Groundwater Management Plan

SMWSTCTP-AFJ-1NL-PE-PLN-000008 Rev 10

Sydney Metro West – Central Tunnelling Package

DOCUMENT APPROVAL

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Date:	25/10/24	10/12/24	10/12/24

REVISION HISTORY

Rev:	Date:	Pages:	By:	Description:
00	16/9/21	All	SH	For review
01	11/10/21	All	CW	Response to comments
02	25/10/21	All	EW	Response to comments
03	20/06/22	All	OG	Changes for Phase B2 Submission
04	16/8/22	All	GW	Update to address stakeholder comments
05	20/07/23	All	CGM	Annual review
06	12/08/24	All	Various	Annual Review
07	01/10/24	All	Various	Update to address ER and SM comments
08	25/10/24	All	Various	Updated following second round of comments
09	10/12/2024	All	DL	Appendix C amendment
10	13/01/2024	Various	DL	Response to comments

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GLOSSARY / ABBREVIATIONS

Abbreviation	Description / Definition
AFJV	Acciona Ferrovial Joint Venture (the Contractor)
ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
AS/NZS	Australia/New Zealand Standards
CEMP	Construction Environmental Management Plan
Construction	Includes all work required to construct Stage 1 of the CSSI as described in the documents listed in Condition A1 of Schedule 3, including commissioning trails of equipment and temporary use of any part of the CSSI, but excluding Low Impact Work. *Note: As defined in Table 1 of SSI 10038 Infrastructure approval for the Project.*
CoA	Minister's Conditions of Approval (as relevant to Sydney Metro West Concept and Stage 1)
CTP	Central Tunnelling Package
DPIE	NSW Department of Planning, Infrastructure and Environment
DPI (Water)	NSW Department of Primary Industries (Water) (Former Office of Water)
EIS	Sydney Metro West Concept and Stage 1 Environmental Impact Statement (April 2020)
EMS	Environmental Management System
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment
Environmental incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance with the conditions of this approval. Note "material harm" is defined in this document.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve
EPA	NSW Environment Protection Authority
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999*
EPL	NSW Environment Protection Licence under the *Protection of the Environment Operations Act 1997*.
ESCP	Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statements
GDE	Groundwater Dependent Ecosystems
GCMP	Groundwater Construction Monitoring Program
GWMP	Groundwater Management Plan

Abbreviation	Description / Definition
Material harm	This is harm that: (a) involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial or (b) results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment).
mbgs	metres below ground surface
Minister, the	NSW Minister for Planning and Public Spaces
Non-compliance	An occurrence, set of circumstances or development that is a breach of this approval but is not an incident.
Planning Secretary	The Planning Secretary of the Department of Planning, Industry and Environment
POEO Act	*NSW Protection of the Environment Operations Act 1997*
Project	Sydney Metro West Concept and Stage 1
Relevant Councils	Any or all local government councils as relevant, Inner West Council, Strathfield City Council, Burwood Council, City of Canada Bay and Parramatta City Council
REMM	Revised Environmental Mitigation Measure
SOPA	Sydney Olympic Park Authority
WTP	Water Treatment Plant

1. INTRODUCTION

1.1 BACKGROUND

Sydney Metro is Australia's biggest public transport program. Services on the North West Metro Line between Rouse Hill and Chatswood started in May 2019. The Sydney Metro network also includes Sydney Metro City & Southwest, Sydney Metro West and Sydney Metro Western Sydney Airport.

Sydney Metro West is a new 24 kilometres metro line between Westmead and the Sydney CBD. This infrastructure investment will double the rail capacity of the Greater Parramatta to Sydney CBD corridor with a travel time target between the two centres of about 20 minutes.

The planning approvals and environmental impact assessment for Sydney Metro West has been split into a number of stages recognising the size of the project. This includes:

- Stage 1 – Concept and all major civil construction works including station excavation and tunnelling between Westmead and The Bays. Planning approval for this stage was granted in March 2021.
- Stage 2 – All major civil construction works including station excavation and tunnelling from The Bays to Sydney CBD
- Stage 3 – Tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line.

An Environmental Impact Statement (EIS) (Jacobs/Arcadis, 2020) for the Concept and Stage 1 (herein referred to as the Project) assessed the soil and surface water quality impacts in response to the Secretary's Environmental Assessment Requirements issued by the Department of Planning, Industry and Environment (DPIE). The groundwater impact assessment is included in Chapter 18 and Technical Paper 7 – Hydrogeology of the EIS. The Project was approved on 11 March 2021 (SSI 10038). An administrative modification (Modification 1) was approved on 28 July 2021.

1.2 SCOPE

The Groundwater Management Plan (GWMP or Plan) forms part of the Construction Environmental Management Plan (CEMP). This Plan outlines how the Acciona Ferrovial Joint Venture (AFJV) will comply with and implement the applicable 'environmental requirements' for the Central Tunnelling Package (CTP) and identify how AFJV will manage the groundwater impacts during construction of the CTP civils construction phase B1 and tunnelling construction phase B2 (in accordance with the Sydney Metro Phasing Report).

This GWMP outlines how AFJV will comply with and implement the applicable elements from the following documents, collectively referred to herein as the 'Project requirements':

- NSW Minister for Planning's Conditions of Approval (CoA)
- Revised Environmental Mitigation Measures (REMMs) and the
- Sydney Metro Construction Environmental Management Plan (CEMF).

2. OBJECTIVES AND TARGETS

The key objective of this Plan is to ensure that impacts to groundwater are minimised during construction of the CTP and that all works are undertaken in compliance with the Project requirements.

The CEMF provides objectives that will apply to groundwater management during construction, listed in Table 2-1.

TABLE 2-1: OBJECTIVES AND TARGETS

Objective	Target	Measurement tool
Reduce the potential for drawdown of surrounding groundwater resources	Minimise impacts to ground water levels in active licenced groundwater supply bores during construction	Monitoring and inspection records Audit reports
Prevent the pollution of groundwater through appropriate controls;	Prevent pollution of groundwater	Monitoring and inspection records Audit reports
Reduce the potential impacts of Groundwater Dependent Ecosystems (GDE)	No decline of GDEs attributable to construction activities	Monitoring and inspection records

The EIS (Chapter 27) identified specific performance outcomes for the Project; those relevant to the management of groundwater are included as Table 2-2.

TABLE 2-2: PERFORMANCE OUTCOME REQUIREMENTS

Performance Outcome Requirement	Sydney Metro West Construction Performance Outcomes	How Stage 1 addresses performance outcomes
Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised	▪ Groundwater supply for licenced groundwater users is not significantly affected by groundwater drawdown ▪ The groundwater accessible to GDE is not significantly reduced ▪ Structural damage to buildings from ground movement associated with excavation, tunnelling or groundwater drawdown is avoided.	Tanking of stations at The Bays to avoid ongoing groundwater inflow Stage 1 includes a commitment to implement make good measures in relation to any potential loss of yield for existing groundwater (bore supply) users due to construction Stage 1 includes a commitment to further groundwater monitoring to better understand potential impacts on groundwater dependant ecosystems and inform mitigation as part of the design process Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based criteria), a structural assessment of the affected buildings/structures would be carried out and specific measures implemented to address the risk of damage

3. ENVIRONMENTAL REQUIREMENTS

3.1 RELEVANT LEGISLATION AND GUIDELINES

The relevant legislation to this Plan includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Contaminated Land Management Act 1997* (CLM Act)
- *Water Management Act 2000* (WM Act).

Refer to the CEMP for more details of the relevant legislation.

Additional guidelines and standards relating to the management of groundwater include:

- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines')
- 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 (2004)
- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book')
- NSW Office of Water (2012). NSW Aquifer Interference Policy
- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (2011)
- Transport for NSW's Water Discharge and Re-use Guideline.

3.2 PROJECT REQUIREMENTS

This Plan has been prepared in compliance with the CEMF; the CEMF requirements relevant to the preparation of this Plan are listed in Table 3-1. CoAs and other requirements relevant to this Plan are included in Appendix A.

TABLE 3-1: COMPLIANCE TABLE - REQUIREMENTS FOR PREPARATION OF THIS PLAN

Project Requirements		
C1	Construction Environmental Management Plans (CEMPs) and CEMP Sub-plans must be prepared in accordance with the Construction Environmental Management Framework (CEMF) included in the documents listed in Condition A1 of this schedule to detail how the performance outcomes, commitments and mitigation measures specified in the documents listed in Condition A1 of this schedule will be implemented and achieved during construction.	Table 3-1 Plan
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 Monitoring Program to be prepared in consultation with DPIE Water and SOPA (in respect of Sydney Olympic Park)	0
Construction Environmental Management Framework		

Project Requirements		
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:	This Plan
i.	The groundwater mitigation measures as detailed in the environmental approval documentation;	Section 6.1 and 0
ii.	The requirements of any applicable licence conditions;	Section 3.4
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;	Section 6
iv.	Evidence of consultation with relevant government agencies;	The Groundwater Monitoring program has undergone consultation with DPIE Water and SOPA in accordance with CoA C14(d).
v.	The responsibilities of key project personnel with respect to the implementation of the plan;	Section 6.1
vi.	Procedures for the treatment, testing and discharge of groundwater from the site;	0
vii.	Compliance record generation and management; and	Section 7.4
viii.	Details of groundwater monitoring if required.	0

Other Project requirements relevant to the management of groundwater during the delivery of the CTP can be found in **Appendix A**.

3.3 REVISED ENVIRONMENTAL MITIGATION MEASURES

Refer to **Appendix A** for all relevant REMMs.

3.4 LICENCES AND PERMITS

An Environmental Protection License (EPL 21610) applies for the CTP. The EPL 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.

Section 6.1 of the EIS states that Section 5.23 of the EP&A Act, states that a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act* 2000, is not required for approved State Significant Infrastructure. As such, water supply works approvals and water use approvals would not be required for Stage 1. However, an aquifer interference approval may still be required. AFJV will continue to consult with DPIE – Water on the need for an aquifer interference approval. If required, an aquifer interference approval will be sought prior to affecting groundwater

during the excavation of the station boxes. The Revised Groundwater Modelling Reports (Section 6.2) as required by CoA D122 will confirm the anticipated extent of the any aquifer interference that may occur as a result of the Project. This Revised Modelling Report will be completed prior to discussing the requirements of an aquifer interference approval with DPIE – Water.

4. EXISTING ENVIRONMENT

Known groundwater constraints within and adjacent to the Project have been identified and documented in the following environmental assessment reports, which included detailed desktop studies and field investigations:

- Sydney Metro West Stage 1 EIS Chapter 18 Groundwater
- Sydney Metro West Stage 1 EIS Technical Paper 7 – Hydrogeology
- Sydney Metro West Stage 1 EIS Technical Paper 8 - Contamination
- Golder/Douglas Partners, October 2018, Groundwater Level Monitoring Report, 1791865-003-R-GWMR3-RevA
- Golder/Douglas Partners, October 2020. Groundwater Monitoring Report - Stage 2 Locations, 1791865-023-RGWMR RevA
- Jacobs, dated 18 December 2020,Tender Advice Notice Hydrogeology- Site Wide Central Tunnelling Package, Groundwater Quality Assessment, CENT-JTJV-PW-HG-TAN-0040.3,Rev A
- ERM, January 2021, Metro West-Contamination-Groundwater, 0577577, Rev 1
- Senversa, May 2021, Factual Contamination Investigation Report- The Bays, 000013/11868 White Bay Site Investigations
- Sydney Metro, Tender Advice Notice, 2021, Central Tunnelling Package – Desktop Water Discharge Assessment Report, SMWSTEDS-SMD-SW-SD-TAN-044001.

The following chapters summarise the existing groundwater environment and the likely CTP impacts as identified in the EIS and the Revised Groundwater Modelling Reports.

4.1 TOPOGRAPHY

The CTP falls within the catchment of the Parramatta River and Sydney Harbour. The catchment lies to the west of the Sydney CBD within the relatively flat region of the Cumberland Plain. Elevations range from 140 metres Australian Height Datum (AHD) in the north-west of the catchment to sea level in the east. Most of the waterways are within urbanised coastal areas.

4.2 GEOLOGY

The EIS (Section 18.4.1) identifies that the Sydney 1:100,000 Geological Series Sheet 9130 (NSW Department of Mineral Resources, 1983) and the Parramatta 1:100,000 Geological Sheet 9030 (NSW Department of Mineral Resources, 1991) indicate that most of the Project is underlain by geological units associated with the Wianamatta Group. Ashfield Shale with occurrences of Hawkesbury Sandstone and Mittagong Formation. In addition, significant areas of disturbed ground (imported fill) are known to be present within the CTP works area at Sydney Olympic Park and The Bays. Geological units at the CTP construction sites are presented in Table 4-1. A description of the geological formations is presented in Figure 1.

TABLE 4-1: GEOLOGICAL DESCRIPTION

Geological Unit	Construction Site	Description
Fill	▪ The Bays	Material comprising waste, emplaced material and engineered fill.
Quaternary deposits (residual and alluvial soils)	▪ Sydney Olympic Park ▪ North Strathfield ▪ Burwood North ▪ Five Dock ▪ The Bays	Alluvial and marine sediments associated with gullies, valleys, and former drainage channels.

Geological Unit	Construction Site	Description
Mittagong Formation	▪ Sydney Olympic Park ▪ North Strathfield ▪ Burwood North ▪ Five Dock	Interbedded dark siltstone and fine-grained sandstone beds and laminae of varying thickness.
Ashfield Shale	▪ Sydney Olympic Park ▪ North Strathfield ▪ Burwood North ▪ Five Dock	Black to dark grey shale and laminate.
Hawkesbury Sandstone	▪ All CTP construction sites	Medium to coarse-grained quartz sandstone.

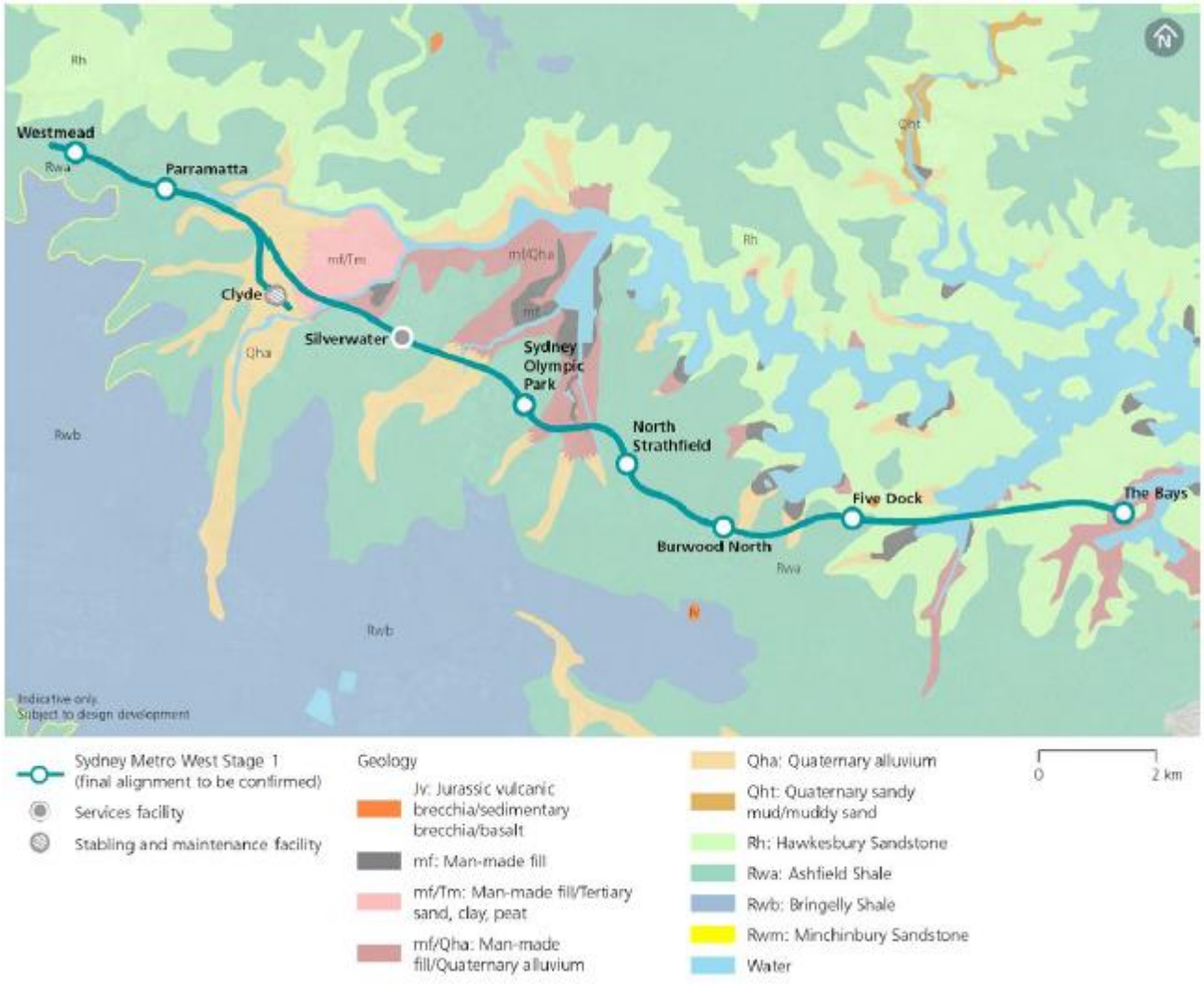

FIGURE 1: GEOLOGICAL FORMATIONS FOR THE CTP

The geology within the CTP works area is crossed by several volcanic structural features such as dykes and faults that may impact groundwater flow. Dykes are bodies of rock that cut across other geological units. Faults are a fracture within rock where displacement may have occurred. Dykes and faults may provide a conduit or hydraulic barrier for groundwater inflows.

Dykes within Ashfield Shale and Hawkesbury Sandstone. Dykes may be present near the North Strathfield construction site, whilst the Great Sydney Dyke is has been encountered at the eastern edge of station box at The Bays. A dyke may also be present near the tunnel alignment to the east of Five Dock.

A geological fault is present near the Sydney Olympic Park with additional faults potentially occurring near the North Strathfield, Burwood North and The Bays construction sites.

4.3 AQUIFERS

Aquifers near the CTP works areas include porous and fractured rock aquifers. Porous aquifers in alluvial soils are continuous (unconfined) over an area. Porous aquifers in residual soils are often ephemeral, localised and discontinuous.

Fractured rock aquifers occur where groundwater is transmitted through fractures or joints and bedding planes, such as in the shales and Hawkesbury Sandstone.

Groundwater has also been identified in the fill layer at The Bays.

4.4 GROUNDWATER LEVELS

The groundwater level across most of the CTP works area is generally shallow and typically between one metre and five metres below ground surface at most locations. Table 4-2 shows the groundwater level near the CTP construction sites.

TABLE 4-2: GROUNDWATER LEVELS

Construction Site	Typical Groundwater level (mbgs)
Sydney Olympic Park	12
North Strathfield	5
Burwood North	12
Five Dock	2
The Bays	2

Interaction between groundwater and surface water is expected to be limited to:

- Likely surface water infiltration that filters through soils and contributes to groundwater
- Discharge from groundwater to surface watercourses and waterbodies, especially in low lying areas or deeply incised channels
- Leakage from surface watercourses which recharge the groundwater.

4.5 GROUNDWATER QUALITY

Groundwater quality is influenced by the underlying geological units. The expected groundwater quality associated with the key geological units for the CTP is presented in Table 4-3.

TABLE 4-3: GROUNDWATER QUALITY

Geological Unit	Expected Salinity	Expected pH	Other characteristics
Quaternary deposits (residual and alluvial soils)	Fresh to saline	Neutral to slightly acidic	N/A

Geological Unit	Expected Salinity	Expected pH	Other characteristics
Ashfield Shale	Brackish to saline 2,000 milligrams per litre to 20,000 milligrams per litre	Neutral to slightly acidic (4-8)	N/A
Hawkesbury Sandstone	Fresh to brackish 300 milligrams per litre to 1,400 milligrams per litre	Neutral to slightly acidic (4.5 to 8)	Elevated iron Elevated manganese
Mittagong Formation	Fresh to brackish 250 milligrams per litre to 350 milligrams per litre	Neutral to slightly acidic (4.5 to 8)	Elevated iron Elevated manganese

4.6 POTENTIAL CONTAMINATED GROUNDWATER

The Chapter 20 of the Project EIS and Technical Papers 7 and 8 detailed the results of the existing groundwater monitoring bores and potential contamination risk. Data collected from the groundwater monitoring bores exceeded ANZECC (2000) trigger levels for 95 per cent protection of freshwater aquatic ecosystems for the following substances:

- Ammonia
- Heavy metals (including cobalt, manganese, arsenic, copper, lead, nickel and zinc).

The EIS (Section 18.4.2) noted that ANZECC (2000) does not provide a 95 per cent trigger level for iron, however iron concentrations in measured groundwater near the CTP construction footprint is relatively high. Human activities may have also influenced groundwater quality and groundwater contamination from current or historical land uses in some areas. Construction sites with the potential for contaminated groundwater are summarised below. This information has been extracted and summarised from Chapter 20 of the Project EIS.

The Soil and Water Management Plan details areas of potentially contaminated soil and the contaminated land assessment and management process that will be occurring for the Project where there have been areas identified as having potential contaminated soils and groundwater.

A summary of the potential groundwater contamination at the station box sites is summarised below. The management of contaminated groundwater is also addressed in Section 6.3 of this Plan and Section 6.3.4 of the Groundwater Monitoring Program.

4.6.1 SYDNEY OLYMPIC PARK

Construction at Sydney Olympic Park (SOP) is primarily through rock and there is limited fill present at the station box excavation. As a result, there are no specific areas of environmental interest in the area of construction. There are, however, areas of environmental interest to the south-west, south and south-east, primarily associated with legacy land-use, such as uncontrolled landfilling. The areas of environmental interest are within the current modelled groundwater drawdown extent for the station box. These drawdown extents are being confirmed via the Revised Groundwater Modelling Report.

Chapter 20 and Technical Paper 8 of the EIS identifies there to be a high potential for groundwater contamination at SOP, primarily as a result of contaminated groundwater being mobilised towards the construction area and intersected during excavation and dewatering. Advice from Jacobs (2020) during the tender does however suggest that the movement of contaminated groundwater from the fill areas through residual clay and into the shale will be limited and is therefore considered to not be a significant concern during construction of the station box. Regardless, the potential for migration of impacted groundwater cannot be ruled out and will be monitored via ongoing groundwater monitoring.

4.6.2 NORTH STRATHFIELD

Construction of the station box at North Strathfield will primarily be through rock. Chapter 20 of the EIS does not identify a potential risk of encountering contaminated groundwater. There are however three areas of environmental interest in close proximity to the site and therefore located within the preliminary modelled drawdown extent.

A review of the Revised Groundwater Modelling Report and Detailed Site Investigation for the North Strathfield site notes that whilst there are exceedances of the nickel, copper and zinc concentrations assessment criteria, they are in the same magnitude as the criteria and no heavy metal sources are on site further investigation is not warranted.

