (µg/L)	Aroclor 1242 (B-Fw)	0.3	99	0.3	Unknown
	Aroclor 1254 (B-Fw)	0.01	99	0.01	Unknown
Aromatic Hydrocarbons (µg/L)	Benzene	950	95	700	95
	Toluene	180	95	180	95
	Ethylbenzene	80	95	80	95
	m-Xylene	75	95	75	95
	o-Xylene	350	95	350	Unknown
	Cumene (isopropylbenzene)	30	95	30	95
	p-Xylene	200	95	200	Unknown

* Default Guideline Values adopt 95% species protection, and 99% species protection for bioaccumulating toxicants.

* NIWA (2013) *Updating nitrate toxicity effects on freshwater aquatic species* is adopted for freshwater and marine water as recommended in ANZG (2018)

* (B-Mw) – Marine bioaccumulation risk; (B) – Freshwater and marine bioaccumulation risk; (B-Fw) – Freshwater bioaccumulation risk

Attachment 6 - Calculated Baseline Trigger Values