4.6.3 BURWOOD NORTH STATION

Construction of the station box at Burwood North will primarily be through rock, however, a clay layer was identified at about 3.1 metres. Chapter 20 of the EIS identifies a moderate groundwater contamination risk at Burwood North. Two areas of environmental interest are located in close proximity to the station box excavation and are within the preliminary modelled drawdown extent that, which pose a risk of groundwater contaminates to migrate towards the station box.

A review of the Revised Groundwater Modelling Report and the Detailed Site Investigation for the Burwood North site notes that whilst groundwater flow patterns may be affected by the project, it is unlikely that this would result in a change of risk profile to the site. This will be verified via ongoing monitoring.

4.6.4 FIVE DOCK

Construction of the station box at Five Dock will primarily be through rock. Chapter 20 of the EIS does not identify a potential risk of encountering contaminated groundwater. No areas of environmental interest were identified in the EIS, and there was little evidence of groundwater contamination in the background data that has been collected from the bores in this area. This supported by the Revised Groundwater Modelling Report and the Detailed Site Investigation for the Five Dock Site.

4.6.5 THE BAYS STATION

The construction of the station box at The Bays will be through sediment and then rock. Chapter 20 of the EIS identified an overall moderate to high potential risk of encountering contaminated groundwater at The Bays during excavation.

Groundwater from the sediments identified elevated levels of arsenic concentrations and concentrations of isopropylbenzene were reported above the water quality objectives in the shallow sediments. PFOS was detected at two of the monitoring bores.

A review of the Revised Groundwater Modelling Report and the Detailed Site Investigation for The Bays site notes that whilst groundwater flow patterns may be affected by the project, it is unlikely that this would result in a change of risk profile to the site. This will be verified via ongoing monitoring.

4.7 GROUNDWATER USE AND EXTRACTION

The EIS states there are 31 registered groundwater bores located within the predicted groundwater level drawdown zone of influence during construction, split as follows:

- Twenty-eight bores which are installed for monitoring purposes
- One bore which is installed for industrial purposes
- One bore which is installed for dewatering purposes
- One bore which is installed for water supply.

A total of 39 Water Access Licence users are registered within one kilometre of the Sydney Metro West works areas.

The following sections provides a brief summary of the groundwater users relevant to each CTP construction site. This information has been extracted from the Project EIS Technical Paper 7.

4.7.6 SYDNEY OLYMPIC PARK

Three WaterNSW-registered bores were identified within the predicted extent of groundwater level drawdown. WaterNSW reports the purpose of these bores as monitoring. Water supply at WaterNSW-registered bores are therefore not likely to be impacted by the station excavation.

4.7.7 NORTH STRATHFIELD

Seven WaterNSW-registered bore were identified within the predicted extent of groundwater level drawdown. WaterNSW reports the purpose of these bores are monitoring. WaterNSW-registered water supply bores are therefore not likely to be impacted by station excavation.

4.7.8 BURWOOD NORTH

Fifteen WaterNSW-registered bore were identified within the predicted extent of groundwater level drawdown. WaterNSW reports the purpose of these bores as monitoring, with the exception of bore GW305646, which is reported as a domestic water supply bore, and bore GW102215, which is reported as a dewatering bore. As GW102215 is not a groundwater supply bore, it is not likely to be adversely impacted by the CTP works.

Water supply bore GW305646 is recorded as six metres deep. The estimated groundwater drawdown at its location is two metres at two years after excavation. This bore is not listed as active in the NSW Water Register. Refer to Section 6.1 for further detail relating to bore GW305646.

4.7.9 FIVE DOCK

One WaterNSW-registered bore was identified within the predicted extent of groundwater level drawdown. WaterNSW identifies this bore as a monitoring bore. WaterNSW-registered water supply bores are therefore not likely to be impacted by station excavation.

4.7.10 THE BAYS

WaterNSW-registered bores were not identified within the predicted extent of groundwater level drawdown.

4.8 GROUNDWATER DEPENDENT ECOSYSTEMS

The EIS Technical Paper 10 (Biodiversity development assessment report) identifies potential GDEs located about one kilometre away from the CTP construction sites. The location of GDEs relevant to the Project is shown in Figure 2.

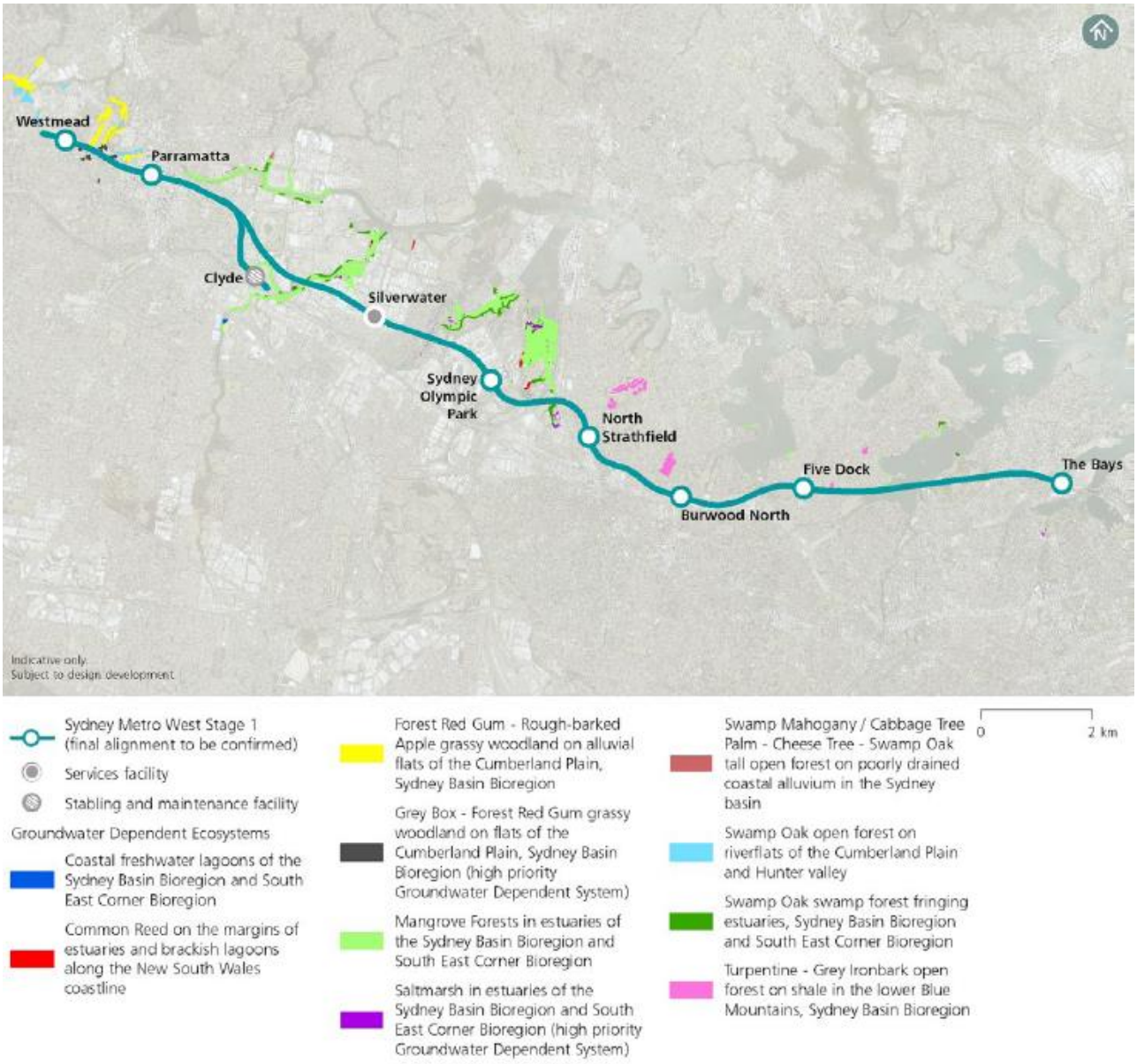

FIGURE 2: GROUNDWATER DEPENDENT ECOSYSTEMS

High priority GDEs are listed in Schedule 4 of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (Department of Industry, 2011). The plan lists Coastal Saltmarsh in the Sydney Basin Bioregion as high priority GDE. Therefore, the Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion in the vicinity of Sydney Olympic Park and North Strathfield construction sites are classified as high priority GDEs.

The Project EIS also identified a GDE (terrestrial vegetation) Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion Plant Community Type (PCT 1281) in proximity to the Five Dock construction site (approximately 350 metres to the east). This PCT Is considered to have a moderate to high likelihood to be terrestrial GDEs.

Refer to the Flora and Fauna Management Plan for further detail on GDEs relevant to the CTP works area.

5. ENVIRONMENTAL ASPECTS AND IMPACTS

5.1 ASPECTS

The key aspects of the CTP, which potentially impacts upon groundwater include:

- Bulk earthworks
- Drainage works
- Station box excavation
- Operations at site compounds including fuel and chemical storage, refuelling and chemical handling
- Tunnelling.

In addition, aspects and the potential for impacts have been considered during a high-level CTP wide risk assessment. The risk assessment has been undertaken to identify if there is a requirement for establishing appropriate control measures and identifying if there is a requirement for a project-specific or site-specific controls which should be applied (ie. environmental work method statement).

For those activities with residual environmental risks identified as 'high', the justification for accepting the residual risk was discussed with all attendees. For all activities in this category, an Environmental Work Method Statement will be developed for that activity where other risk assessment strategies are not already in place. The risk assessment did not identify a residual risk rating of 'high' for the aspects relating to the management of groundwater during the delivery of the civils component of the CTP (Phase B1 in accordance with the Sydney Metro West Phasing Report).

5.2 IMPACTS

The Project EIS (Chapter 27) identified the key potential impacts requiring mitigation relating to groundwater and ground movement are:

- Potential minor impacts associated with localised ground movement and/or settlement due to excavation or groundwater drawdown causing damage to infrastructure
- Minor potential impacts on registered groundwater users
- Potential migration of contaminated groundwater towards, and into, station excavations, posing a potential exposure risk to site users/workers, and potentially reducing the beneficial use of the aquifer
- Groundwater collected within site excavations and station box excavations during construction would be directed to the WTP/s and then discharged to the local stormwater system at each construction site.

In addition to the potential impacts identified in the EIS, there is a potential risk of the generation of contaminated groundwater through the interaction with contaminated soils.

The potential for impacts on groundwater is dependent on the nature, extent and magnitude of the construction activities and their interaction with the natural environment. The potential impacts associated with the construction of the CTP are discussed in the following sections.

5.2.1 GROUNDWATER RECHARGE

Soils are recharged by rainfall and localised irrigation, as well as incidental runoff from impervious surfaces. When rock layers are exposed at surface, there can be direct recharge of the rock aquifers, with transmission primarily through rock joints. Recharge to the rock aquifers elsewhere is by downward percolation through soils. Given most of the construction sites are currently impervious the CTP would not reduce recharge rates near the sites. The exception to this is at North Strathfield where most of the construction site is identified as pervious and therefore the CTP may potentially reduce recharge rates. At a regional scale, the contribution of potential recharge from North Strathfield is likely

to be minor, and changes to groundwater recharge from the conversion of the site to an impervious area are likely to be minor to negligible.

5.2.2 POTENTIAL IMPACTS TO GROUNDWATER DEPENDENT ECOSYSTEMS

As detailed in Section 4.8, Coastal Saltmarsh in the Sydney Basin Bioregion is identified as a high priority terrestrial vegetation GDE, including the Saltmarsh in estuaries of the Sydney Basin Bioregion and Southeast Corner Bioregion in the vicinity of Sydney Olympic Park and North Strathfield construction sites. However negligible impacts are expected at the saltmarsh estuaries near Sydney Olympic Park and North Strathfield construction sites as these sites are located outside of the impacted groundwater zone.

The PCT associated with the terrestrial GDE identified in proximity to the Five Dock is not obligate (i.e. they are not entirely dependent on groundwater) and are likely to be opportunistic facultative that may depend on the subsurface presence of groundwater in some locations but not in others. This PCT may be impacted by the groundwater drawdown associated with excavations at the North Strathfield, Burwood North and the Five Dock construction sites. Drawdown beneath all of these PCT's is predicted in the sandstone at depth. However, given the geology there is a possibility that there is a perched water table in the shale. Plant roots will be in the silty clay soils separated from the zone of drawdown by the lower permeability shale layer. Only the western portion of the PCT at Concord Golf Club is predicted to be affected by groundwater drawdown. Plant roots will be within the silty clay soils and given the presence of a shale layer that may have a perched aquifer the potential for impacts on this PCT is low

Revised Groundwater Modelling Reports have been prepared before the commencement of bulk excavations for each site. They will identify the groundwater drawdown effects (refer to Section 5.2.3). The model/s will identify if additional monitoring or mitigations measures are required to prevent adverse impacts on groundwater dependant ecosystems. The Revised Groundwater Modelling Reports are made available on the Project Website as required by CoA B11.

5.2.3 GROUNDWATER DRAWDOWN AND GROUND MOVEMENT

The specific risk to most buildings and structures due to ground movement is considered negligible, with superficial damage to buildings unlikely. Construction of some underground sections may potentially induce ground movement at the surface and below ground which could include ground settlement and lateral movement. If not adequately managed, ground movement has the potential to cause damage to infrastructure, nearby buildings and other structures. Ground movement may occur from either the release or redistribution of stress in rock formations or from ground consolidation following the drawdown of groundwater. Typically ground movement caused by stress redistribution in rock generally occurs shortly after excavation, while consolidation settlement from groundwater drawdown can occur over a longer period.

It is expected that any potential settlement associated with groundwater drawdown would be minimal as most underground excavation would be within rock that has low permeability. At The Bays however, the Revised Groundwater Modelling Report required under CoA D122 has identified that this area is expected to be of relatively high permeability. As such, AFJV have implemented a program of pre-excavation grouting in order to manage potential groundwater inflows to the station box and to the tunnels north of the station box in order to reduce groundwater inflows, and by extension groundwater drawdown and groundwater movement.

Section 5.12 of Technical Paper 7: Hydrogeology, predicts that groundwater level drawdown due to the tunnelling is not likely to be significant. This is due to the relatively low hydraulic conductivity and storativity of the rock and the short timeframe over which an open (unlined) excavation would be open in the tunnels. Some settlement could potentially occur as a result of groundwater drawdown associated with open excavations and this potential would be greatest in soft superficial surface deposits, if the perched water table is lowered.

Most of the CTP works area is considered to have a negligible ground movement risk, with superficial damage to buildings unlikely. Small areas at construction sites are considered to be subject to possible

superficial damage which is unlikely to have structural significance. These would be subject to further assessment at later design stages, which may include building strain and structural assessment to address settlement related risks. Refer to Section 6.1 for mitigation and management measures relating to settlement.

5.2.4 GROUNDWATER INFLOWS

Excavations at construction sites can act as groundwater sinks, potentially resulting in the surrounding groundwater to flow towards the excavations. Some excavations would be tanked (i.e. sealed) during construction, which would prevent groundwater from flowing into the excavation. Other excavations would be untanked (i.e. the excavation would not be sealed and groundwater, if present, would flow to the excavation across both soil and rock horizons). Whether an excavation is untanked or tanked may influence the actual groundwater inflow rates at each of the construction sites where excavations would occur.

Rock in the vicinity of water-bearing geological features such as faults, dykes and joint swarms has the potential to have relatively high hydraulic conductivity (i.e. ability of groundwater to pass through the pores and fractures in the rock). Identification of such features would be carried out, and significant water-bearing features would be grouted prior to excavation, to reduce the potential for relatively high groundwater inflows to the excavations

Potential inflow rates to address the requirements of the NSW Aquifer Interference Policy and the Water Sharing Plan (as defined in the Project EIS) are presented in Table 5-1. None of the estimated inflows satisfy the minimum impact considerations of the NSW Aquifer Interference Policy and therefore the Policy is not expected to be triggered (this will be concerned after the completion of the Revised Groundwater Modelling Reports and consultation with DPIE – Water). Excavations have the potential to change the direction of existing groundwater flow regime, causing groundwater to flow towards the excavation. There is a potential for contaminants within the groundwater to be mobilised towards the excavation sites at Sydney Olympic Park, North Strathfield and The Bays.

The model used to inform the Project EIS has been revised and Revised Groundwater Modelling Reports have been prepared before the commencement of bulk excavations effecting groundwater, in accordance with CoA D122 that identify the groundwater drawdown effects (refer to Section 6.2). Refer to the Soil and Water Management Plan for mitigation and management measures relating to the management of contamination.

TABLE 5-1: POTENTIAL INFLOW RATES (DATA SOURCED FROM TABLE 18-7 OF THE EIS AND TECHNICAL PAPER 7 AND THE REVISED GROUNDWATER MODELLING REPORTS)

Construction site	EIS assumed design	EIS Estimated inflow (L/s)	EIS Cumulative inflow at two years (ML)	AFJV Cumulative inflow at two years (ML)
Sydney Olympic Park	Untanked	0.4 in both years	25	16
North Strathfield	Untanked	0.4 in both years	34	10
Burwood North	Untanked (excavation and shaft) Tanked (crossover cavern)	3.1 in first year 2.8 in second year	208	44
Five Dock	Untanked	1.7 in both years	117	20
The Bays	Tanked (soil)	10.1 in both years	639	324

Construction site	EIS assumed design	EIS Estimated inflow (L/s)	EIS Cumulative inflow at two years (ML)	AFJV Cumulative inflow at two years (ML)
	Untanked (rock)			

5.2.5 GROUNDWATER QUALITY

There is potential to contaminate groundwater through incidents such as spills due to storage of hazardous materials and refuelling. The risks to groundwater as a result of an incident will be managed in accordance with the CEMP. Surface runoff will be managed in accordance with the Soil and Water Management Plan and associated Erosion and Sediment Control Plans (ESCP).

The Soil and Water Management Plan identified areas of potentially contaminated soil within the CTP works areas. Potential impact pathways due to the disturbance of contaminated soil without appropriate management and/or remediation includes exposure to environmental receptors from the impacts of intercepting contaminated soil. Contaminated soil, when encountered during excavations, could contaminate the groundwater through the migration of contaminated groundwater plumes towards the tunnels. The description of key aspects and impacts as a result of contaminated soil, and mitigation and management measures are detailed in the Soil and Water Management Plan.

As summarised in Section 4.6, the Project EIS identified areas of potential groundwater contamination and impact pathways including risk to construction works and contaminant exposure to environmental receptors from intercepting contaminated groundwater. The highest risk of encountering contaminated groundwater is at The Bays (refer to Section 4.6.1). There is also a high risk associated with contaminated groundwater migration from off-site source to be present at depth (shallow and depth) within construction footprint at Sydney Olympic Park (refer to Section 4.6.5). The potential contamination risk is identified as moderate. Impacts as a result of vapour and gases due to potential contamination are/will be detailed in Detailed Site Investigations and any resulting site specific contamination management plans or Remediation Action Plans (RAPs).

5.2.6 SURFACE WATER IMPACTS

The following sections provides a brief summary of the potential for reduced baseflow to surface waters in the vicinity of Sydney Olympic Park and North Strathfield construction sites. This information has been extracted from the Project EIS Technical Paper 7.

5.2.6.1 SYDNEY OLYMPIC PARK

Groundwater level drawdown due to station excavation is predicted at distance from Haslams Creek, the Mason Park wetlands, Bicentennial Park wetlands, and the Brickpit at Sydney Olympic Park. It is not known whether groundwater contributes baseflow to these surface water features.

If there is existing groundwater baseflow contribution to the surface waters, then the Project has the potential to reduce that baseflow contribution to these surface waters. Groundwater level drawdown from the CTP works at distance from these surface water features could result in reduced groundwater flow towards these surface waters, which could potentially cause reduced baseflow contribution to streamflow.

5.2.6.2 NORTH STRATHFIELD

Groundwater level drawdown due to station excavation is predicted at distance from Powells Creek and the wetlands at Mason Park, Powells Creek Reserve and Bicentennial Park.

Groundwater level drawdown at distance from the creek and wetlands could result in reduced groundwater flow towards the creeks/wetlands, and ultimately reduced baseflow to the creeks/wetlands. It is not known whether groundwater currently contributes baseflow to these surface water features. If there is existing groundwater baseflow contribution to these surface water features, then the CTP has the potential to reduce that baseflow contribution and reduce stream flows.

In accordance with REMM GW2 and GW3, additional site investigations would be carried out to confirm geological and groundwater conditions and determine if groundwater drawdown as a result of the CTP works is likely to occur. Refer to Section 6.1 for mitigation and management measures.

5.2.6.3 BURWOOD NORTH

The EIS did not predict any surface water impacts as a result of groundwater drawdown or any other groundwater associated issues, however, during consultation with City of Canada Bay Council, concern was raised in regard to the groundwater connection to St Lukes Canal and the potential effect on base water flows.

In accordance with Section 6.2 Revised Groundwater Modelling Reports have been completed and submitted to the DPE prior to bulk excavations impacting groundwater. Following preparation of the Groundwater Modelling Report for the Burwood North site a review of the potential impacts compared with the outcomes of the EIS was undertaken, with particular reference to St Luke's Stormwater Canal. A worsening of impacts versus that modelled in the EIS outcomes was not identified. However, groundwater monitoring will continue to ensure groundwater drawdown is consistent with modelled predictions.

6. ENVIRONMENTAL CONTROLS

6.1 MITIGATION AND MANAGEMENT MEASURES

Construction associated with the CTP has the potential to impact groundwater levels and quality within and adjacent to the CTP works area. In order to avoid, mitigate and/or minimise these potential impacts, a range of environmental requirements and control measures are identified in the various environmental assessment documents (including the EIS) and other guidance documents. Specific measures and requirements to address impacts on groundwater are outlined in Table 6-1.

TABLE 6-1: MITIGATION AND MANAGEMENT MEASURES

Reference	Measure	When	Responsibility	Source
GWMM1	Undertaking groundwater monitoring during construction in accordance with the Groundwater Construction Monitoring Program (**Appendix B**).	Prior to and during construction	Environmental Manager	CoA C14
GWMM2	Site inspection would be carried out on private domestic supply bore GW305646 near Burwood North to confirm the current viability of that bore. If the bore is found to be viable, and predicted to be significantly impacted by the Project, make good measures would be implemented if a loss of yield were to occur. If required, make good options will be determined and agreed to by the registered user prior to being implemented.	Prior to construction	Design Manager Environmental Manager	REMM GW1 D121
GWMM3	A review of additional geotechnical and hydrogeology data at Sydney Olympic Park and North Strathfield construction sites would be undertaken to confirm the geological and groundwater conditions and determine, based on these local conditions, whether predicted groundwater drawdown from CTP is likely to occur in the vicinity of creeks. This information will be documented as part of the Revised Groundwater Modelling Report.	Prior to construction	Design Manager	REMM GW2

Reference	Measure	When	Responsibility	Source
GWMM4	Additional site investigations would be carried out at Sydney Olympic Park and North Strathfield creeks or surface water bodies where the additional data review shows there is a likely surface water / groundwater interaction, subject to the outcomes in GWMM3. Addressed via the Groundwater Modelling Reports produced for CoA D122.	Prior to tunnelling	Design Manager	REMM GW3
GWMM5	Monitoring of groundwater levels and quality at the site would occur during construction. This would also include monitoring of potential contaminants of concern. Monitoring and reporting of groundwater levels and quality will be carried out in accordance with the Groundwater Monitoring Program. Groundwater level data would be regularly reviewed during and for a period of one year after construction by a qualified hydrogeologist.	Construction	Environmental Manager	REMM GW4 CoA C14, D121
GWMM6	A detailed geotechnical and hydrological model for Stage 1 would be developed and progressively updated during design and construction. The detailed geotechnical and hydrological model would include elements as described in REMM GW5. This information will be documented as part of the Revised Groundwater Modelling Report.	Prior to the construction of excavations that impact groundwater	Design Manager	REMM GW5

GWMM7	Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based criteria), a structural assessment of the affected buildings/structures would be carried out and specific measures implemented to address the risk of damage from settlement created by groundwater drawdown. A suitably qualified and experienced person must undertake condition surveys of all buildings, structures, utilities and the like identified as being at risk of damage before commencement of any work that could impact on the subject surface / subsurface structure. The results of the surveys must be documented in a Pre-construction Condition Survey Report for each item surveyed. Copies of Pre-construction Condition Survey Reports must be provided to the relevant owners of the items surveyed in the vicinity of the proposed work, and no later than one (1) month before the commencement of the work that could impact on the subject surface / subsurface structure. The results of the surveys must be documented in a Post-construction Condition Survey Report for each item surveyed. Copies of Post-construction Condition Survey Reports must be provided to the landowners of the items surveyed, and no later than three (3) months following the completion of the work that could impact on the subject surface / subsurface structure unless otherwise agreed by the Planning Secretary.	Prior to work that could potentially impact the surface or sub-surface structure	Construction manager Project Engineer Community and Stakeholder Manager	CoA D60 and D61 REMM GW5 REMM GW6

Reference	Measure	When	Responsibility	Source
	Pre and Post conditions survey inspections and reports will be carried out in accordance with the process documented in the CEMP.			
GWMM8	Where a significant exceedance of target changes to groundwater levels are predicted at surrounding land uses and nearby water supply works, an appropriate groundwater monitoring program would be developed and implemented. The program would aim to confirm no adverse impacts on groundwater levels or to appropriately manage any impacts. Monitoring at any specific location would be subject to the status of the water supply work and agreement with the landowner.	Prior to the construction of excavations that impact groundwater.	Design Manager Environmental Manager	REMM GW5 COA C14

6.2 GROUNDWATER MODELLING REPORT

In accordance with CoA D122, Revised Groundwater Modelling Reports has been prepared to document the results of additional assessment undertaken in regard to permeability of substrates and potential inflow rates for the CTP locations to generate updated modelling and a base case. The updated modelling has been used to provide guidance on inflow rates and management practices associated with the CTP groundwater. The Revised Groundwater Modelling Report also provides information on the predicted drawdown at each of the station boxes. The Revised Modelling Report can then be compared to the EIS predictions and trigger values established for drawdown, inflow rates and potential salinity or contamination migration issues.

The updated modelling results may result in the need to update this Plan, and this will occur on an as needs basis. Revision of this Management Plan and Groundwater Monitoring Program will be undertaken in accordance with the continual improvement process outlined in the CEMP.

The revised Groundwater Modelling Report is expected to be developed in a progressive manner. A Revised Groundwater Modelling Report will be developed for each station box and at least one report for the tunnelling. Each Revised Modelling Report will be prepared prior to bulk excavation impacting groundwater at each site.

6.3 CONSTRUCTION WATER TREATMENT PLANTS

Groundwater inflow and water from the TBMs is being collected and treated during construction of the CTP via construction WTPs. The WTPs have been designed so that discharged water quality is compliant with the relevant discharge criteria to ensure water is of a suitable quality for discharge to the receiving environment. A commissioning phase was conducted to identify the capability of each plant to meet the proposed water quality guidelines in the EPL. This was conducted as part of a Proof of Performance (PoP) criteria in the EPL which allowed for variance in meeting the discharge criteria set in the EPL. Upon completion of the PoP, an updated WPIA was submitted to the EPA. Water to be discharged from the water treatment plant should comply with CTP's EPL..

Refer to the Groundwater Construction Monitoring Program (0) for more details regarding the monitoring of discharge volume and discharge water quality and relevant discharge criteria.

Discharge locations in each of the WTPs are registered in the EPL and have been reviewed for water flow capacity prior to installation. Discharge volumes are continuously monitored at the WTP's via calibrated flow meters, in-line calibrated pH and turbidity sensors with appropriate alerts set to inform management of any drift in WTP performance.

During commissioning of each of the WTPs, a minimum of two rounds of commissioning sampling will be undertaken to confirm their efficacy. The main objectives of the commissioning testing will be to determine:

- If the WTPs perform to meet the relevant discharge criteria and what (if any) design or operational modifications may be required to the WTP in order for it to meet the required specifications
- 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 WTP will not be deemed "commissioned" until two subsequent rounds of testing confirm compliance with the criteria.

Procedures relating to the management of the WTPs will also be prepared and implemented in an Environmental Work Method Statement.

WTPs will be located at all sites with the exception of North Strathfield. Water from North Strathfield will be transferred to Burwood North and The Bays for treatment. Sydney Olympic Park WTP has been decommissioned and the discharge point removed from the project's EPL in July 2024. The station box water generated from this site is currently being redirected for treatment via the Western

Tunnelling Package (GLC) WTP, located in Rosehill ill. Once AFJVs TBM tunnels break through at Sydney Olympic Park, AFJVs station box water will be redirected to either The Bays WTP or Burwood North WTP. Additionally, the Five Dock water is no longer in operation and will be decommissioned in Q4 of 2024. Indicative information on the WTPs is provided in Table 6-2.

TABLE 6-2: WTP INDICATIVE INFORMATION

WTP location	Indicative capacity (L/s)	Discharge location	Receiving watercourse
The Bays	35	Local stormwater infrastructure	White Bay
Burwood North	35	Local stormwater infrastructure	St Lukes Canal / Parramatta River

7. COMPLIANCE MANAGEMENT

7.1 PEOPLE, RESPONSIBILITIES AND COMMUNICATION

Refer to CEMP for full details on people, responsibilities and communication.

Refer to Table 6-1 for the roles and responsibilities in relation to the implementation of this Plan.

7.2 TRAINING

Refer to CEMP for full details on the delivery of environmental training including:

- Environmental induction
- Toolbox talks and awareness.

Targeted training in relation to groundwater management will include groundwater monitoring methodology and specific Project requirements in relation to this Plan.

7.3 MONITORING, INSPECTIONS AND AUDITS

Review and confirmation of the implementation of groundwater management measures described in this document will be undertaken as part of the auditing and inspection regimes described in the CEMP. Site environmental inspections will include check on the relevant mitigation measures and the groundwater level monitoring / bore obligations.

Refer to the Groundwater Construction Monitoring Program in 0 for details relating to groundwater monitoring and inspection criteria.

Refer to the CEMP for more information on monitoring, inspections and audits.

7.4 REPORTING AND RECORDS

Refer to the CEMP for full details on reporting and record keeping requirements and processes.

In addition to any records listed in the CEMP, the following compliance records will be kept by AFJV:

- Records of groundwater monitoring bores and wells in the immediate vicinity of CTP sites. If monitoring locations need to change due to a damage bore and bore need to be added as a result of the Revised Groundwater Modelling Report, this monitoring program would be revised and and approved in accordance with Section 8.1
- Records of Groundwater levels and water quality testing – A six-monthly monitoring report will be prepared for the Project as outlined in the Groundwater Monitoring Program (0)
- EPL Annual Reports
- Groundwater monitoring field sheets
- WTP operational performance data
- Laboratory records.

8. REVIEW AND IMPROVEMENT

8.1 CONTINUOUS IMPROVEMENT

The Groundwater Management Plan forms part of the CEMP. Refer to the CEMP for the process on continuous improvement and sub plan update and amendment.

APPENDIX A OTHER CONDITIONS OF APPROVAL, REMMS AND CEMF REQUIREMENTS RELEVANT TO THIS PLAN

Minister's Conditions of Approval (11 March 2021) (SSI 10038)		
Ref	**Requirement**	**Where addressed**
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 - DPIE Water and SOPA (in respect of Sydney Olympic Park)	Appendix B
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.	Groundwater Monitoring Program ER Endorsement
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.	Groundwater Monitoring Program
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.	Groundwater Monitoring Program ER Endorsement
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.	Groundwater Monitoring Program
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	Groundwater Monitoring Program

Minister's Conditions of Approval (11 March 2021) (SSI 10038)		
	or specified by the Planning Secretary or the ER (whichever is applicable), whichever is the greater.	
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. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	Groundwater Monitoring Program The Groundwater Monitoring Program will be incorporated in the Ground Water Management Plan
D60	A suitably qualified and experienced person must undertake condition surveys of all buildings, structures, utilities and the like identified in the documents listed in Condition A1 of this schedule as being at risk of damage before commencement of any work that could impact on the subject surface / subsurface structure. The results of the surveys must be documented in a Pre-construction Condition Survey Report for each item surveyed. Copies of Pre-construction Condition Survey Reports must be provided to the relevant owners of the items surveyed in the vicinity of the proposed work, and no later than one (1) month before the commencement of the work that could impact on the subject surface / subsurface structure.	Section 5.2.3 and Section 6.1 (Table 6-1)
D61	Condition surveys of all items for which condition surveys were undertaken in accordance with Condition D60 of this schedule must be undertaken by a suitably qualified and experienced person after completion of the work identified in Condition D60 of this schedule. The results of the surveys must be documented in a Post-construction Condition Survey Report for each item surveyed. Copies of Post-construction Condition Survey Reports must be provided to the landowners of the items surveyed, and no later than three (3) months following the completion of the work that could impact on the subject surface / subsurface structure unless otherwise agreed by the Planning Secretary.	Section 5.2.3 and Section 6.1 (Table 6-1)
D79	A Water Reuse Strategy must be prepared, which sets out options for the reuse of collected stormwater and groundwater during Stage 1 of the CSSI. The Water Reuse Strategy must include, but not be limited to: (a) evaluation of reuse options; (b) details of the preferred reuse option(s), including volumes of water to be reused, proposed reuse locations and/or activities, proposed	Sustainability Management Plan

Minister's Conditions of Approval (11 March 2021) (SSI 10038)		
	treatment (if required), and any additional licences or approvals that may be required; (c) measures to avoid misuse of recycled water as potable water; (d) consideration of the public health risks from water recycling; and (e) time frame for the implementation of the preferred reuse option(s). The Water Reuse Strategy must be prepared based on best practice and advice sought from relevant agencies, as required. The Strategy must be applied during construction. Justification must be provided to the Planning Secretary if it is concluded that no reuse options prevail. A copy of the Water Reuse Strategy must be made publicly available. Nothing in this condition prevents the Proponent from preparing separate Water Reuse Strategies for the construction phases of Stage 1 of the CSSI.	
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.	Appendix B
D118	Unless an EPL is in force in respect to Stage 1 of the CSSI and that licence specifies alternative criteria, discharges from wastewater treatment plants to surface waters must not exceed: a) the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018* (ANZG (2018)) default guideline values for toxicants at the 95 per cent species protection level; b) for physical and chemical stressors, the guideline values set out in Tables 3.3.2 and 3.3.3 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000* (ANZECC/ARMCANZ); and c) for bioaccumulative and persistent toxicants, the ANZG (2018) guidelines values at a	Section 6.3 0 – Groundwater Monitoring Program - Section 6.3.4

Minister's Conditions of Approval (11 March 2021) (SSI 10038)		
	minimum of 99 per cent species protection level. Where the ANZG (2018) does not provide a default guideline value for a particular pollutant, the approaches set out in the ANZG (2018) for deriving guideline values, using interim guideline values and/or using other lines of evidence such as international scientific literature or water quality guidelines from other countries, must be used.	
D119	If construction stage stormwater discharges are proposed, a **Water Pollution Impact Assessment** will be required to inform licensing consistent with section 45 of the POEO Act. Any such assessment must be prepared in consultation with the EPA and be consistent with the National Water Quality Guidelines, with a level of detail commensurate with the potential water pollution risk.	0 – Groundwater Monitoring Program
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 6.1 (Table 6-1)
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.	Section 6.2
Revised Environmental Mitigation Measures		

Minister's Conditions of Approval (11 March 2021) (SSI 10038)		
GW1	Site inspection would be carried out on private domestic supply bore GW305646 to confirm the current viability of that bore. If found to be viable the bore would be monitored throughout construction	Section 6.1 (Table 6-1)
GW2	A review of additional geotechnical and hydrogeology data would be undertaken to confirm the geological and groundwater conditions and determine, based on these local conditions, whether predicted groundwater drawdown from Stage 1 is likely to occur in the vicinity of these creeks. Where the additional data review shows local conditions and predicted groundwater drawdown are likely to cause surface water/groundwater interaction, then additional site investigations (in accordance with GW3) would be undertaken for those creeks or surface water bodies.	Section 6.1 (Table 6-1)
GW3	Additional site investigations would be carried out at creeks or surface water bodies where the additional data review in GW2 shows there is a likely surface water/groundwater interaction. This would involve baseline monitoring of creek flows (streamflow gauging) prior to construction, and baseflow streamflow analysis to confirm the existing groundwater baseflow contribution to streamflow for each creek. Where a significant reduction in baseflow is predicted due to Stage 1, design responses would be implemented at station and shaft excavations to reduce potential baseflow loss.	Section 6.1 (Table 6-1)
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 and Environment and the Natural Resources Access Regulator for information prior to commencement of construction.	Section 6.1 (Table 6-1) Appendix B
GW5	A detailed geotechnical and hydrogeological model for Stage 1 would be developed and progressively updated during design and construction. The detailed geotechnical and hydrogeological model would include: • Assessment of the potential for damage to structures, services, basements and other sub-surface elements through settlement or strain • Predicted groundwater inflows, groundwater take and changes to groundwater levels including at nearby water supply works. • Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based	Section 6.1 (Table 6-1)

Minister's Conditions of Approval (11 March 2021) (SSI 10038)		
	criteria), a structural assessment of the affected buildings/structures would be carried out and specific measures implemented to address the risk of damage. • Where a significant exceedance of target changes to groundwater levels are predicted at surrounding land uses and nearby water supply works, an appropriate groundwater monitoring program would be developed and implemented. The program would aim to confirm no adverse impacts on groundwater levels or to appropriately manage any impacts. Monitoring at any specific location would be subject to the status of the water supply work and agreement with the landowner.	
GW6	Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the commencement of excavation at each site.	Section 6.1 (Table 6-1)
SSWQ5	The water treatment plants would be designed so that wastewater is treated to a level that is compliant with the ANZECC/ARMCANZ (2000), ANZG (2018) and draft ANZG (2020) default guidelines for 95 per cent species protection and 99 per cent species protection for toxicants that bioaccumulate unless other discharge criteria are agreed with relevant authorities.	Section 6.3 Groundwater Monitoring Program Soil and Water Management Plan
B3	Additional investigations and assessment would be completed to confirm the potential for impacts to groundwater dependant ecosystems due to groundwater drawdown, and to identify any required mitigation through design.	Refer to Flora and Fauna Management Plan and 0

APPENDIX B GROUNDWATER CONSTRUCTION MONITORING PROGRAM

Groundwater Monitoring Program

SMWSTCTP-AFJ-1NL-PE-PLN-000006 Revision 09

Sydney Metro West – Central Tunnelling Package

DOCUMENT APPROVAL

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Date:	25/09/2024	10/12/2024	10/12/2024

REVISION HISTORY

Rev:	Date:	Pages:	By:	Description:
00	19/09/21	All	EW	For submission to Sydney Metro
01	11/10/21	All	EW	Response to comments
02	25/10/21	All	EW	Response to comments
03	20/06/22	All	OGS	For Phase B2 Submission
04	15/8/22	All	GW	Response to stakeholder comments
05	16/08/23	All	CGM	Annual Review
06	01/08/24	All	CGM	Annual Review
07	25/10/24	All	CGM	Uprreved to coincide with the GWMP
08	10/12/24	All	DL	Response to comments
09	13/01/24	Various	DL	Response to comments

CONTENTS

GLOSSARY AND ABBREVIATIONS

Abbreviation	Description / Definition
AFJV	Acciona Ferrovial Joint Venture (the Contractor)
ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)
AS/NZS	Australia/New Zealand Standards
Amendment Report	Sydney Metro West Westmead to The Bays and Sydney CBD Amendment Report Concept and Stage 1 (2020
CEMP	Construction Environmental Management Plan
Construction	Includes all work required to construct Stage 1 of the CSSI as described in the documents listed in Condition A1 of Schedule 3, including commissioning trails of equipment and temporary use of any part of the CSSI, but excluding Low Impact Work. *Note: As defined in Table 1 of SSI 10038 Infrastructure approval for the Project.*
CoA	Minister's Conditions of Approval (as relevant to Sydney Metro West Concept and Stage 1)
CTP	Central Tunnelling Package
DECC	Former Department of Environment and Climate Change (NSW) now NSW Office of Environment and Heritage.
DPIE	NSW Department of Planning, Infrastructure and Environment
DPI (Water)	NSW Department of Primary Industries (Water) (Former Office of Water)
EIS	Sydney Metro West Concept and Stage 1 Environmental Impact Statement (April 2020)
EMS	Environmental Management System
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment
Environmental incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance with the conditions of this approval. Note "material harm" is defined in this document.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve
Environment Policy	Statement by an organisation of its intention and principles for environmental performance
EPA	NSW Environment Protection Authority
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999*

Abbreviation	Description / Definition
EPL	NSW Environment Protection Licence under the *Protection of the Environment Operations Act 1997*.
ESCP	Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statements
Hold point	Is a verification point that prevents work from commencing prior to release.
Material harm	This is harm that: (a) involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial or (b) results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment).
Minister, the	NSW Minister for Planning and Public Spaces
Non-compliance	An occurrence, set of circumstances or development that is a breach of this approval but is not an incident.
OCCS	Overarching Community Communication Strategy
Planning Secretary	The Planning Secretary of the Department of Planning, Industry and Environment
PoEO Act	*NSW Protection of the Environment Operations Act 1997*
Project	Sydney Metro West Concept and Stage 1
Relevant Councils	Any or all local government councils as relevant, Inner West, Strathfield, Burwood
REMM	Revised Environmental Management Measure
Submissions Report	Sydney Metro West Westmead to The Bays and Sydney CBD Submissions Report Concept and Stage 1 (2020)

1. INTRODUCTION

1.1 BACKGROUND

Sydney Metro is Australia's biggest public transport program. Services on the North West Metro Line between Rouse Hill and Chatswood started in May 2019. The Sydney Metro network also includes Sydney Metro City & Southwest, Sydney Metro West and Sydney Metro Western Sydney Airport.

Sydney Metro West is a new 24-kilometre metro line between Westmead and the Sydney CBD. This infrastructure investment will double the rail capacity of the Greater Parramatta to Sydney CBD corridor with a travel time target between the two centres of about 20 minutes.

The planning approvals and environmental impact assessment for Sydney Metro West has been split into a number of stages recognising the size of the project. This includes:

- Stage 1 – Concept and all major civil construction works including station excavation and tunnelling between Westmead and The Bays. Planning approval for this stage was granted in March 2021
- Stage 2 – All major civil construction works including station excavation and tunnelling from The Bays to Sydney CBD
- Stage 3 – Tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line.

An Environmental Impact Statement (EIS) (Jacobs/Arcadis, 2020) for the Concept and Stage 1 (herein referred to as the Project) assessed the groundwater impacts in response to the Secretary Environmental Assessment Requirements issued by the Department of Planning, Industry and Environment (DPIE). The Project was approved on 11 March 2021 (SSI 10038).

Sydney Metro is delivering the Project via several different packages, including the Central Tunnelling Package (CTP). This Groundwater Construction Monitoring Program (GCMP) has been prepared to address the Condition of Approval (CoA) C14(d), C15 and C17. In addition, the Program has been developed in accordance with the Project EIS, the Revised Environmental Mitigation Measures (REMMs) and all applicable for the design and construction of the CTP.

1.2 SCOPE

The Ground Water Monitoring Program will be appended to the Groundwater Management Plan (GWMP) which forms part of the Project Construction Environmental Management Plan (CEMP). This Program outlines how Acciona Ferrovial Joint Venture (AFJV) will comply with and implement the applicable environmental requirements for the CTP to monitor the construction groundwater impacts during construction of the CTP construction phase B1 and tunnelling construction phase B2 (in accordance with the Sydney Metro Phasing Report).

This monitoring program outlines how AFJV propose to undertake groundwater quality monitoring during construction of the CTP and how AFJV will comply with and implement the applicable elements from the following documents, collectively referred to herein as the 'Project requirements':

- NSW Minister for Planning and Public Spaces Conditions of Approval (CoA)
- Revised Environmental Mitigation Measures (REMMs) and the
- Sydney Metro Construction Environmental Management Framework (CEMF).

This Program will be appended to the Groundwater Management Plan (GWMP) which forms part of the Project Construction Environmental Management Plan (CEMP).

1.3 OBJECTIVES

This Program will be utilised to define, address, and implement groundwater monitoring requirements and will apply for the duration of TBM tunnelling and cross passage works.

This Program outlines how AFJV will comply with and implement the applicable elements of the following documents, collectively referred to herein as the 'Project requirements' for the CTP:

- The CoA (issued on 11 March 2021 and as modified on 29 July 2021)
- The Project EIS, Submissions Report and Amendment Report
- Sydney Metro Construction Environmental Management Framework (CEMF).

2. LEGAL AND OTHER REQUIREMENTS

2.1 RELEVANT LEGISLATIONS AND GUIDELINES

The legislation relevant to the Groundwater Monitoring Program and this program is listed in Section 3 of the GWMP.

Guidelines and standards specifically relating to this monitoring program include:

- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines')
- 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 (2004).

2.2 CONDITIONS OF APPROVAL

The Minister's Conditions of Approval (CoA) and Revised Environmental Management Measures (REMM) requirements relevant to the development of this GCMP are listed in Table 2-1.
Note that only the CEMF requirements that pertain to the development or implementation of a GCMP are included in Table 2-1, otherwise they have been referenced in the GWMP.

TABLE 2-1 PROJECT REQUIREMENTS

Project Planning Approval		
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 quality Consultation with: DPIE Water, Sydney Olympic Park Authority (SOPA) (in respect of Sydney Olympic Park)	This plan Evidence of consultation in D
C15	Each Construction Monitoring Program must provide: (a) details of baseline data available including the period of baseline monitoring;	Section 6.1
	(b) details of baseline data to be obtained and when;	Section 6.1
	(c) details of all monitoring of the project to be undertaken	Refer to responses for C17
	(d) the parameters of the project to be monitored;	Section 6 Section 7
	(e) the frequency of monitoring to be undertaken;	Section 6.3
	(f) the location of monitoring;	Section 6.2
	(g) the reporting of monitoring results and analysis results against relevant criteria;	Section 9.2 Section 12

Project Planning Approval		
	(h) details of the methods that will be used to analyse the monitoring data;	Section 9.2 Section 12
	(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;	Section 6.3
	(j) a consideration of SMART principles; and	Section 8
	(k) any consultation to be undertaken in relation to the monitoring programs; and	Section 3.1 Appendix IV
	(l) any specific requirements as required by Conditions C16 to C17 of this schedule.	See C17
C17	Groundwater Construction Monitoring Program must include: (a) groundwater monitoring networks at each construction excavation site;	Section 6.2
	(b) detail of the location of all monitoring bores with nested sites to monitor both shallow and deep groundwater levels and quality;	Section 6.2
	(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 6.2
	(d) results from existing monitoring bores;	Section 6.1 0
	(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 6.3.3
	(f) trigger levels for groundwater quality, salinity and groundwater drawdown in monitoring bores and / or other groundwater users;	Section 6.3.2 Section 6.3.5
	(g) daily measurement of the amount of water discharged from the water treatment plants;	Section 7.5.8
	(h) water quality testing of the water discharged from treatment plants;	Section 7.5
	(i) management and mitigation measures and criteria;	Section 7 of the GWMP

Project Planning Approval		
	(j) groundwater inflow to the excavations to enable a full accounting of the groundwater take from the Sydney Basin Central Groundwater Source; and	Section 6.3.3 Section 7.6
	(k) reporting of groundwater gauging at excavations, groundwater monitoring, groundwater trigger events and action responses; and	Section 12
	(l) methods for providing the data collected to Sydney Water where discharges are directed to their assets.	Section 12
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.	Refer to ER endorsement
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.	N/A
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.	Refer to ER Endorsement and submission timing.
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.	Refer to Planning Secretary Approval
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.	Note
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	Section 12

Project Planning Approval		
	of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	
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 6.3
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.	Groundwater Management Plan Section 6.3.4
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.	Groundwater Management Plan

Project Planning Approval		
CEMF Requirements		
7.2b	Principal Contractors will develop and implement a Groundwater Management Plan for their scope of works. The Groundwater Management Plan will include as a minimum:	
	vi. Procedures for the treatment, testing and discharge of groundwater from the site	Section 7
	vii. Compliance record generation and management	Section 9
	viii. Details of groundwater monitoring if required	Section 6
Revised Environmental Mitigation Measures		
SSWQ5	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 per cent species protection and 99 per cent species protection and 99 per cent species protection for toxicants that bioaccumulate unless other discharge criteria are agreed with relevant authorities.	Section 6.3
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 6 Section 7 Section 9.2 Section 12

2.3 ENVIRONMENTAL PROTECTION LICENCE

An Environmental Protection Licence (EPL) is in place for the CTP. Licence number 21610 sets discharge limits for the WTPs, frequency of sampling and other requirements relevant to Groundwater Management.

3. DOCUMENT CONSULTATION AND APPROVAL

3.1 DOCUMENT CONSULTATION

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

In accordance with CoA C14(d), this Program will be provided to the following government agencies for review and comment.

- DPIE Water
- SOPA (in respect of Sydney Olympic Park).

Details of issues raised by a government agency during consultation is included as D, including copies of all correspondence from those agencies, as required under CoA A6.

Ongoing consultation with stakeholders may be undertaken as required during project delivery.

3.2 DOCUMENT APPROVAL

In accordance with CoA C18 this Monitoring Program will be submitted to the Planning Secretary for approval, following ER endorsement.

4. EXISTING ENVIRONMENT

4.1 OVERVIEW

A review of the existing environment is included in the GWMP. The following section summarises that detail, sourced from Section 18 and Section 20 of the EIS and Technical Paper 7 and 8.

The GWMP noted the general topographic and geological characteristics of the Project areas. The topography of the area is generally flat, and characteristic of the region of Cumberland plain west of the Sydney CBD.

The geology within the Stage 1 construction footprint is crossed by several volcanic structural features such as dykes and faults that may impact groundwater flow. Dykes are bodies of rock that cut across other geological units. Faults are a fracture within rock where displacement may have occurred. Dykes and faults may provide a conduit or hydraulic barrier for groundwater inflows.

The geological and groundwater conditions of the project are summarised in Table 4.1 below.

4.2 AQUIFERS

Aquifers in the CTP include porous and fractured rock aquifers. Porous aquifers in alluvial soils are continuous (unconfined) over an area. Porous aquifers in residual soils are often ephemeral, localised and discontinuous.

Fractured rock aquifers occur where groundwater is transmitted through fractures or joints and bedding planes, such as in the shales and Hawkesbury Sandstone.

TABLE 4-1 GENERAL CHARACTERISICS OF THE GROUNDWATER ASPECTS OF THE CTP

Location	Geological Unit	Dykes or faults present?	Salinity	Typical Groundwater Levels (m AHD)	Typical GW level (metres below ground surface)	Groundwater dependent ecosystems present? (High priority ecosystems are in italics)	Groundwater contamination
Sydney Olympic Park	Mittagong formation Quaternary deposits Hawkesbury Sandstone Ashfield Shale	Geological fault present	Very high	12	12	Four identified in the EIS- • Common Reed on the margins of estuaries and brackish lagoons • Swamp Oak swamp forest fringing estuaries • Mangrove Forests • *Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*	Areas of confirmed groundwater contamination resulting from historic landfills located around 200m away from the project have been identified to the south, west and south east of Sydney Olympic Park Station. Monitoring indicated the presence of Benzene above the NHMRC (2008) guidelines for direct human contact as well as the presence of PFOS and PFOA.
North Strathfield	Mittagong formation Quaternary deposits Ashfield Shale Hawkesbury Sandstone	Dyke may be present Geological fault may be present	Very high	15	5	Three identified in the EIS- • Turpentine -– Grey Ironbark open forest on shale • *Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion* • Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Areas of potential groundwater contamination have been identified in close proximity to the east of the station and at distance around 400 m north west of the station. These are based on current or historical land uses at the site with a track-record of potentially causing groundwater contamination e.g. historical work practices, chemical storage, especially underground etc

Location	Geological Unit	Dykes or faults present?	Salinity	Typical Groundwater Levels (m AHD)	Typical GW level (metres below ground surface)	Groundwater dependent ecosystems present? (High priority ecosystems are in italics)	Groundwater contamination
Burwood North	Mittagong formation Quaternary deposits Ashfield Shale Hawkesbury Sandstone	Geological fault may be present	High to very high in elevated areas Very low in low elevated areas	4	12	One identified in the EIS- • Turpentine -– Grey Ironbark open forest on shale	A review of potential contamination sources (EIS) highlight a moderate risk of potential groundwater contamination immediately at the site of the station excavation. This groundwater would flow into the station during excavation (<2 years) and would yield a moderate risk.
Five Dock	Mittagong formation Quaternary deposits Hawkesbury Sandstone Ashfield Shale	Dyke may be present	High to very high in elevated areas Very low in low elevated areas	16-18	2	One identified in the EIS- • Turpentine -– Grey Ironbark open forest on shale	Areas of potential groundwater contamination have been identified at distance 100 m north and around 200 m south the station. These are based on current or historical land uses at the site with a track-record of potentially causing groundwater contamination e.g. based on historical work practices, chemical storage, especially underground etc.
The Bays	Fill Hawkesbury Sandstone	Dyke may be present Geological fault may be present	High to very high in elevated areas	2	2	None	Areas of potential groundwater contamination have been identified at The Bays Station. Groundwater monitoring has indicated the occurrence of Arsenic above the NHMRC (2008) trigger

Location	Geological Unit	Dykes or faults present?	Salinity	Typical Groundwater Levels (m AHD)	Typical GW level (metres below ground surface)	Groundwater dependent ecosystems present? (High priority ecosystems are in italics)	Groundwater contamination
			Very low in low elevated areas				level for direct contact at a bore located within the footprint of the excavation. Inflow of this water will occur during excavation (<2 years), yielding a high risk of contaminant movement.

5. ENVIRONMENTAL ASPECTS AND IMPACTS

5.1 CONSTRUCTION ACTIVITIES

Key aspects of the CTP which potentially impacts upon Groundwater include:

- Excavation works below the groundwater table;
- Extraction of groundwater, due to dewatering activities;
- Excavation where known soil or water contamination is present; and
- Construction of significant hardstand areas which have the potential of reducing or preventing groundwater recharge.

The potential impacts to groundwater are discussed below.

Additional information surrounding groundwater is being reviewed for the tunnelling portion of the Project.

5.1.1 REDUCED GROUDWATER RECHARGE

Changing the natural land surface from being pervious (that is, water can infiltrate through), to an impervious area has the potential to reduce infiltration of rainfall or surface water to the aquifer below, which would recharge the groundwater system.

The above ground footprint represents a small increase in built infrastructure in the urban area the CTP traverses. The CTP would increase the proportion of impervious areas through the site establishment and excavation which could reduce recharge rates, however, the net increase in impervious areas owing to the project is small relative to the local catchment areas, and the net impact on regional recharge due to CTP is not likely to be significant.

5.1.2 GROUNDWATER LEVEL DECLINE

The CTP excavation program indicates that each CTP station or shaft excavation would be carried out over a period of less than two years.

The EIS Technical paper 7- Hydrogeology, noted that groundwater inflows to the CTP excavations would decrease with time until a steady state is reached. The groundwater level drawdown induced by the excavations would increase over time, also until a steady state is reached.

For all sites excavation is assessed to act as a groundwater sink, causing groundwater to flow towards the excavation.

The predicted groundwater inflow rates for each site are presented in Table 4-2.

TABLE 5-1 GROUNDWATER INFLOW RATES (DATA SOURCED FROM EIS TECHNICAL PAPER 7 AND REVISED GROUNDWATER MODELLING REPORTS)

CTP site	EIS Estimated inflow (L/s)	EIS Estimated inflow at two years (ML)	AFJV Cumulative inflow at two years (ML)
Sydney Olympic Park	0.4 in both years	25	16
North Strathfield	0.4 in both years	34	10
Burwood North	3.1 in first year 2.8 in second year	208	44
Five Dock	1.7 in both years	117	20
The Bays	10.1 in both years	639	324

5.1.3 GROUNDWATER USERS

Details about groundwater users sourced from the EIS technical paper 7 are presented per CTP site below:

SYDNEY OLYMPIC PARK

Three WaterNSW-registered bores were identified within the predicted extent of groundwater level drawdown. WaterNSW reports the purpose of these bores as monitoring. Water supply at WaterNSW-registered bores are therefore not likely to be impacted by the station excavation.

NORTH STRATHFIELD

Seven WaterNSW-registered bore were identified within the predicted extent of groundwater level drawdown. WaterNSW reports the purpose of these bores are monitoring. WaterNSW-registered water supply bores are therefore not likely to be impacted by station excavation.

BURWOOD NORTH

Fifteen WaterNSW-registered bore were identified within the predicted extent of groundwater level drawdown. WaterNSW reports the purpose of these bores as monitoring, with the exception of bore GW305646, which is reported as a domestic water supply bore, and bore GW102215, which is reported as a dewatering bore. As GW102215 is not a groundwater supply bore, it is not likely to be adversely impacted by Stage 1.

Water supply bore GW305646 is recorded as six metres deep. The estimated groundwater drawdown at its location is two metres at two years after excavation. This bore is not listed as active in the NSW Water Register.

FIVE DOCK

One WaterNSW-registered bore was identified within the predicted extent of groundwater level drawdown. WaterNSW identifies this bore as a monitoring bore. WaterNSW-registered water supply bores are therefore not likely to be impacted by station excavation.

THE BAYS

WaterNSW-registered bores were not identified within the predicted extent of groundwater level drawdown.

5.1.4 SURFACE WATER IMPACTS

Details about surface water impacts are sourced from the EIS technical paper 7 are presented per CTP site below:

SYDNEY OLYMPIC PARK

Groundwater level drawdown due to station excavation is predicted at distance from Haslams Creek, the Mason Park wetlands, Bicentennial Park wetlands, and the Brickpit at Sydney Olympic Park. It is not known whether groundwater contributes baseflow to these surface water features.

If there is existing groundwater baseflow contribution to the surface waters, then Stage 1 has the potential to reduce that baseflow contribution to these surface waters. Groundwater level drawdown from the CTP at distance from these surface water features could result in reduced groundwater flow towards these surface waters, which could potentially cause reduced baseflow contribution to streamflow.

NORTH STRATHFIELD

Groundwater level drawdown due to station excavation is predicted at distance from Powells Creek and the wetlands at Mason Park, Powells Creek Reserve and Bicentennial Park.

Groundwater level drawdown at distance from the creek and wetlands could result in reduced groundwater flow towards the creeks/wetlands, and ultimately reduced baseflow to the creeks/wetlands. It is not known whether groundwater currently contributes baseflow to these surface water features. If there is existing groundwater baseflow contribution to these surface water features, then the CTP has the potential to reduce that baseflow contribution and reduce stream flows.

BURWOOD NORTH

Groundwater level drawdown due to station excavation is expected in the vicinity of St Lukes Park Canal and Barnwell Park Canal. Groundwater is not likely to contribute to these waters as they are concrete-lined channels. The potential naturalisation of these channels by Sydney Water would modify the banks of the channels, but would retain the concrete-lining at the base and centre-line of the channels. Connection between surrounding groundwater and the concrete-lined channel is not likely, and groundwater level drawdown due to station excavation is not likely to affect groundwater interaction with these surface waterways. Therefore, surface water-groundwater interaction is not likely to be affected by CTP excavation.

FIVE DOCK

Groundwater level drawdown due to station excavation is expected in the vicinity of Barnwell Park Canal and Iron Cove Creek. Groundwater is not likely to contribute to these waterways as they are concrete-lined channels. The naturalisation of these channels by Sydney Water would modify the banks of the channels, but would retain the concrete-lining at the base and centre-line of the channels. Connection between surrounding groundwater and the concrete-lined channel is not likely, and groundwater level drawdown due to station excavation is not likely to affect groundwater interaction with these surface waterways.

Water from Kings Bay may also be indirectly drawn into the groundwater to the south of the bay.

THE BAYS

A proportion of inflow to the station excavation is likely to be indirectly sourced from White Bay, as bay waters would be drawn into the groundwater system.

6. GROUNDWATER MONITORING

6.1 GROUNDWATER QUALITY BASELINE DATA

In addition to the EIS and accompanying technical paper the following groundwater documents have been prepared for the Project:

- Golder/Douglas Partners, October 2018, Groundwater Level Monitoring Report, 1791865-003-R-GWMR3-RevA
- Golder/Douglas Partners, October 2020. Groundwater Monitoring Report - Stage 2 Locations, 1791865-023-RGWMR Rev A
- Jacobs, dated 18 December 2020,Tender Advice Notice (TAN) Hydrogeology- Site Wide Central Tunnelling Package, Groundwater Quality Assessment, CENT-JTJV-PW-HG-TAN-0040.3,Rev A
- ERM, January 2021, Metro West-Contamination-Groundwater, 0577577, Rev 1
- Senversa, May 2021, Factual Contamination Investigation Report- The Bays, 000013/11868 White Bay Site Investigations.

Groundwater quality is influenced by the underlying geological units. A summary of the background data and the expected groundwater quality associated with the key geological units for the CTP is presented in Table 6-1.

TABLE 6-1 GROUNDWATER QUALITY OVERVIEW

Geological Unit	Expected Salinity	Expected pH	Other characteristics
Quaternary deposits (residual and alluvial soils)	Fresh to saline	Neutral to slightly acidic	N/A
Ashfield Shale	Brackish to saline 2,000 milligrams per litre to 20,000 milligrams per litre	Neutral to slightly acidic (4-8)	N/A
Hawkesbury Sandstone	Fresh to brackish 300 milligrams per litre to 1,400 milligrams per litre	Neutral to slightly acidic (4.5 to 8)	Elevated iron Elevated manganese
Mittagong Formation	Fresh to brackish 250 milligrams per litre to 350 milligrams per litre	Neutral to slightly acidic (4.5 to 8)	Elevated iron Elevated manganese

The results of the testing undertaken for the EIS noted that while pH, and electrical conductivity levels were consistent with expected levels; groundwater along the alignment exceeds the ANZG (2018) trigger levels for 95 percent protection of freshwater aquatic ecosystems at numerous locations for ammonia and heavy metals.

As noted in the EIS Technical Report 7, background data showed that existing concentrations of ammonia, cobalt and manganese were above the trigger in 50 percent or more of the samples tested. Existing concentrations also exceeded the trigger levels for arsenic, copper, lead, nickel and zinc at some locations.

The freshwater aquatic ecosystems trigger levels are lower than those for marine waters, and therefore represent a more conservative metric for impact assessment.

Baseline groundwater monitoring data has been extracted from the reports listed above, summarised by ERM and included in Appendix II. Additional baseline data captured by Senversa at The Bays has also been included in Appendix II.

Additional baseline data will also be gathered prior to the commencement of excavation that will interact with groundwater. A minimum of at least two baseline monitoring events (two monthly-

monitoring everts) will be carried out to allow for direct comparison to baseline data captured immediately prior to construction commencing. Where possible, more than two monitoring events will take place.

6.2 GROUNDWATER MONITORING LOCATIONS

6.2.1 MONITORING NETWORK

There are 39 monitoring bores currently located along the alignment that are proposed to be monitoring during construction. A number of additional bores were monitored for the EIS, however, as these bores will be destroyed as part of the construction, these bores are not proposed to be monitored. All bores have been listed in Table 6-2 and Table 6-3 and shown below in Figure 1 and Figure 2 as they all contribute to the baseline information gathered for the Project. Table 6-3 outlines the depth classification of each AFJV monitoring bore and what type of monitoring each bore will be subject to. Monitoring may include depth monitoring, electrical conductivity (salinity), water quality or a combination of these. Types of monitoring proposed at each bore are outlined in Table 6-3. The locations of the AFJV monitoring bores listed in Table 6-3 are shown in Appendix II.

These bores are part of the monitoring network, the final locations of monitoring are being finalised in consideration of the Revised Groundwater Modelling Reports and Detailed Site Investigations that relate to potentially contaminated groundwater.

6.2.2 SENTINEL GROUNDWATER MONITORING

In line with CoA C17(c) saltwater interception monitoring will be undertaken to identify appropriate locations of bores to be installed between the saline sources of the estuary or river and that of the stations or shafts.

The primary reason for sentinel monitoring bores is to identify where saltwater migration from saline sources such as the river, estuaries or White Bay may migrate into the station boxes or tunnels and affect the design. Sentinel groundwater monitoring bore locations will be identified as part of the detailed Groundwater Model and in consultation with the design team as required by CoA D122.

TABLE 6-2 SUMMARY OF MONITORING BORE LOCATIONS ALONG THE ALIGNMENT AND BASELINE CONDITIONS

Location	Bore ID	Depth classification	Groundwater contaminants of concern	Recorded exceedances in the area
Tunnel – NW of SOP	SMW_BH070	Deep Rock	There is a high risk of- Nutrients, heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC and PFAS	Exceedances of the adopted objectives for: • EC, TDS, sodium, sulfate and chloride • Ammonia, nitrate, total nitrogen and phosphorous • Cobalt, iron, manganese, and zinc
	SMW_BH121	Deep Rock		
Sydney Olympic Park	SMW_BH120	Deep Rock	There is a high risk of- Nutrients, heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC and PFAS	Exceedances of the adopted objectives for: • EC, TDS, sodium, sulfate and chloride • Ammonia, nitrate, total nitrogen and phosphorous • Cobalt, copper, iron, manganese, nickel and zinc
	SMW_BH019	Deep Rock		
	SMW_BH015	Deep Rock		
	SMW_BH015_s	Shallow Rock		
	SMW_BH032	Deep Rock		
	SMW_BH032_s	Shallow Rock		
	SMW_BH068	Deep Rock		
	SMW_BH068_s	Shallow Rock		
	SMW_BH126	Deep Rock		
Tunnel – SOP to NS	SMW_BH069	Deep Rock		
	SMW_BH033	Deep Rock		
	SMW_BH034	Deep Rock		
North Strathfield	SMW_BH038	Deep Rock	There is a moderate risk of-	Exceedances of the adopted objectives for:
	SMW_BH009	Deep Rock		

	SMW_BH009_s	Shallow Rock	Chlorinated Hydrocarbons, solvents (formaldehyde), heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC and PFAS	• EC, TDS, sodium, sulfate and chloride • Ammonia, total nitrogen and phosphorous • Arsenic, cobalt, iron, manganese, and zinc
	SMW_BH073	Shallow Rock		
	SMW_BH035	Deep Rock		
	SMW_BH035_s	Shallow Rock		
Tunnel – NS to BWD	SMW_BH040	Deep Rock		
Burwood	SMW_BH044	Deep Rock	There is a moderate risk of- Surfactants, solvents (VOC), heavy metals, hydrocarbons (TRH, BTEX, PAH), and VOC	Exceedances of the adopted objectives for: • EC, TDS, sodium, sulfate and chloride • Ammonia, total nitrogen and phosphorous • Cobalt, iron, and manganese
	SMW_BH046	Deep Rock		
	SMW_BH046_s	Shallow Sediments		
Five Dock	SMW_BH050	Deep Rock	There is a moderate risk of- Solvents (formaldehyde), heavy metals, hydrocarbons (TRH, BTEX, PAH) and VOC	Exceedances of the adopted objectives for: • EC, TDS, sodium, sulfate and chloride • Ammonia, total nitrogen and phosphorous • Cobalt, iron, and manganese
	SMW_BH050_s	Shallow Sediments		
	SMW_BH082	Deep Rock		
	SMW_BH051	Deep Rock		
	SMW_BH051_s	Shallow Sediments		
The Bays	SMW_ENV020	Deep Sediments	There is a moderate to high risk of- Heavy metals, hydrocarbons (TRH, BTEX, PAH) and VOC	Exceedances of the adopted objectives for: • EC, TDS, sodium, sulfate and chloride • Ammonia, total nitrogen and phosphorous • iron, manganese, and zinc
	SMW_ENV020_s	Shallow Sediments		
	SMW_ENV021	Deep Sediments		
	SMW_ENV021_s	Shallow Sediments		

	SMW_ENV026	Shallow Sediments		Exceedances were also noted for arsenic in sediments and cobalt in rock aquifer. Jacobs (2020) identified exceedances of criteria for lead and cadmium at selected bores at the western end of the station, and the presence of Light non aqueous liquid to the west of the station and within the drawdown extent. An exceedance was noted for isopropyl benzene at one shallow sediment groundwater monitoring location.
	SMW_ENV027	Shallow Sediments		
	SMW_BH066	Deep Rock		
	SMW_BH066_s	Shallow Sediments		
	SMW_ENV034	Deep Sediments		
	SMW_BH067	Deep Rock		
	SMW_BH067_s	Shallow Rock		
	S02_s	Shallow sediment		
	S02_d	Deep Rock		
	S06	Deep Rock		
	S40_s	Shallow sediments		
	S40_d	Deep rock		
	S51	Shallow sediments		
	S54	Deep rock		
	S55	Shallow sediments		
	S58_s	Shallow sediment		
	S58_d	Deep rock		

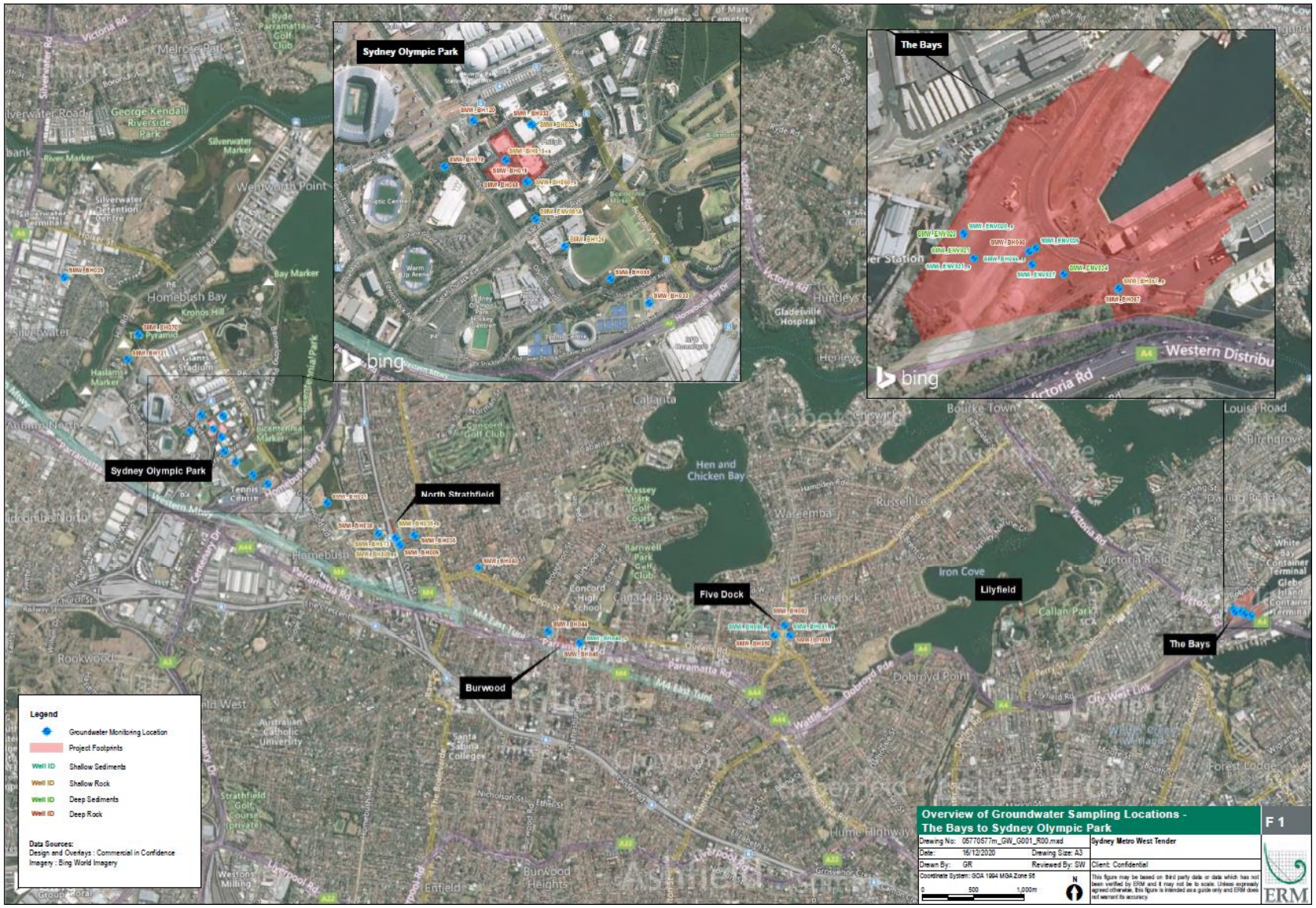


FIGURE 1 INDICATIVE LOCATION OF BASELINE MONITORING BORES

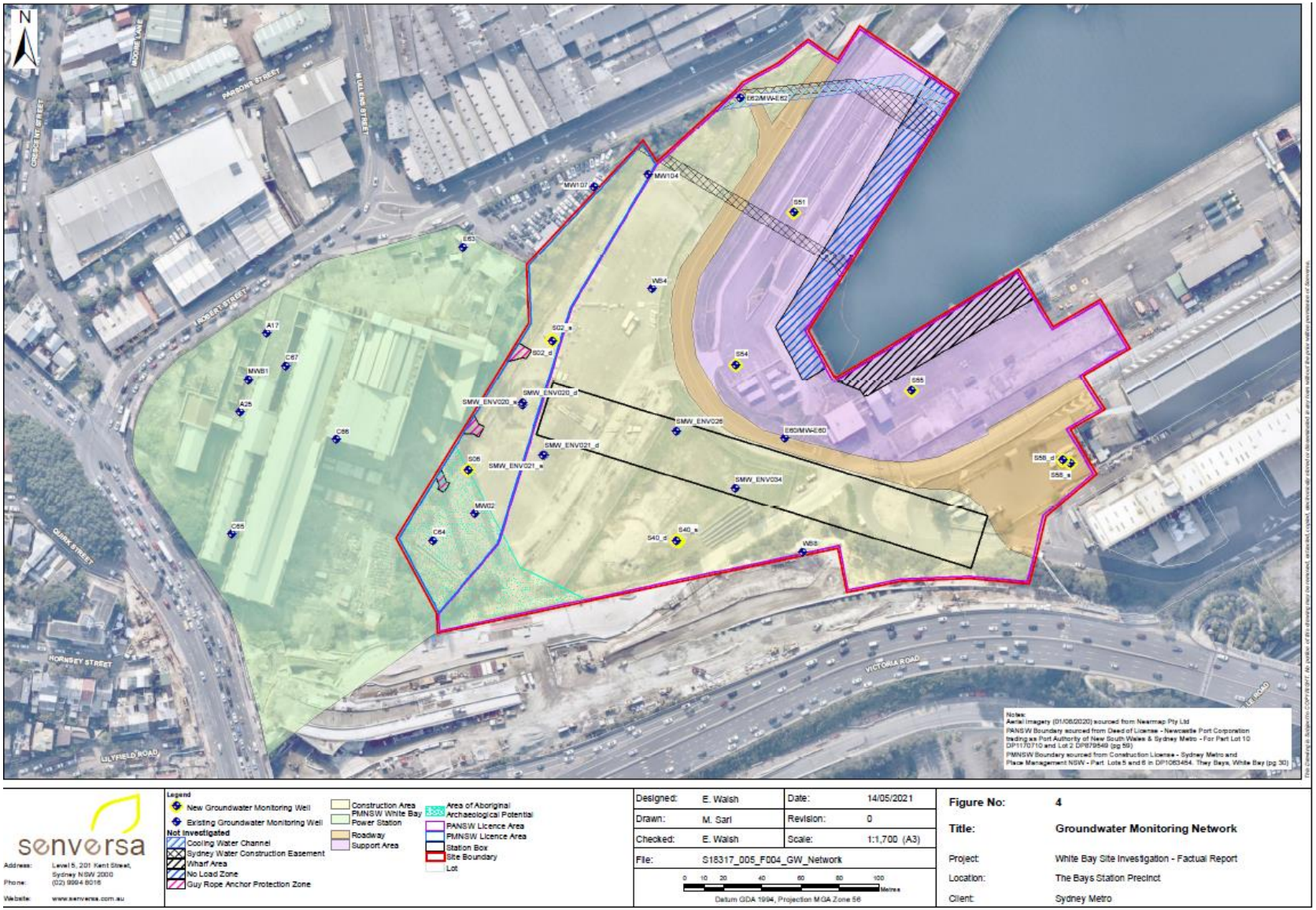


FIGURE 2 LOCATION OF ADDITIONAL BASELINE BORES AT THE BAYS

TABLE 6-3. AFJV GROUNDWATER BORE LOCATION AND MONITORING DETAILS

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
Tunnel – NW of SOP	SMW_BH070	Deep Rock	4.85	27–7 - 30.7	Siltstone/ sandstone	Nil	Not found. Possibly decommissioned.
	SMW_BH121	Deep Rock	4.15	–3 - 16	Siltstone	WQ/EC/L	
Sydney Olympic Park	SMW_BH120	Deep Rock	17.38	22–5 - 25.5	Siltstone/ sandstone	WQ/EC/L	
	SMW_BH019	Deep Rock	17.33	22–5 - 25.5	Siltstone	Nil	Not found. Possibly decommissioned.
	SMW_BH015	Deep Rock	22.94	25–2 - 28.2	Siltstone	Nil	Has been decommissioned during construction.
	SMW_BH015_s	Shallow Rock	22.02	1–5 - 4.5	Siltstone/ sandstone	Nil	Has been decommissioned during construction.
	SMW_BH032	Deep Rock	19.74	–8 - 22	Siltstone	EC/L	WQ will be sampled in pre-construction baseline sampling.
	SMW_BH032_s	Shallow Rock	19.76	3.5 – 7.25	Siltstone	EC/L	Likely to be dry and unable to be sampled.

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
	SMW_BH068	Deep Rock	23.64	22.2 – 25.1	Siltstone/ sandstone	Nil	Located inside site, and decommissioned due to construction purposes.
	SMW_BH068_s	Shallow Rock	23.36	2.6 – 4.3	Siltstone/ sandstone	Nill	Located inside site, and decommissioned due to construction purposes.
	SMW_BH126	Deep Rock	11.4	9.2 -12.2	Fill/ Siltstone	WQ/EC/L	
Tunnel – SOP to NS	SMW_BH069	Deep Rock	7.96	19.4 – 22.4	Unknown	Nil	No monitoring proposed.
	SMW_BH033	Deep Rock	6.82	8.5 – 11.5	Siltstone	Nil	No monitoring proposed.
	SMW_BH034	Deep Rock	2.44	26.2 – 29.2	Sandstone	Nil	No monitoring proposed.
	SMW_BH036	Deep Rock	27	28.59 (Approximate level, no interval determined)	Siltstone/ sandstone	WQ/EC/L	
North Strathfield	SMW_BH038	Deep Rock	9.91	26.0 – 32.0	Siltstone/ sandstone	WQ/EC/L	

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
	SMW_BH009	Deep Rock	18.45	37.45 – 40.45	Sandstone	L	
	SMW_BH009_s	Shallow Rock	18.6	1.0 – 5.0	Gravelly clay/ siltstone	L	
	SMW_BH073	Shallow Rock	18.93	10.2 – 13.2	Siltstone	Nil	Decommissioned during construction – No monitoring proposed.
	SMW_BH035	Deep Rock	26.74	33.5 – 45.5	Siltstone/ sandstone	WQ/EC/L	
	SMW_BH035_s	Shallow Rock	26.62	1.7 – 3.2	Siltstone	WQ/EC/L	
Tunnel – NS to B	SMW_BH040	Deep Rock	23.06	45.0 – 54.0	Sandstone	EC/L	
Burwood	SMW_BH044	Deep Rock	22.6	22.5 – 34.5	Siltstone/ sandstone	WQ/EC/L	
	SMW_BH046	Deep Rock	6.47	6.0 – 15.0	Siltstone/ sandstone	Nil	Has been decommissioned due to Concord Oval works.
	SMW_BH046_s	Shallow Sediments	6.47	1.3 – 3.1	Clay	L	Depth measured by live datalogger.
	SMW_BH046_R		7.26			WQ/EC/L	Replaced BH046_S for

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
							monitoring purposes.
Five Dock	SMW_BH050	Deep Rock	24.34	9.0 – 24.5	Siltstone/ sandstone	WQ/EC/L	
	SMW_BH050_s	Shallow Sediments	24.35	0.4 – 1.3	Gravelly clay	WQ/EC/L	Likely to be dry and unable to be sampled.
	SMW_BH082	Deep Rock	18.04	9.3 – 12.4	Siltstone/ sandstone	Nil	Has been decommissioned during construction.
	SMW_BH051	Deep Rock	21.68	7.0 – 10.0	Siltstone/ sandstone	WQ/EC/L	Likely to be dry and unable to be sampled.
	SMW_BH051_s	Shallow Sediments	21.66	0.8 – 2.0	Silty clay	WQ/EC/L	Likely to be dry and unable to be sampled.
The Bays	SMW_ENV020	Deep Sediments	2.94	9.0 – 15.0	Sand/ Sandy clay/ Sand/ Silt	Nil	Has been destroyed during construction.
	SMW_ENV020_s	Shallow Sediments	2.94	2.5 – 5.5	Sand/ Silt/ Silty sand	Nil	Has been destroyed during construction.
	SMW_ENV021	Deep Sediments	3.09	9.4 – 14.4	Core loss/ Sand	Nil	Has been damaged due to pre-excavation

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
							grouting. Not sampled.
	SMW_ENV021_s	Shallow Sediments	3.09	2.2 – 4.6	Silty sand/ Sand	Nil	Has been damaged due to pre-excavation grouting. Not sampled.
	SMW_ENV026	Shallow Sediments	4.23	3.5 – 6.5	Sand/ Silty sand	Nil	Has been destroyed during construction.
	SMW_ENV027	Shallow Sediments	3.58	2.0 – 5.0	Fill/ Sand/ Clay	Nil	Has been destroyed during construction.
	SMW_BH066	Deep Rock	4.14	27.2 – 30.2	Sandstone	Nil	Has been destroyed during construction.
	SMW_BH066_s	Shallow Sediments	4.14	2.0 – 6.0	Fill/ Sand/ Silty sand	Nil	Has been destroyed during construction.
	SMW_ENV034	Deep Sediments	3.17	7.9 – 9.3	Sand/Sandy clay/ Clayey sand	Nil	Has been decommissioned during construction.
	SMW_BH067	Deep Rock	2.93	12.5 – 15.5	Sandstone	Nil	Has been decommissioned during construction.

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
	SMW_BH067_s	Shallow Rock	2.92	2.5 – 6.0	Sandstone	Nil	Has been destroyed during construction.
	S02_s	Shallow sediment	3.11	0.7 – 6		WQ/EC/L	
	S02_d	Deep Rock	3.11	11 – 15.1	Fill/ Sand/ Silty sand	WQ/EC/L	
	S06	Deep Rock	3.13	13.5 – 20.44	Sandstone	WQ/EC/L	
	S40_s	Shallow sediments	3.60	0.5 – 8	Fill/ Sand/ Silty sand	WQ/EC/L	Under ETP boundary after handover.
	S40_d	Deep rock	3.68	8.7 – 15.2	Sandstone	WQ/EC/L	Under ETP boundary after handover.
	S51	Shallow sediments	4.15	0.8 – 6.2	Fill/ Sand/ Silty sand	Nil	Has been decommissioned due to construction.
	AF_CGW1	Shallow sediments	4.15	4.5-10	Alluvium	WQ/EC/L	Replacement for S51.Shallow well, unable to extract sample.
	S54	Deep rock	3.59	12 – 17.5	Sandstone	WQ/EC/L	

Location	Bore ID	Depth classification	Ground surface elevation (mAHD)	Screened interval (m)	Screened aquifer	Monitoring*	Comments
	S55	Shallow sediments	3.13	0.5 – 6.22	Fill/ Sand/ Silty sand	Nil	Under ETP boundary after handover.
	S58_s	Shallow sediment	3.24	0.7 – 6	Fill/ Sand/ Silty sand	Nil	Under ETP boundary after handover.
	S58_d	Deep rock	3.22	18 – 21.5	Sandstone	Nil	Under ETP boundary after handover.

WQ = Water Quality Monitoring. EC = Electrical Conductivity Monitoring. L = Groundwater level monitoring

*Due to a number of monitoring bores being located within the extent of the station boxes or tunnel alignment, which will be destroyed during construction, these monitoring wells will not be monitored during construction. Monitoring may still occur at these locations prior to construction to assist in gathering baseline information.

6.3 GROUNDWATER PERFORMANCE CRITERIA

6.3.1 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. If treated water complies with the project quality requirements, it will be reused in different processes of construction when possible.

Where treatment of water 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.

6.3.2 GROUNDWATER QUALITY

Dedicated dataloggers with specifications allowing the measurement of pressure will be installed at key monitoring bores. The exact location and number of bores to be monitored at will be determined after the completion of the groundwater modelling report.

The dataloggers will be programmed to record all analytes on a six hourly basis (00:00, 06:00, 12:00, and 18:00). Dataloggers will be downloaded quarterly (every three months).

Water quality monitoring will occur for key contaminants of concern in the bores indicated in Table 6-3. Water quality monitoring at these groundwater bores is intended to identify where contaminants are potentially migrating to the station boxes as a result of drawdown.

The initial suite of contaminates of concern for all boreholes will include the following:

- Total recoverable hydrocarbons (TRH)
- BTEX (benzene, toluene, ethylbenzene, xylene and naphthalene)
- PAH (polycyclic aromatic hydrocarbons)
- VOC (volatile organic compounds, including chlorinated hydrocarbons)
- PFAS
- Major ions.

This will be in addition to basic water quality parameters including:

- pH
- EC
- Nutrients
- Dissolved metals.

PERFORMANCE CRITERIA

Baseline monitoring shows that some groundwater quality parameters exceed the default ANZECC (2000) water quality trigger values for slightly to moderately disturbed ecosystems. This is not unexpected given the highly disturbed and urbanised Project area.

After final monitoring locations are chosen site specific salinity/EC trigger values and water quality criteria will be finalised to provide an easily identifiable indication of a potential change in salinity and/or general water quality. A management response would be initiated if any of the following occurs:

- The EC depicts a rising trend over a 3 month period
- The EC or water quality data exceeds the previous months value by 100%.

In the event that one or both of the above EC triggers are observed a review will be initiated to determine the significance of the exceedance(s) and possible causes. The review will assess the historical and surrounding monitoring bore data, and modelling predictions.

A set of trigger values has been developed by a groundwater specialist on a site-by-site basis. This has been done following these steps:

- If result below LOR (Limit of reporting), the trigger value is set at:
    - LOR x 10 (if LOR is more than 10x > screening levels);
    - LOR (if LOR is less than 10x screening levels)
- For result with detects:
    - If data does not support statistics applied maximum plus 20%, also note where the maximum already exceeds screening levels (The 20% represents the standard field/lab error we apply in normal QA/QC (Quality Assurance/Quality Control)).

If there is an exceedance of a Trigger Value, the following next steps may be considered:

- Review Site data for the well with the exceedance
- Data for that well should be tracked for long-term trends after the next sampling period;
- If the next sampling round also exceeds, increased frequency of sampling is warranted for that to evaluate the longer-term trend; and
- If increasing trends are identified, further site-specific assessment should be conducted that can include review of hydrogeologic information, trends and as well as assessment of risks to quality of water.

Refer to Appendix III for the detailed trigger values for each analyte and site.

6.3.3 GROUNDWATER INFLOW MONITORING

Groundwater level drawdown would be dependent on a number of factors, including proximity to the tunnel alignment and the specific geological conditions present.

As a result of the tunnelling methodology (double shield TBM) generally, the internal tunnel wall will only be exposed for a very short time period (i.e. less than an hour) before being enclosed (i.e. sealed to groundwater inflow) behind pre-cast concrete units. Hence the potential for groundwater drawdown impacts is relatively low compared to other methodologies such as using roadheaders. Given the short timeframe between the tunnel excavation and lining, the inflow rates and proposed methodology, drawdown is not anticipated to be a significant issue for the CTP.

Station boxes are expected to be open for much longer periods of time and therefore, greater inflows are expected at these locations. Section 5.1.2 outlines the expected groundwater inflow rates at each of the station boxes as predicted as part of the EIS and by the Revised Groundwater Modelling Reports required under CoA D122.

Groundwater inflow monitoring will be undertaken at each of the station boxes. Inflow rates can be approximated by determining the volume of water that is captured in the station box excavations or tunnels and pumped to the various construction WTPs across the project, minus the volume of water that is pumped into the excavations and/or tunnel for construction purposes. However, it is noted that this does not account for water entrained into the spoil during the cutting process, which will need to be estimated using a standard estimation equation.

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

The groundwater inflow will be monitored and assessed bi-annually accounting for groundwater take from the Sydney Basin Central Groundwater Source in accordance with CoA C17(j). Results of this accounting will be included in the six-monthly monitoring reports as discussed in Section 12.

6.3.4 GROUNDWATER LEVEL AND DRAWDOWN

As described in Section 6.2 of the Groundwater Management Plan, Revised Groundwater Modelling Reports are being prepared to document potential inflow rates and drawdown for the CTP Project sites to generate updated modelling and a base case. The Revised Groundwater

Modelling Reports provide information on the predicted drawdown at each of the station boxes. The Revised Groundwater Modelling Reports can then be compared to the EIS predictions and trigger values established for drawdown, inflow rates and potential salinity or contamination migration issues.

The updated modelling results may result in the need to update this Monitoring Program, and this will occur on an as needs basis. Revision of this Management Plan and Groundwater Monitoring Program will be undertaken in accordance with the continual improvement process outlined in the CEMP.

A Revised Groundwater Modelling Report will be developed for each station box and at least one report for the tunnelling. Each Revised Modelling Report will be prepared prior to bulk excavation impacting groundwater at each site.

Dataloggers will be installed (or maintained from the baseline monitoring phase) to provide continuous data collection. Dataloggers will be programmed to record at six hourly intervals.

To supplement the above continuous monitoring, manual measurements will be collected every three months (quarterly), pending access, at key bores in the monitoring network.

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).

Recorded data will be compensated for barometric pressure and converted to a groundwater level measurement. Manual monitoring data will be used to verify continuous data.

Groundwater level data will be compared to local rainfall records to assess trends.

PREFORMANCE CRITERIA

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 trigger 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.

If drawdown is identified outside of model predictions, management actions outlined in the GWMP will be initiated including (but not limited to) a review of baseline groundwater level and quality data in the relevant and surrounding monitoring bores as well as an assessment of groundwater inflow rates into the station boxes and shafts.

If registered groundwater users are impacted by a material decline in groundwater supply levels, quality or quantity, make good provisions will be provided to those groundwater users in accordance with the Groundwater Management Plan.

6.3.5 WTP DISCHARGE PERFORMANCE CRITERIA

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

Water treatment plants were designed 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 D118 and REMM SSWQ5, Groundwater discharges must be compliant with the limits established by the CTP's EPL (21610). Refer to table 6-4 for limits and section 6.3 of the Groundwater Management Plan. Where this is not achievable, groundwater will be removed from site as liquid waste in accordance with NSW EPA's Waste Classification Guidelines.

ABLE 6-4: DISCHARGE POINTS 4,5,6,7 OF WTPS LIMITS (EPL CONDITION L2.4)

Parameter	Unit of measure	100 percentile concentration limits
Aluminium	µg/L	55
Ammonia	µg/L	910
Cadmium	µg/L	0.7
Chromium (VI) Coumpounds	µg/L	4.4
Cobalt	µg/L	1
Copper	µg/L	1.3
Iron	µg/L	300
Lead	µg/L	4.4
Manganese	µg/L	80
Nickel	µg/L	7
Nitrate + nitrite (oxidised nitrogen)	µg/L	200
Nitrogen (total)	µg/L	300
Oil and grease	Visible	Not visible
Perfluorooctanesulphonate (PFOS)	µg/L	0.13
pH	pH	6.5-8.5
Phosphorus (total)	µg/L	30
TRH	µg/L	100
TSS	mg/L	15
Zinc	mg/L	8

TABLE 6-5:: DISCHARGE LOCATIONS OF WTP (EPL SECTION 2-P1)

Discharge Point	Site
4	The Bays
6	Burwood North

7. MONITORING METHODOLOGY

7.1 OVERVIEW

The methodology for monitoring groundwater for the project includes:

- Assessment of groundwater level (measurement and datalogger download)
- Assessment of groundwater salinity as EC (on site measurement)
- Assessment of groundwater quality at key locations
- Assessment of WTP discharge water quality (grab samples for lab analysis and field measurements)
- Assessment of groundwater inflows (pump flow meter data)
- Implementation of quality control plan including appropriate chain-of-custody for laboratory analysis and provision of appropriate documentation.

Groundwater monitoring is to be undertaken by suitably qualified personnel at all times.

Groundwater monitoring will be undertaken in accordance with the following monitoring regime:

- Baseline monitoring will be gathered from all bores for at least two consecutive months prior to construction commencing that will interact with groundwater
- Construction monitoring will occur monthly for the first three months of construction and then quarterly thereafter
- Construction monitoring will occur at smaller intervals where the Revised Groundwater Modelling Report indicates it is required
- Continuous groundwater level and EC monitoring will only occur where recommended by the Revised Groundwater Modelling Report
- WTP discharge monitoring is outlined in Section 7.5
- Groundwater inflow monitoring is outlined in Section 7.6.

7.2 MANUAL GROUNDWATER LEVEL MEASUREMENTS

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 monitoring equipment.

The static groundwater level will be measured and recorded at each standpipe groundwater monitoring bore using an electronic groundwater level dip meter (dipper) to verify the continuous data recorded by dataloggers. The level (to the nearest millimetre) will be referenced to a known (and consistent) surveyed point at the top of the bore casing (mTOC). This measurement will be corrected to mAHD using survey data. Recorded groundwater level will be tabulated in both metres below top of bore casing (mBTOC) and mAHD.

The base of the bore will be measured and recorded periodically by lowering the dipper to the base of the bore until it touches the bottom, where possible.

7.3 CONTINUOUS GROUNDWATER LEVEL MEASUREMENTS

Groundwater level (as pressure) will be measured automatically by calibrated dataloggers at key monitoring locations and VWPs (pore pressure only). Continuous data (recorded every 6 hours) will be periodically validated by manual measurements. Continuous groundwater level will only occur in those bores where recommended in the Revised Groundwater Modelling Report, otherwise they will be monitored quarterly.

Groundwater level/pressure measurement will be converted to mAHD using calibration coefficients, installation data, and survey data. Spreadsheets will be maintained detailing the conversion and converted groundwater level measurement.

The dataloggers will be downloaded quarterly. Dataloggers will be checked and maintained as necessary before being re-calibrated and then returned to the monitoring bore at a known depth below the top of casing.

7.4 MANUAL GROUNDWATER QUALITY SAMPLING

Groundwater quality sampling will be carried out by suitably qualified personnel at all times, in accordance with AS/NZS 5667.11:1998, 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 sits in the bore
- Methods of collection and storage in 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 WTP's or disposed of in accordance with the Waste Management Plan. To avoid large volumes of purged water, low-flow monitoring is recommended where possible. Passive sampling or no-purge sampling may be suitable in some of the monitoring bores, however, these sampling methods will only be carried out where recommended by the subject matter expert.

In the event that the bladder pump cannot be used to sample water, a disposable bailer will be used to achieve a sample.

7.5 WTP DISCHARGE SAMPLES

7.5.1 IN-LINE MONITORING

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

7.5.2 SAMPLE COLLECTION FOR LABORATORY ANALYSIS

Grab samples will be collected manually from the WTP locations following established frequencies in the project's EPL (Condition E2.1 and M2.2) to verify that water from the WTPs remains below the parameters described in Table 4-6. The volume of sample collected will be sufficient for the required physico-chemical (field) parameter analysis using a multi-probe water quality meter(s).

7.5.3 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 and completion of each day of water quality sampling. Calibration records will be maintained in accordance with the appropriate standard.

7.5.4 RECORDING OF FIELD RESULTS

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

7.5.5 DECONTAMINATION

Equipment will need to be cleaned periodically to prevent build-up of dirt.

The following method will be followed:

- Rinse the equipment in tap water
- Clean with De-Con 90 (a phosphate free detergent), or equivalent. Where PFAS is tested, a PFAS free detergent will be used.
- Rinse again with tap water
- Rinse three times with de-ionised water, and finally
- Allow to dry.

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

7.5.6 WTP COMMISSIONING

During commissioning of each of the WTPs, a minimum of two rounds of commissioning sampling will be undertaken to confirm their efficacy. All of the parameters listed in Table 4-6 will be tested during this commissioning phase. The main objectives of the commissioning testing will be to determine:

1. If the WTPs perform to meet the proposed discharge criteria in Table 4-6 and what (if any) design or operational modifications may be required to the WTP in order for it to meet the required specifications
2. 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 WTP will not be deemed “commissioned” until two subsequent rounds of testing confirm compliance with the criteria and the WTP is operating at the correct performance level.

7.5.7 POST-COMMISSIONING

In addition to the commissioning sampling, the WTP discharge will be sampled for water quality analysis for the parameters listed in Table 4-6 during discharge. 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 (Condition L2.4 of CTP’s EPL).

Sampling of the design performance criteria listed in Table 4-6 will be undertaken to ensure that each of the WTPs continues to meet design specifications, as per condition E2.1A of CTP’s EPL (Table 12-1 of this document for sampling and reporting frequency) Where in-line sensors or monitoring identify WTP performance drift outside of the required criteria the WTP will be shut down and measures implemented to return the WTP 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 WTP performance backing to the required range, the WTP will be re-commissioned as per the steps outlined in Section 7.5.6 before the WTP is considered to be operational again.

If a WTP is shutdown due to a result that is out of range, this will be treated as an incident and managed in accordance with the incident management procedure outlined in the CEMP. Once the incident investigation has been completed, the WTP will be recommissioned in accordance with the process described in Section 7.5.6.

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

A commissioning phase was conducted to identify the capability of each plant to meet the proposed water quality guidelines in the EPL. This was conducted as part of a Proof of Performance (PoP) criteria in the EPL which allowed for variance in meeting the discharge criteria set in the EPL. Upon completion of the PoP, an updated WPIA was submitted to the EPA. Water to be discharged from the water treatment plant should comply with CTP’s EPL (Section 6.3 of the Groundwater Management Plan).

7.5.8 WTP DISCHARGE VOLUMES

The volume of water discharged from the construction WTP's will be recorded using flow metres at the discharge point connected to an online portal where data can be retrieved.

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 Balance Study that will be developed in accordance with CoA D79 (as detailed in Section 6.4.1 of the Soil and Water Management Plan). The Water Balance Study will be updated regularly during construction, where real values differ greatly to the predicted values.

7.6 GROUNDWATER INFLOW

Groundwater inflow monitoring will be carried out at each of the station boxes and recorded daily on a project with inflow monitoring register. Inflow rates will be derived from the amount of water that is captured in the station box excavations or tunnels and pumped to the various construction WTPs across the project (minus the amount of clean water that is pumped into the excavations and/or tunnel for construction purposes). The inflow rates and volume will be determined through the use of flow metres on the intake into each of the construction WTP's when they are established. Flow metres can also be installed on individual pumps throughout the tunnel where more focused inflow data is required.

8. SMART PRINCIPES

The groundwater quality monitoring attempts to use the 'SMART' principles.

- S for specific: The groundwater monitoring for the CTP will be implemented in the following clear phases:
    - Civils Construction stage groundwater monitoring
    - Tunnelling stage groundwater monitoring
- M for measurable: the monitoring parameters are provided in section 6.3
- A for actionable: the monitoring actions are described in section 7
- R for realistic: the actions in section 7 are realistically achievable
- T for timely: The timing for actions are provided in section 7.

The monitoring program will continue for the duration of CTP construction. Following AFJV's construction works, other follow-on contractors to Sydney Metro may undertake further Groundwater Construction monitoring.

9. COMPLIANCE MANAGEMENT

9.1 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 daily by the WTP 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
- Sample time
- 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.

9.2 DATA ANALYSIS

Results from the groundwater monitoring program will be compared with the relevant trigger values and groundwater modelling predictions following each quarterly sampling event for ground water salinity, groundwater water quality, and any continuous level monitoring.

A qualified hydrogeologist will review the groundwater level data in each reporting period and provide analysis of the groundwater data in comparison to the trigger values and the Revised Groundwater Modelling Report.

Monitoring groundwater level will involve the recorded data being adjusted where required to compensate for barometric pressure, and converted to a final groundwater level measurement. Groundwater level data will then be compared to local rainfall records to assess trends. The monitoring results for groundwater level will be used to inform the groundwater model updates increasing the confidence level in model predictions with respect to groundwater inflow and drawdown. Where required the groundwater model will be calibrated to monitoring results and predictions updated.

Water quality results from the WTPs will be analysed monthly, and along with an overview of corrective actions. The monitoring results will be compared against the requirements for discharge from the EPL as detailed in table 6-5 of this document.

Monitoring results for EC will be compared against trigger values on a quarterly basis. If results trigger a response, management actions will be implemented as required following an initial review determine a potential cause.

All data will be reported in the six-monthly water monitoring report.

10. CALIBRATION, QUALITY ASSURANCE AND COMPETENCY

Specific targeted training will be developed by the Environmental Manager 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 AFJV throughout delivery of the Project.

Any sample to be sent to a laboratory will be subject to quality assurance protocols.

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 (2000b) to ensure the integrity of the dataset.

As part of sampling the following will be undertaken:

- Rinsate blanks (one per sampling event only)
- 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.

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.

11. REVIEW AND IMPROVEMENT

Monitoring data will be reviewed throughout the construction period to provide potential requirements to increase, or decrease, the number of sampling locations. As noted in section 6.2 the project's trigger values will be reviewed six months after commencement of civils construction once further groundwater data is collated.

Continuous improvement of this Program, during the civils work phase will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets, and the Project performance outcomes of the EIS for the purpose of identifying opportunities for improvement.

Improvement of performance will be reviewed every six months as part of the six-monthly reporting, detailed in Section 12.

12. REPORTING

During construction, groundwater monitoring data will be collected, tabulated and assessed against baseline conditions and performance criteria.

Reporting requirements associated with the Program for the construction phase of the Project are presented in Table 12-1.

TABLE 12-1 REPORTING REQUIREMENTS AND SCHEDULE

Schedule (during construction)	Requirements	Submission timeline
Pre-construction Groundwater Monitoring Data	Groundwater monitoring data would be provided to the NSW Environment Protection Authority and Department of Planning, Industry and Environment and the Natural Resources Access Regulator (NRAR).	Prior to construction that would interact with groundwater.
Groundwater 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. In addition, WTP discharge results would also be presented. Applicable management responses will be documented.	The six-monthly monitoring reports will be provided to the relevant authorities (including SOPA, EPA (if requested) DPIE Water and NRAR) within 40 business days of the monitoring period ending.
Proof of Performance report – EPL number 21610 (E2.1)	Water quality sampling of all discharges from the WTPs must be undertaken: i) Daily on the first 3 days of discharges, ii) Weekly for the first month of discharges, iii) Fortnightly for the first 3 months, iv) Monthly for the rest of the WTPs operation. (Condition M2.2 of the EPL)	Performance report must be submitted to the EPA within 10 business days of each sample results being taken.

In line with CoA B11, a copy of the Construction Monitoring Report will be published on the AFJV project website within ten days following submission to the DPIE via the Major Projects Portal.

Separate from the Construction Monitoring Report, 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.

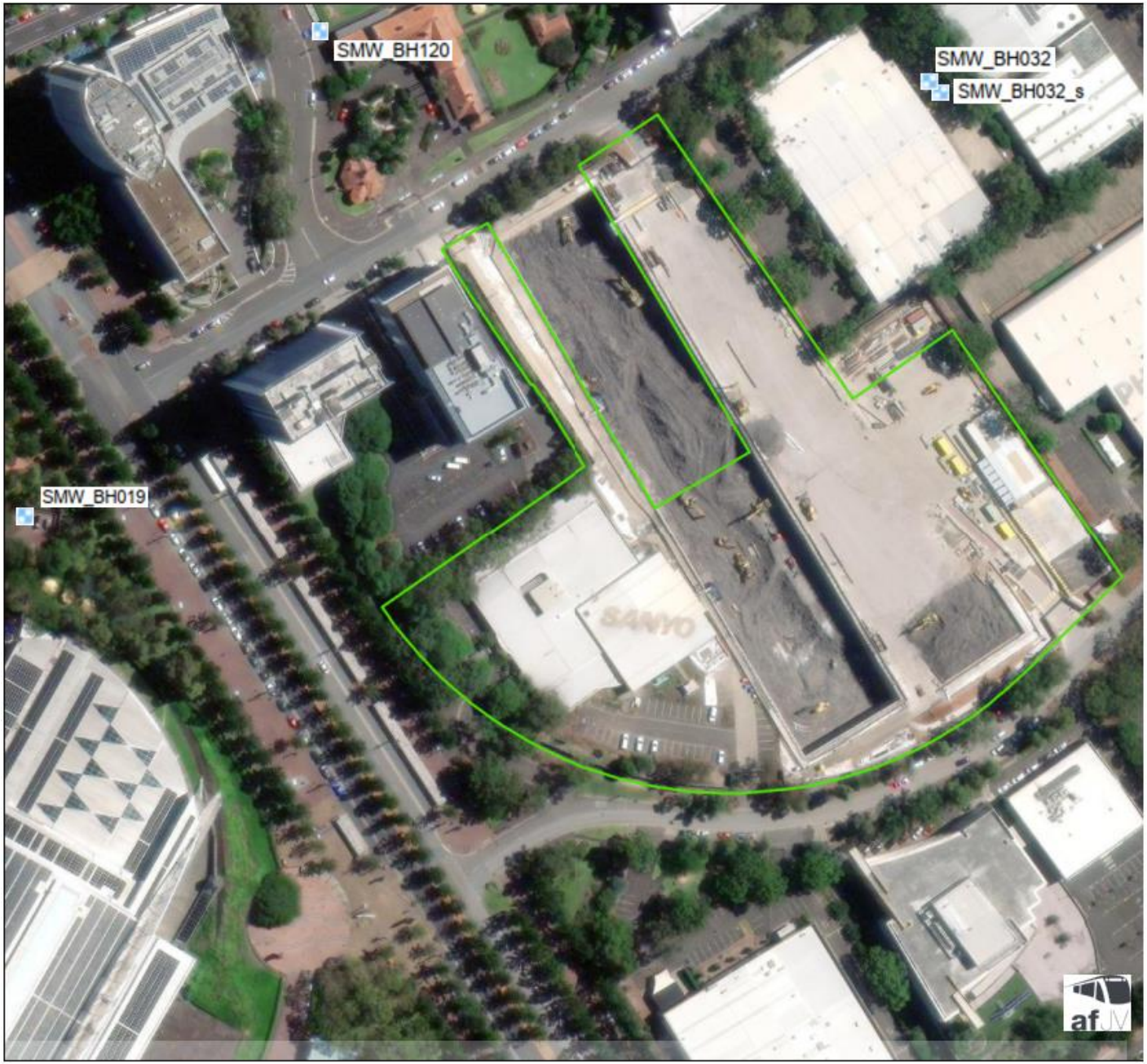
Where Sydney Water assets are required to be used to receive discharged water from the Project, as part of a trade waste agreement or similar, monitoring and reporting requirements would be agreed

with Sydney Water. Where required, these monitoring and reporting requirements will be included in this Monitoring Program.

APPENDIX I. AFJV GROUNWATER MONITORING LOCATIONS

Groundwater monitoring locations shown in Appendix I come from AFJV's tender advice report by ERM, January 2021, Metro West-Contamination-Groundwater, 0577577, Rev 1 and Senversa, (May 2021), Factual Contamination Investigation Report- The Bays, 000013/11868 White Bay Site Investigations.

As described in the Monitoring Program, monitoring locations are being confirmed as part of the Revised Groundwater Modelling Report.



Sydney Metro West - CTP

Sydney Olympic Park

Legend

CONSTRUCTION

BOUNDARY

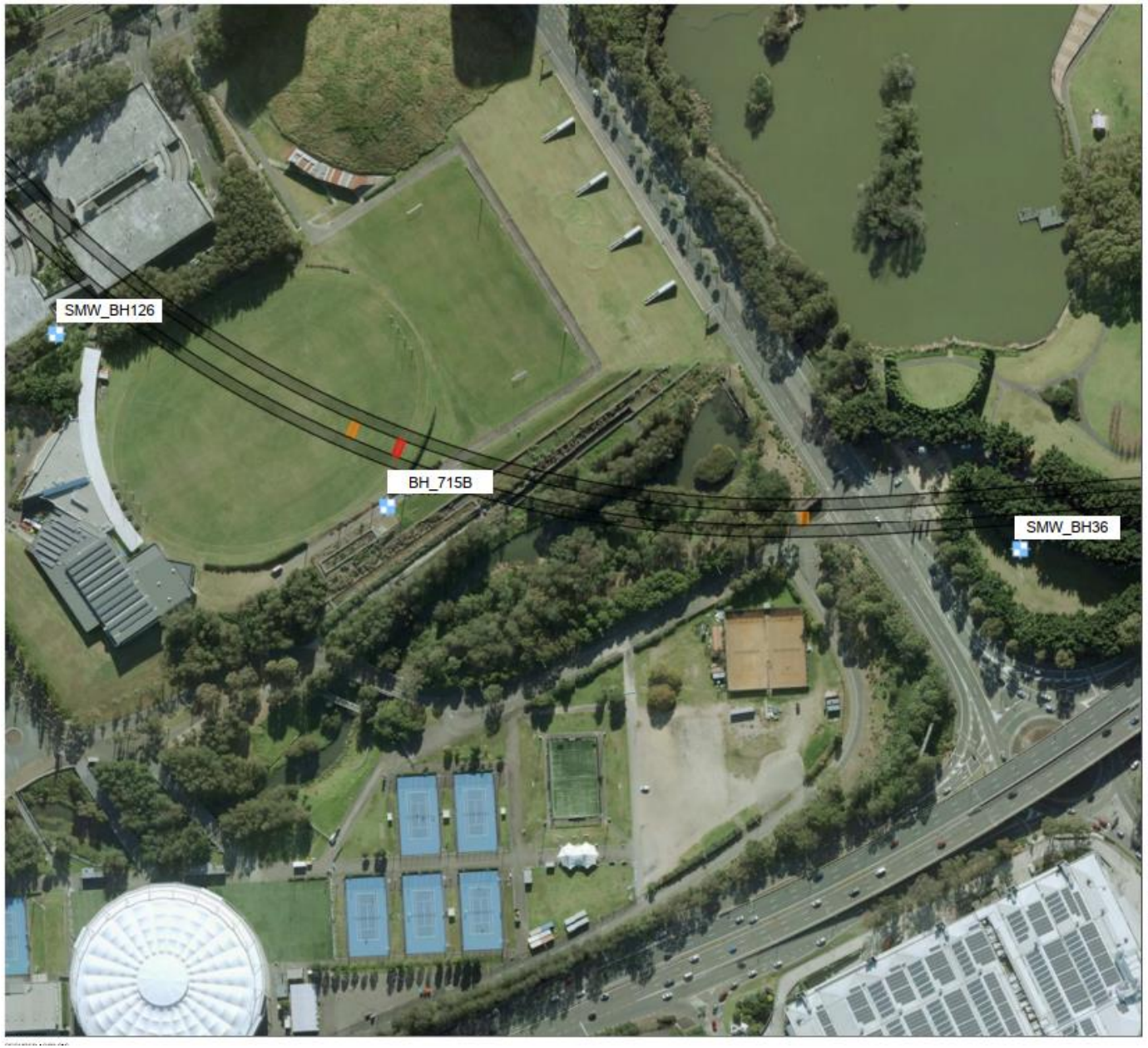
EPL Premise Boundary

Olympic Park

Groundwater well

0 35 70 m

This map is shown for reference purposes only. Acciona Ferrovial JV provides this information "as is" with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort is made to ensure the information displayed is as accurate and current as possible, Acciona Ferrovial JV will not be held responsible for any loss, damage or inconvenience caused as a result of reliance on such information or data.

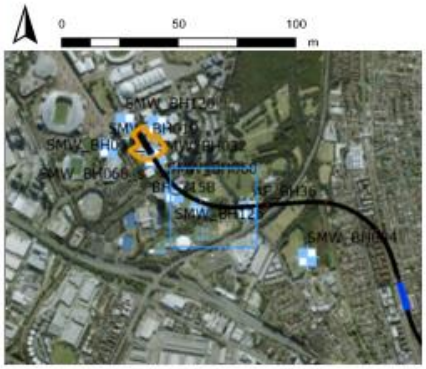


Sydney Metro West - CTP

Tunnel - Sydney Olympic Park to Nort...

Legend

- Site boundary
- Groundwater well



afJV

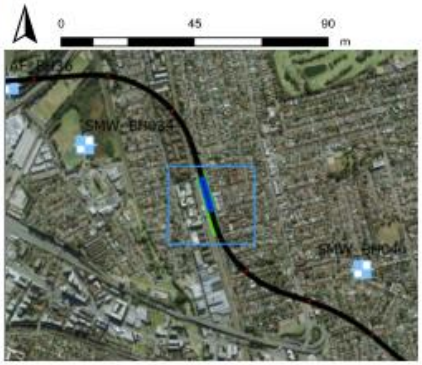
Sydney Metro West - CTP

North Strathfield

Legend

Site boundary

Groundwater well



afJV

Sydney Metro West - CTP

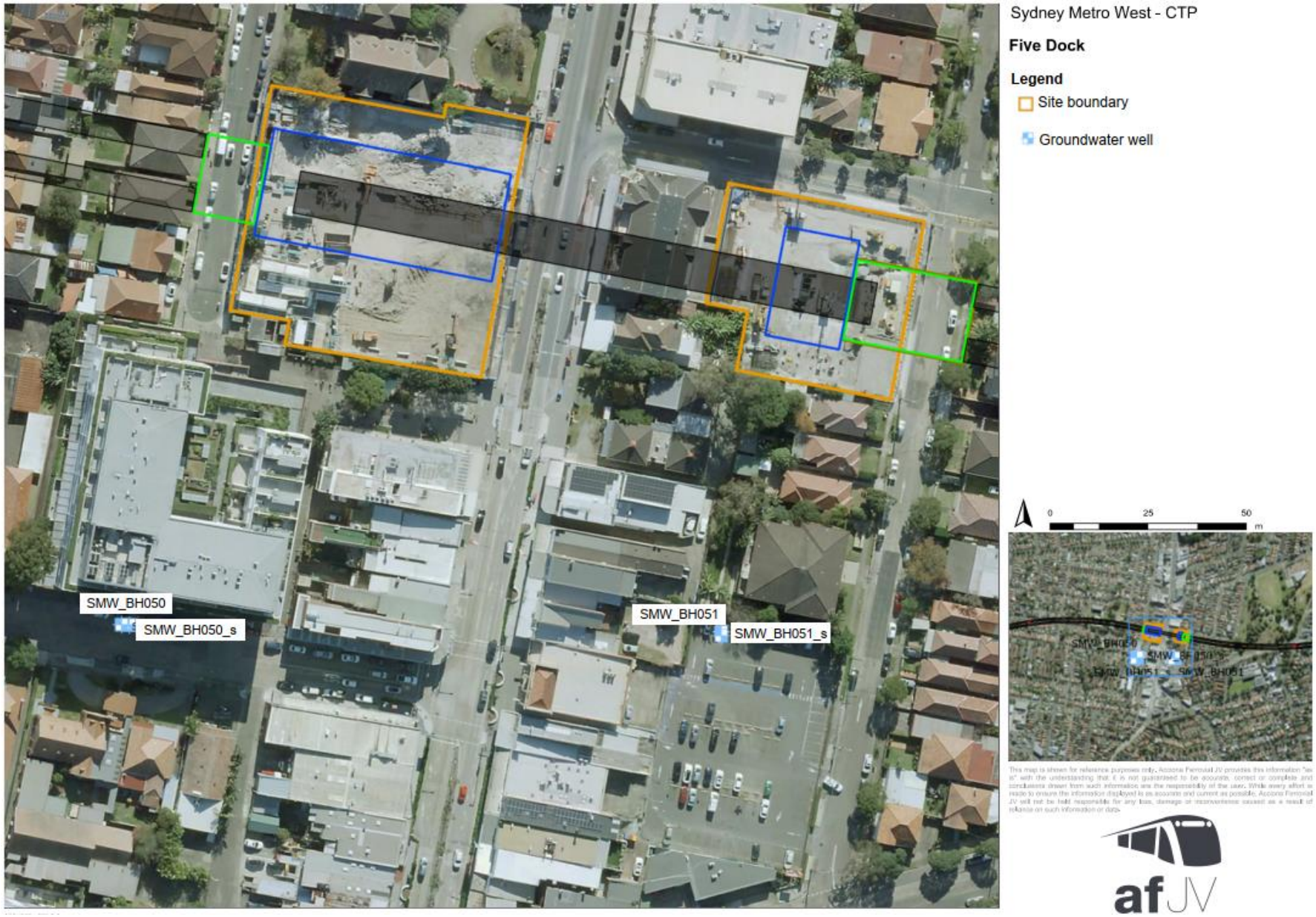
Burwood North

Legend

Site boundary

Groundwater well

afJV



Sydney Metro West - CTP

Five Dock

Legend

Site boundary

Groundwater well

afJV

Sydney Metro West - CTP

The Bays

Legend

CONSTRUCTION

BOUNDARY

EPL Premise Boundary

The Bays Construction Site

EPL

Groundwater well

0 30 60 m

APPENDIX II. BACKGROUND GROUNWATER MONITORING DATA

Summary data has been extracted from AFJV's tender advice report by ERM, January 2021, Metro West-Contamination-Groundwater, 0577577, Rev 1.

Source: Summary data has been extracted from AFJV's tender advice report by ERM, January 2021, Metro West-Contamination-Groundwater, 0577577, Rev 1

Bore ID	Location	Ground Surface Elevation (mAHD)	Screen Interval (m bgs)	Screened Aquifer	ERM Bore Classification	Analysis Completed (X) and Exceedances of Adopted Groundwater Criteria									ERM Comments
						Field Parameters and Major Ions	Nutrients	Metals	PFAS	TRH / BTEX / PAH	VOC	OCP / OPP	Phenols	SVOC	
SMW_BH029	Tunnel - North West of Sydney Olympic Park	17.31	41.2 - 56.2	Sandstone	Deep Rock	x - EC, TDS, Cl, SO4	x - NH3. total N	x - Co, Fe, Mn, Zn	x - PFOS LOR>SL	x	x			x	Data from SMW_BH029 has been excluded from further assessment as this bore is located further east than the project area of interest.
SMW_BH070	Tunnel - North West of Sydney Olympic Park	4.85	27.7 - 30.7	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - NH3, total N	x - Co, Fe, Mn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH121	Tunnel - North West of Sydney Olympic Park	4.51	13.0 - 16.0	Siltstone	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - NH3, total N, total P	x - Fe, Mn, Zn and Cu (SL>LOR)	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH120	Sydney Olympic Park	17.38	22.5 - 25.5	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - NH3, total N	x - Fe, Co, Cu, Mn, Zn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH019	Sydney Olympic Park	17.33	22.5 - 25.5	Siltstone	Deep Rock	x - TDS, EC, Na, SO4	x - NH3, total N	x - Co, Fe, Mn, Zn		x	x				
SMW_BH015	Sydney Olympic Park	22.94	25.2 - 28.2	Siltstone	Deep Rock	x - TDS, EC, Cl, Na, SO4	x - NO3, NH3, total N	x - Co, Fe, Mn	x - PFOS LOR>SL	x	x				
SMW_BH015_s	Sydney Olympic Park	22.92	1.5 - 4.5	Siltstone / Sandstone	Shallow Rock										no groundwater data - well dry
SMW_BH032	Sydney Olympic Park	19.74	18.0 - 22.0	Siltstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - NH3. total N, total P	x - Zn	x - PFOS LOR>SL	x	x			x	
SMW_BH032_s	Sydney Olympic Park	19.76	3.5 - 7.25	Siltstone	Shallow Rock										no groundwater data - well dry
SMW_BH068	Sydney Olympic Park	23.64	22.1 - 25.1	Siltstone / Sandstone	Deep Rock										no groundwater data - obstruction in well
SMW_BH068_s	Sydney Olympic Park	23.36	2.6 - 4.3	Siltstone / Sandstone	Shallow Rock										no groundwater data - well dry
SMW_ENV081A	Sydney Olympic Park	13.94	0.70 - 1.65	Fill / Clay / Siltstone	Shallow Rock										This bore was ultimately installed as a soil vapour bore, rather than a groundwater monitoring bore.
SMW_BH126	Sydney Olympic Park	11.4	9.2 - 12.2	Fill / Siltstone	Shallow Rock	x - TDS, Na, Cl	x - NH3, total N, total P	x - Co, Fe	x - PFOS	x - benzene	x	x	x	x	
SMW_BH069	Tunnel - between Sydney Olympic Park and North Strathfield	7.96	19.4 - 22.4	-	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - NH3, total N, total P	x - Co, Mn, Zn	x - PFOS LOR>SL	x	x	x	x	x	no borelog available
SMW_BH033	Tunnel - between Sydney Olympic Park and North Strathfield	6.82	8.5 - 11.5	Siltstone	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - NH3. total N, total P	x - Fe, Co, Mn, Zn	x - PFOS LOR>SL	x	x			x	
SMW_BH034	Tunnel - between Sydney Olympic Park and North Strathfield	2.44	26.2 - 29.2	Sandstone	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - NH3. total N, total P	x - Fe, Mn	x - PFOS LOR>SL	x	x			x	
SMW_BH038	North Strathfield	9.91	26.0 - 32.0	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - NH3. total N, total P	x - As, Co, Fe, Mn		x		x		x	
SMW_BH009	North Strathfield	18.45	37.45 - 40.45	Sandstone	Deep Rock	x - TDS, EC, Cl, Na, SO4	x - NH3, total N	x - Co, Mn, Zn		x	x				
SMW_BH009_s	North Strathfield	18.6	1.0 - 5.0	Gravelly Clay / Siltstone	Shallow Rock	x - TDS	x - total N, total P	x- Co, Mn, Zn		x	x				
SMW_BH073	North Strathfield	18.93	10.2 - 13.2	Siltstone	Shallow Rock	x - EC, TDS, Na, Cl, SO4	x - total N, total P	x - Fe, Mn, Zn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH035	North Strathfield	26.74	33.5 - 45.5	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Na, Cl	x - NH3. total N, total P	x - Co, Fe, Mn, Zn		x				x	
SMW_BH035_s	North Strathfield	26.62	1.7 - 3.2	Siltstone	Shallow Rock										no data, no explanation provided
SMW_BH040	Tunnel - between North Strathfield and Burwood	23.06	45.0 - 54.0	Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - NH3. total N, total P	x - Co, Fe, Mn, Zn		x					
SMW_BH044	Burwood	22.67	22.5 - 34.5	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - NH3, total N	x - Mn, Fe		x					
SMW_BH046	Burwood	6.47	6.0 - 15.0	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - total N, total P	x - Co, Fe, Mn		x					
SMW_BH046_s	Burwood	6.47	1.3 - 3.1	Clay	Shallow Sediments										no groundwater data - well dry

Bore ID	Location	Ground Surface Elevation (mAHD)	Screen Interval (m bgs)	Screened Aquifer	ERM Bore Classification	Analysis Completed (X) and Exceedances of Adopted Groundwater Criteria									ERM Comments
						Field Parameters and Major Ions	Nutrients	Metals	PFAS	TRH / BTEX / PAH	VOC	OCP / OPP	Phenols	SVOC	
SMW_BH050	Five Dock	24.34	9.0 - 24.5	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Na	x - total N	x - Co, Mn		x					
SMW_BH050_s	Five Dock	24.35	0.4 - 1.3	Gravelly Clay	Shallow Sediments										no groundwater data - well dry
SMW_BH082	Five Dock	18.04	9.3 - 12.3	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Na, Cl, SO4	x - total N	x - Co, Fe, Mn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH051	Five Dock	21.68	7.0 - 10.0	Siltstone / Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - NH3, total N, total P	x - Co, Cu, Mn, Zn		x					
SMW_BH051_s	Five Dock	21.66	0.8 - 2.0	Silty Clay	Shallow Sediments										no groundwater data - well dry
SMW_ENV020	The Bays	2.94	9.0 - 15.0	Sand / Sandy Clay /Sand/Silt	Deep Sediments	x - EC, TDS, Na, Cl, SO4	x - total N, total P	x - As, Fe, Mn, Zn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_ENV020_s	The Bays	2.94	2.5 - 5.5	Sand / Silt / Silty Sand	Shallow Sediments	x - TDS	x - NH3, total N, total P	x - As, Co, Fe, Mn, Zn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_ENV021	The Bays	3.09	9.4 - 14.4	Core Loss / Sand	Deep Sediments	x - TDS, Na	x - total N, total P	x - As, Mn	x - PFOS	x	x	x	x	x	
SMW_ENV021_s	The Bays	3.09	2.2 - 4.6	Silty Sand / Sand	Shallow Sediments	x - EC, TDS, Na, Cl, SO4	x - NH3, total N, total P	x - Fe	x - PFOS	x	x	x	x	x	
SMW_ENV026	The Bays	4.23	3.5 - 6.5	Sand / Silty Sand	Shallow Sediments	x - EC, TDS, Cl, Na	x - NH3. total N, total P	x - Fe, Zn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_ENV027	The Bays	3.58	2.0 - 5.0	Fill / Sand / Clay	Shallow Sediments	x - TDS	x - NH3. total N, total P	x - Fe, Mn, Zn	x - PFOS LOR>SL	x	x - isopropylbenzene	x	x	x	
SMW_BH066	The Bays	4.14	27.2 - 30.2	Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - NH3, total N, total P	x - Fe, Mn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH066_s	The Bays	4.14	2.0 - 6.0	Fill / Sand / Silty Sand	Shallow Sediments	x - EC, TDS, Cl, Na, SO4	x - NH3. total N, total P	x - Fe, Mn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_ENV034	The Bays	3.17	7.9 - 9.3	Sand / Sandy Clay / Clayey Sand	Deep Sediments	x - EC, TDS, Cl, Na, SO4	x - NH3. total N	x - Fe	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH067	The Bays	2.93	12.5 - 15.5	Sandstone	Deep Rock	x - EC, TDS, Cl, Na, SO4	x - total N, total P	x - Co, Fe, Mn	x - PFOS LOR>SL	x	x	x	x	x	
SMW_BH067_s	The Bays	2.92	2.5 - 6.0	Sandstone	Shallow Rock	x	x - total N, total P	x - Co, Fe, Mn. Zn	x - PFOS LOR>SL	x	x	x	x	x	

NOTES:

mAHD - metres Australian Height Datum
mbgl - metres below ground level
LOR - Limit of Reportin
SL - Screening Level (Water Quality Objective)
EC - Electrical Conductivity
TDS - Total Dissolved Solids
Cl - Chloride
Na - Sodium
SO4 - Sulfate

Total N - Total Nitrogen
Total P - Total Phosphorous
NO3 - Nitrate
NH3 - Ammonia
Fe - Iron
Mn - Manganese
Co - Cobalt
As - Arsenic
Zn - Zinc
Cu - Copper
Ni - Nickel

PFAS - Per- and Poly- Fluorinated Substances
PFOS - Perfluorooctanesulfonic acid
TRH - Total Recoverable Hydrocarbons
BTEX - Benzene, Toluene, Ethylbenzene, Xylene
PAH - Polycyclic Aromatic Hydrocarbons
VOC - Volatile Organic Compounds
SVOC - Semi Volatile Organic Compounds
OCP - Organochlorine Pesticides
OPP - Organophosphorous Pesticides

Concentrations are reported in ug/L, unless otherwise noted			TDS (mg/L)	Sodium (mg/L)	Nitrate as N	Ammonia as N	Total N	As	Co	Mn	Zn	Total P (ug/L)	Fe	EC (uS/cm)	Cu	Sulfate (mg/L)	Chloride (mg/L)	PFOS	Benzene	Isopropylbenzene
ANZG 2018 / ANZECC 2000 95% Species Protection					579	749		24/13	1	1900	15				1.3				950	30
NHMRC 2008 Recreational Guidelines			600	180	11670	412		100		5000/100	200/3000		300		10000	250	250		1	40000
Other Guidelines (NEMP V2.0 or EIS Chapter 19)							300				5	25		2200	5			0.00023/0.13		
Bore ID	Location	Depth Classification																		
SMW_BH070	Tunnel - NW of SOP	Deep Rock	25200	5060	<10	6890	7000	4	8	523	<5	<50	12000	33200		864	11900			
SMW_BH121	Tunnel - NW of SOP	Deep Rock	37500	9400	<50	3430	3400	<10	<10	3100	<50	160	10600	48700		2830	21400			
SMW_BH120	SOP	Deep Rock	10100	2770	10	2220	1700	2	10	441	73	20	1120	36400	6	597	5720	<0.05	<1	
SMW_BH019	SOP	Deep Rock	7610	1940	190	4090	4200	<1	3	425	11	<10	4870	13600	<1	4430	82	-	<1	
SMW_BH015	SOP	Deep Rock	11900	3000	610	3590	3900	6	40	607	<5	<20	2830	17100	<1	1090	5040	<0.01	<1	
SMW_BH015_s	SOP	Shallow Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SMW_BH032	SOP	Deep Rock	10700	3200	110	1800	2100	2	<1	99	7	40	190	19000	<1	785	6050	<0.01	<1	
SMW_BH032_s	SOP	Shallow Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SMW_BH068	SOP	Deep Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SMW_BH068_s	SOP	Shallow Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SMW_BH126	SOP	Shallow Rock	6800	2100	<10	267000	312000	5	11	41	<5	440	300	1200	<1	<5	3710	0.14	61	
SMW_BH069	Tunnel - SOP to NS	Deep Rock	8830	2600	10	2220	3600	3	10	406	58	30	60	15700	<1	438	5830	<0.01	<1	
SMW_BH033	Tunnel - SOP to NS	Deep Rock	7100-7560	2000-2080	<5-<10	1100-1590	1500-2600	3-4	6	352-430	<5-12	110-220	1550-1600	11000-12000	<1	470-555	3200-3960	<0.05	<1	
SMW_BH034	Tunnel - SOP to NS	Deep Rock	17600	5200	10	1300	2900	1	<1	1320	<5	80	23100	23800	<1	891	8540	<0.05	<1	
SMW_BH038	North Strathfield	Deep Rock	5330-8290	1220	60	2370-2740	2400-2700	66-68	10-11	370-383	1-<5	<10-<50 20 detected	1390-1490	8280-8370		300-336	2100-2560			
SMW_BH009	North Strathfield	Deep Rock	6990	1790	370	1350	1900	<1	26	374	33	<10	<50	11000		400	3560			
SMW_BH009_s	North Strathfield	Shallow Rock	524-902	129-131	10-30	110	300	<1	12	2320-2410	<5-14	140-170	<50	860-880		20-25	114-117			
SMW_BH073	North Strathfield	Shallow Rock	8770	975	<10	30	100	<1	-	5620	11	115	1540	5500		398	1380			
SMW_BH035	North Strathfield	Deep Rock	11400	5200	80	5320	5900	<1	28	180	13	20	3080	13700		22	5880			
SMW_BH035_s	North Strathfield	Shallow Rock	-	-	-	-	-	-	-	-	-	-	-	-		-	-			
SMW_BH040	Tunnel - NS to B	Deep Rock	6660	1660	10	2430	2800	<1	28	3190	9	400	73400	10700		351	3610			
SMW_BH044	Burwood	Deep Rock	5440	1820	40	1300	1300	2	<1	581	<5	20	390	8810		458	2990			
SMW_BH046	Burwood	Deep Rock	9560	1900	<10	220	1200	1	3	163	<5	300	23000	9510		456	3040			
SMW_BH046_s	Burwood	Shallow Sediments	-	-	-	-	-	-	-	-	-	-	-	-		-	-			
SMW_BH050	Five Dock	Deep Rock	4060	1220	190	90	1100	<1	4	23900	<5	<10	<50	7940	<1	190	2640			
SMW_BH050_s	Five Dock	Shallow Sediments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SMW_BH082	Five Dock	Deep Rock	679	1580	<10	300	400	8	16	1800	<5	<10	2950	8870	<1	1580	1520			
SMW_BH051	Five Dock	Deep Rock	2910	966	50	860	2300	2	70	2940	10	80	240	5750	2	361	1510			
SMW_BH051_s	Five Dock	Shallow Sediments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SMW_ENV020	The Bays	Deep Sediments	1640	1640	20	130	600	54	<1	176	8	120	8260	10000		539	2990	<0.01		<5
SMW_ENV020_s	The Bays	Shallow Sediments	610-679	24-36	<5-20	260-420	400-500	41-190	<1-1	264-280	95-180	280-300	300-9400	800-954		30-37	30-33	<0.01		<1-<5
SMW_ENV021	The Bays	Deep Sediments	1380	345	30	10	500	55	<1	298	<5	170	200	1530		38	174	0.01		<5
SMW_ENV021_s	The Bays	Shallow Sediments	8540	2360	30	3790	3600	12	<1	6	<5	890	12900	14300		423	4290	0.1		<5
SMW_ENV026	The Bays	Shallow Sediments	1330	290	20	7700	7500	9	<1	39	6	420	1500	2510		<1	426	<0.01		20
SMW_ENV027	The Bays	Shallow Sediments	698	41	30	4240	4200	7	<1	394	10	1000	9560	1160		10	28	<0.01		90
SMW_BH066	The Bays	Deep Rock	1500-2680	238-266	<5-<100	85-590	<110-400	<1	<1	2120-2840	2-<5	<50-480	89500-98200	2690-3290		21-316	723-1000	0.08		<5
SMW_BH066_s	The Bays	Shallow Sediments	972-1220	147-248	<10	8520	4500-8300	<1-2	<1	100-248	<5	50-800	2600-6810	1760-2270		<10-40	210-437	<0.01		<5
SMW_ENV034	The Bays	Deep Sediments	6440	1880	30	3960	3400	6	<1	79	<5	<10	1950	11100		372	3110	<0.01		<5
SMW_BH067	The Bays	Deep Rock	1010-1180	164-197	<10	30-140	<100-400	<1	3-4	1060-1490	<5	<10-220	21900-28900	1620-1900		404-469	170-269	<0.01		<5
SMW_BH067_s	The Bays	Shallow Rock	454-462	95-103	<10-10	30-110	<100-300	<1	1-5	132-429	11-16	<10-30	220-2030	751-835		138	52	<0.01		<5

SOP - Sydney Olympic Park
NS - North Strathfield
B - Burwood
NW - North West

ANZG 2018 / ANZECC 2000 95% Species Protection	Australian and New Zealand Guidelines (2018) / Australian and New Zealand Environment Conservation Council (2000) Default Guideline Values for marine ecosystem criteria with a 95% level of protection for slightly to moderately modified ecosystems. In the absence of marine criteria, freshwater criteria were adopted by ERM.
NHMRC 20008 Recreational Guidelines	National Health and Medical Research Council (NHMRC) (2008) Recreational Water Quality Guidelines; or 10 x Australian Drinking Water Guidelines (NHMRC, 2011, updated August 2018). For volatile compound the drinking water criteria were adopted without a 10 x factor calculation.
NEMP V2.0	Heads of EPA (HEPA) (2020) Per- and Poly-fluorinated Substances (PFAS) National Environmental Management Plan (NEMP) V 2.0 - Health-based guidance values for recreational use -Ecological water quality guidelines for interm marine 95% and 99% protection. Note that 99% protection levels should be adopted for slightly to moderately disturbed systems, rather than 95% protection. However, the limit of reporting (LOR) achievable by Australian laboratories is higher than the 95% criteria for perfluorooctanesulfonic acid (PFOS) and the LOR is typically adopted instead of the 99% criteria
EIS Chapter 19	The lowest concentrations presented for Lowland Rivers and Estuaries were adopted. Criteria are also provided for turbidity, dissolved oxygen and temperature but the quality of intercepted groundwater pumped to water treatment plants with respect to these parameters will more likely reflect construction processes and ambient temperatures, rather than in situ groundwater quality

EC - Electrical Conductivity
TDS - Total Dissolved Solids
N - Nitrogen
P - Phosphorous
PFOS - Perfluorooctanesulfonic acid
- data not available

Mn - Manganese
Co - Cobalt
As - Arsenic
Zn - Zinc
Fe - Iron
Ni - Nickel
Cu - Copper

data not extracted by ERM as all concentrations in the station area are below the adopted water quality guidelines, or the LOR in the case of PFOS

Source: Summary data has been extracted from Senversa, (May 2021), Factual Contamination Investigation Report- The Bays, 000013/11868 White Bay Site Investigations.

Monitoring Well Information		Survey Data				Gauging Data										
Well ID	Well Cover Type	Easting	Northing	Ground Surface	Top of Casing	Date Gauged	Total Well Depth	Depth to Water	Depth to LNAPL	LNAPL Thickness	Assumed LNAPL Density*	Corrected Depth to Water	Reduced Water Level	Well Condition	Headspace PID	Observations
		(GDA94)	(GDA94)	(mAHD)	(mAHD)		(mBTOC)	(mBTOC)	(mBTOC)	(m)		(mBTOC)	(mAHD)		(ppm)	
S02_s	Gatic	331460.58	6251156.18	3.110	2.99	3/05/2021	5.66	2.05	-	-			0.940	New	1.2	excellent recharge
S02_d	Gatic	331460.68	6251155.41	3.110	3	4/05/2021	15.03	2.13	-	-			0.870	New	1.2	sulphurous odour
S40_s	Gatic	331525.61	6251052.18	3.600	3.49	6/05/2021	7.87	2	-	-			1.490	New	0.9	yellow/orange sediment present
S40_d	Gatic	331524.4	6251052.32	3.680	3.66	6/05/2021	15.12	3.48	-	-			0.180	New	1.4	
S06	Gatic	331417.04	6251088.99	3.130	3.04	3/05/2021	20.44	2.152	-	-			0.888	New	1.6	
S51	Gatic	331585.35	6251221.78	4.150	4.01	7/05/2021	5.80	3.58	-	-			0.430	New	0.8	
S54	Gatic	331555.39	6251143.2	3.590	3.53	5/05/2021	16.61	3.02	-	-			0.510	New	6	hydrocarbon odour
S55	Gatic	331646.15	6251129.87	3.130	3.03	5/05/2021	5.86	2.77	-	-			0.260	New	0.3	
S58_s	Gatic	331728	6251092.44	3.240	3.15	6/05/2021	5.63	1.72	-	-			1.430	New	8.7	gatic flooded
S58_d	Gatic	331724.04	6251093.77	3.220	3.13	7/05/2021	20.85	16.12	-	-			*	New	3.1	purged dry, sampled with footvalve

Monitoring Well Information			Water Quality Stabilised Results									
Well ID	Well Cover Type	Date Sampled	DO (mg/L)	EC (µS/cm)	Calculated TDS (mg/L)	pH	ORP (mV)	Temp (°C)	Volume Purged	Field Observations	Sampling Method	Recharge Ability
			±10% (1)	±3% (1)	±3% (1)	±0.05 (1)	±10mV (1)	±10%	(L)			
S02_s	Flush	3/05/2021	0.06	870	566	7.0	-129	23.4	11.3	Non-turbid, colourless, no odour with no sheen	Low Flow	Good >0.4L/min
S02_d	Flush	4/05/2021	0.52	2002	1301	6.5	-199	21.4	16.2	Highly turbid, brown, sulphurous odour with no Sheen	Low Flow	Good >0.4L/min
S40_s	Flush	6/05/2021	0.99^	890	579	6.8	-4	21.5	8.0	Slightly turbid, colourless, no odour with no sheen	Low flow	Avg 0.1-0.4L/min
S40_d	Flush	6/05/2021	0.76	12620	8203	7.2	-10	20.8	13.4	Slightly turbid, colourless, no odour with no sheen	Low flow	Avg 0.1-0.4L/min
S06	Flush	3/05/2021	0.35	2025	1316	6.5	-96	21.4	14.0	Non-turbid, colourless, no odour with no sheen	Low flow	Good >0.4L/min
S51	Flush	7/05/2021	0.16	1690	1099	7.3	-123	23.7	6.6	Slightly turbid, colourless, no odour with no sheen, bubble/fizz reaction in VOC vial	Low flow	Avg 0.1-0.4L/min
S54	Flush	5/05/2021	<0.05*	14590	9484	5.9	-114	22.1	16.8	Slightly turbid, colourless, No odour with no sheen	Low flow	Good >0.4L/min
S55	Flush	5/05/2021	0.5	48270	31376	7.4	63	21.5	6.8	Non-turbid, colourless, no odour with no sheen	Low flow	Avg 0.1-0.4L/min
S58_s	Flush	6/05/2021	1.29	730	475	7.2	37	22.1	12.0	Slightly turbid, yellow, no odour with no sheen	Grab	Poor <0.1L/min
S58_d	Flush	7/05/2021	<0.05*	1490	969	6.1	-35	23.9	6.0	Moderately turbid, colourless, no odour with no sheen	Low flow	Avg 0.1-0.4L/min

APPENDIX III. SITE SPECIFIC TRIGGER VALUES

Elaborated site specific trigger values to evaluate groundwater quality:

Site	Unit	Sydney Olympic Park	Tunnel SOP-NS	Tunnel-NW of SOP	Burwood	Five Dock
Calcium - Dissolved	mg/L	499.2	168	1680	192	92.4
Potassium - Dissolved	mg/L	504	79.2	372	42	24
Sodium - Dissolved	mg/L	4032	5040	12000	2640	1356
Magnesium - Dissolved	mg/L	568.8	492	1068	324	55920
Hardness	mgCaCO3/L	2760	2400	8400	1800	600
Hydroxide Alkalinity (OH-) as CaCO3	mg/L	50	50	50	117.6	50
Bicarbonate Alkalinity as CaCO3	mg/L	1800	648	216	636	930
Carbonate Alkalinity as CaCO3	mg/L	50	32.4	50	50	50
Total Alkalinity as CaCO3	mg/L	1800	648	216	834	930
Sulphate, SO4	mg/L	660	660	2880	648	576
Chloride, Cl	mg/L	8100	7560	21600	4800	2160
Ionic Balance	%	22.8	14.4	10.8	10.596	7.344
Ammonia (as N in water)	mg/L	348	2.4	6	0.552	11.88
Nitrate as N in water	mg/L	3.72	2.04	0.228	0.756	2.04
Total Nitrogen in water	mg/L	372	3.72	7.44	1.44	12
Dichlorodifluoromethane	µg/L	100	100	100	100	100
Chloromethane	µg/L	100	100	100	100	100
Vinyl Chloride	µg/L	10	10	10	10	10
Bromomethane	µg/L	10	10	10	10	10
Chloroethane	µg/L	100	100	100	100	100
Trichlorofluoromethane	µg/L	100	100	100	100	100
1,1-Dichloroethene	µg/L	10	10	10	10	10
Trans-1,2-dichloroethene	µg/L	10	10	10	10	10
1,1-dichloroethane	µg/L	10	10	10	10	10
Cis-1,2-dichloroethene	µg/L	3.6	10	10	10	10
Bromochloromethane	µg/L	10	10	10	10	10
Chloroform	µg/L	10	10	10	1.2	10
2,2-dichloropropane	µg/L	10	10	10	10	10
1,2-dichloroethane	µg/L	10	10	10	10	10
1,1,1-trichloroethane	µg/L	10	10	10	10	10
1,1-dichloropropene	µg/L	10	10	10	10	10
Cyclohexane	µg/L	15.6	10	10	10	10
Carbon tetrachloride	µg/L	1	1	1	1	1
Benzene	µg/L	76.8	1	1	1	1
Dibromomethane	µg/L	10	10	10	10	10
1,2-dichloropropane	µg/L	10	10	10	10	10

Site	Unit	Sydney Olympic Park	Tunnel SOP-NS	Tunnel-NW of SOP	Burwood	Five Dock
Trichloroethene	µg/L	1	1	1	1	1
Bromodichloromethane	µg/L	1	1	1	1	1
trans-1,3-dichloropropene	µg/L	10	10	10	10	10
cis-1,3-dichloropropene	µg/L	10	10	10	10	10
1,1,2-trichloroethane	µg/L	10	10	10	10	10
Toluene	µg/L	3.6	1.2	10	10	10
1,3-dichloropropane	µg/L	10	10	10	10	10
Dibromochloromethane	µg/L	10	10	10	10	10
1,2-dibromoethane	µg/L	10	10	10	10	10
Tetrachloroethene	µg/L	10	10	10	10	10
1,1,1,2-tetrachloroethane	µg/L	10	10	10	10	10
Chlorobenzene	µg/L	42	10	10	10	10
Ethylbenzene	µg/L	2.4	10	10	10	10
Bromoform	µg/L	10	10	10	10	10
m+p-xylene	µg/L	2.4	20	20	20	20
Styrene	µg/L	10	10	10	10	10
1,1,2,2-tetrachloroethane	µg/L	10	10	10	10	10
o-xylene	µg/L	1.2	10	10	10	10
1,2,3-trichloropropane	µg/L	10	10	10	10	10
Isopropylbenzene	µg/L	6	10	10	10	10
Bromobenzene	µg/L	10	10	10	10	10
n-propyl benzene	µg/L	6	10	10	10	10
2-chlorotoluene	µg/L	10	10	10	10	10
4-chlorotoluene	µg/L	10	10	10	10	10
1,3,5-trimethyl benzene	µg/L	10	10	10	10	10
Tert-butyl benzene	µg/L	10	10	10	10	10
1,2,4-trimethyl benzene	µg/L	2.4	10	10	10	10
1,3-dichlorobenzene	µg/L	10	10	10	10	10
Sec-butyl benzene	µg/L	1.2	10	10	10	10
1,4-dichlorobenzene	µg/L	10	10	10	10	10
4-isopropyl toluene	µg/L	10	10	10	10	10
1,2-dichlorobenzene	µg/L	10	10	10	10	10
n-butyl benzene	µg/L	10	10	10	10	10
1,2-dibromo-3-chloropropane	µg/L	1	1	1	1	1
1,2,4-trichlorobenzene	µg/L	10	10	10	10	10
Hexachlorobutadiene	µg/L	1	1	1	1	1
1,2,3-trichlorobenzene	µg/L	10	10	10	10	10
TRH C6 - C9	µg/L	264	100	100	100	100
TRH C6 - C10	µg/L	300	100	100	100	48
TRH C6 - C10 less BTEX (F1)	µg/L	216	100	100	100	48
Benzene	µg/L	76.8	1	1	1	1

Site	Unit	Sydney Olympic Park	Tunnel SOP-NS	Tunnel-NW of SOP	Burwood	Five Dock
Toluene	µg/L	3.6	1.2	10	10	10
Ethylbenzene	µg/L	2.4	10	10	10	10
m+p-xylene	µg/L	2.4	20	20	20	20
o-xylene	µg/L	1.2	10	10	10	10
Naphthalene	µg/L	28.8	10	10	10	10
TRH C10 - C14	µg/L	996	216	156	500	500
TRH C15 - C28	µg/L	1800	180	1000	516	156
TRH C29 - C36	µg/L	132	1000	1000	1000	1000
Total +ve TRH (C10-C36)	µg/L	2760	396	156	864	156
TRH >C10 - C16	µg/L	1320	228	168	684	500
TRH >C10 - C16 less Naphthalene (F2)	µg/L	1320	228	168	684	500
TRH >C16 - C34	µg/L	1440	168	1000	228	216
TRH >C34 - C40	µg/L	240	1000	1000	1000	1000
Total +ve TRH (>C10-C40)	µg/L	2760	384	168	912	216
Naphthalene	µg/L	28.8	10	10	10	10
Acenaphthylene	µg/L	10	10	10	10	10
Acenaphthene	µg/L	0.12	10	10	10	10
Fluorene	µg/L	10	10	10	10	10
Phenanthrene	µg/L	0.12	1	1	1	1
Anthracene	µg/L	1	1	1	1	1
Fluoranthene	µg/L	1	1	1	1	1
Pyrene	µg/L	10	10	10	10	10
Benzo(a)anthracene	µg/L	10	10	10	10	10
Chrysene	µg/L	10	10	10	10	10
Benzo(b,j+k)fluoranthene	µg/L	20	20	20	20	20
Benzo(a)pyrene	µg/L	1	1	1	1	1
Indeno(1,2,3-c,d)pyrene	µg/L	10	10	10	10	10
Dibenzo(a,h)anthracene	µg/L	10	10	10	10	10
Benzo(g,h,i)perylene	µg/L	10	10	10	10	10
Benzo(a)pyrene TEQ	µg/L	50	50	50	50	50
Total +ve PAH's	µg/L	21.6	10	10	10	10
Perfluorobutanesulfonic acid	µg/L	0.264	0.024	0.1	0.1	0.036
Perfluoropentanesulfonic acid	µg/L	0.192	0.1	0.1	0.1	0.1
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.468	0.024	0.1	0.1	0.048
Perfluoroheptanesulfonic acid	µg/L	0.012	0.1	0.1	0.1	0.1
Perfluorooctanesulfonic acid PFOS	µg/L	0.276	0.1	0.1	0.1	0.024
Perfluorodecanesulfonic acid	µg/L	0.192	0.2	0.2	0.2	0.552
Perfluorobutanoic acid	µg/L	2.4	0.2	0.2	0.2	0.2

Site	Unit	Sydney Olympic Park	Tunnel SOP-NS	Tunnel-NW of SOP	Burwood	Five Dock
Perfluoropentanoic acid	µg/L	0.528	0.2	0.2	0.2	0.168
Perfluorohexanoic acid	µg/L	1.068	0.012	0.012	0.1	0.18
Perfluoroheptanoic acid	µg/L	0.264	0.1	0.1	0.1	0.036
Perfluorooctanoic acid PFOA	µg/L	0.78	0.1	0.1	0.1	0.06
Perfluorononanoic acid	µg/L	0.12	0.1	0.1	0.1	0.1
Perfluorodecanoic acid	µg/L	0.2	0.2	0.2	0.2	0.2
Perfluoroundecanoic acid	µg/L	0.2	0.2	0.2	0.2	0.2
Perfluorododecanoic acid	µg/L	0.5	0.5	0.5	0.5	0.5
Perfluorotridecanoic acid	µg/L	1	1	1	1	1
Perfluorotetradecanoic acid	µg/L	5	5	5	5	5
4:2 FTS	µg/L	0.1	0.1	0.1	0.1	0.1
6:2 FTS	µg/L	0.192	0.1	0.072	0.36	0.156
8:2 FTS	µg/L	0.2	0.2	0.2	0.2	0.2
10:2 FTS	µg/L	0.2	0.2	0.2	0.2	0.2
Perfluorooctane sulfonamide	µg/L	1	1	1	1	1
N-Methyl perfluorooctane sulfonamide	µg/L	0.5	0.5	0.5	0.5	0.5
N-Ethyl perfluorooctanesulfonamide	µg/L	1	1	1	1	1
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.5	0.5	0.5	0.5	0.5
N-Et perfluorooctanesulfonamid oethanol	µg/L	5	5	5	5	5
MePerfluorooctanesulf-amid oacetic acid	µg/L	0.2	0.2	0.2	0.2	0.2
EtPerfluorooctanesulf-amid oacetic acid	µg/L	0.12	0.2	0.2	0.2	0.2
Total Positive PFHxS & PFOS	µg/L	0.708	0.024	0.1	0.1	0.1
Total Positive PFOA & PFOS	µg/L	1.032	0.1	0.1	0.1	0.1
Total Positive PFAS	µg/L	5.64	0.024	0.084	0.36	0.552
Arsenic-Dissolved	µg/L	32.4	2.4	1	20.4	3.6
Boron-Dissolved	µg/L	2280	408	516	120	72
Barium-Dissolved	µg/L	6840	240	204	43.2	82.8
Beryllium-Dissolved	µg/L	5	0.84	5	5	5
Cadmium-Dissolved	µg/L	0.12	0.24	0.1	0.48	0.12
Chromium-Dissolved	µg/L	19.2	1	2.4	1	1
Copper-Dissolved	µg/L	13.2	7.2	24000	39.6	13.2
Cobalt-Dissolved	µg/L	13.2	28.8	1.2	1.2	156

Site	Unit	Sydney Olympic Park	Tunnel SOP-NS	Tunnel-NW of SOP	Burwood	Five Dock
Mercury-Dissolved	µg/L	0.05	0.05	0.05	0.05	0.05
Manganese-Dissolved	µg/L	357.6	1440	4080	1092	52800
Molybdenum-Dissolved	µg/L	74.4	31.2	20.4	6	3.6
Nickel-Dissolved	µg/L	58.8	168	144	33.6	312
Lead-Dissolved	µg/L	1	1	1	1	1
Antimony-Dissolved	µg/L	4.8	4.8	2.4	3.6	1.2
Selenium-Dissolved	µg/L	2.4	1	1	1	1
Tin-Dissolved	µg/L	10	10	10	1.2	10
Zinc-Dissolved	µg/L	216	132	112.8	18	288
Iron-Dissolved	µg/L	6936	4200	1800	2400	1440
Arsenic-Total	µg/L	9.6	14.4	2.4	10.8	10.8
Boron-Total	µg/L	2040	408	528	108	84
Barium-Total	µg/L	7080	1032	252	192	276
Beryllium-Total	µg/L	1.08	20.4	5	1.2	3.6
Cadmium-Total	µg/L	0.48	2.04	0.1	0.12	1.8
Chromium-Total	µg/L	63.6	46.8	19.2	19.2	60
Copper-Total	µg/L	49.2	372	108000	348	240
Cobalt-Total	µg/L	50.4	120	2.4	7.2	300
Mercury-Total	µg/L	0.05	0.6	0.096	0.05	0.096
Manganese-Total	µg/L	312	4560	2760	1200	84000
Molybdenum-Total	µg/L	74.4	30	24	6	4.8
Nickel-Total	µg/L	64.8	192	117.6	31.2	372
Lead-Total	µg/L	74.4	204	7.2	10.8	57.6
Antimony-Total	µg/L	6	3.6	2.4	3.6	2.4
Selenium-Total	µg/L	2.4	2.4	1	1	1
Tin-Total	µg/L	3.6	1.2	1.2	7.2	8.4
Zinc-Total	µg/L	360	1032	99.6	103.2	996
Iron-Total	µg/L	20400	91200	11040	13200	15600

APPENDIX IV. CONSULTATION

In accordance with C14(d) the Groundwater Monitoring Program was prepared in consultation with the following government agencies and stakeholders:

- Sydney Olympic Park Authority
- DPIE – Water.

The attached supporting evidence has been included to demonstrate compliance with Condition of Approval (CoA) A6 in the development of the Groundwater Monitoring Program.

The Groundwater Monitoring Program was provided to the required agencies and stakeholders for consultation as follows:

C14(d) Groundwater Monitoring Program Consultation		
Government Agency/Stakeholder	**Date consulted**	**Date of Response**
Sydney Olympic Park Authority	24/08/2021	08/09/2021
DPIE – Water	24/08/2021	No comments received.

Erran Woodward

From: Matthew Marrinan <Matthew.Marrinan@transport.nsw.gov.au>
Sent: Monday, 20 September 2021 9:15 AM
To: nrar.servicedesk@dpie.nsw.gov.au
Cc: Stuart Hodgson; John Ieroklis; Matthew Todd-Jones; Lorryn Williamson; Erran Woodward; Michael Woolley
Subject: Re: Sydney Metro West - CTP documentation review

Dear NRAR Service Desk,

As of this morning the review of the Central Tunnelling Package (CTP) documentation for Sydney Metro West is closed. You were provided two documents on 20 August 2021:

- The AFJV Surface Water Monitoring Program; and
- The AFJV Groundwater Monitoring Program.

During the time period for the review we did not receive any comments from you, but made inquiries in relation to whether there is a point of contact outside the Service Desk, and the email below requesting your comments urgently if you intend to make some. As we have not heard from you, we are now assuming there is no intent to make comment on the documentation.

We understand you may have other priorities at this time and if you would like to discuss Sydney Metro West with me in the future, please get in touch via my contact details below.

Kind regards,

Matthew Marrinan
Senior Manager Environment
Sydney Metro West
Transport for NSW

M 0475 966 938
Level 40, 680 George Street, SYDNEY 2000
PO Box K659, HAYMARKET NSW 1240

From: Matthew Marrinan
Sent: Thursday, September 9, 2021 2:27 PM
To: nrar.servicedesk@dpie.nsw.gov.au <nrar.servicedesk@dpie.nsw.gov.au>
Cc: Stuart Hodgson <Stuart.Hodgson@transport.nsw.gov.au>
Subject: Sydney Metro West - CTP documentation review

Dear NRAR Service Desk,

Recently Sydney Metro provided documentation through the service desk with respect to Sydney Metro West and the review of two Monitoring programs under Planning Approval SSI 10038.

These documents related to our Central Tunnelling Package (CTP) and the review under Condition C14 for the Surface Water Quality and Groundwater Monitoring Programs produced by Acciona Ferrovial JV (AFJV).

I am following up with you because we have not received any comments at this stage and the review period has expired.

Could you please get in touch with me urgently if it is still your intention to provide Sydney Metro with comments on these documents?

Kind Regards,

Matthew Marrinan
Senior Manager Environment
Sydney Metro West
Transport for NSW

M 0475 966 938
Level 40, 680 George Street, SYDNEY 2000
PO Box K659, HAYMARKET NSW 1240

From: Richard Seaward
To: Erran Woodward
Cc: Vivienne Albin; Sally Hamilton; Julie Currey
Subject: SOPA consolidated comments
Date: Wednesday, 8 September 2021 10:32:13 AM
Attachments: AFJV Comments Review sheet - SOPA CONSOLIDATED COMMENTS.xlsx

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Hi Erran,

I hope that you are well and thank you for allowing SOPA more time to review and provide comments on the Sub plans after the meeting we had

Please find the attached consolidated comments on the documents. I understand that these are quite high-level given the current stage in the process, however, as discussed SOPA is committed to working with the Metro team throughout the project.

Please let me, Sally or Vivienne know if you have any queries on the comments

Kindest regards

Richard Seaward
Urban Planner
Sydney Olympic Park Authority
(02) 9714 7146 | 0452583337
Richard.Seaward@sopa.nsw.gov.au
Level 8, 5 Olympic Boulevard, Sydney Olympic Park, NSW, 2127
sydneyolympicpark.com.au

We acknowledge the Wangal as the first Custodians of the land, air and waters now known as Sydney Olympic Park. We pay respect to all First Nations People and our community Elders past, present and emerging.

REVIEW COMMENTS SHEET

DATE	COMPANY	RAISED BY	REVIEW DOC. NO.*	DOCUMENT REF*	COMMENTS / RESPONSE
16/09/2021	SOA	SHAMILTON	SMWSTCTP-AFJ-1NL-PE-PLN-000006	General	Groundwater is proposed to be discharged into local waterways. No specific information about discharge points at Sydney Olympic Park is provided. Note that stormwater from the Sydney Olympic Park construction site discharges to the freshwater wetland known as the Northern Water Feature, which is habitat for the endangered Green and Golden Bell Frog, and an alternate discharge route will be required to discharge groundwater to Haslams Creek. - Comment by KD
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	General	AFJV have not yet determined exactly where the WTP will be situated and therefore where the discharge point will be. This will be determined as part of the Temporary Works Design and the the EPL. Location of discharge point will need to discussed in detail with SOPA as part of the ongoing consultation and ongoing working relationship AFJV will have with SOPA.
16/09/2021	SOA	SHAMILTON	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 6.3.5	p23/23 s6.3.5 - discharge performance criteria - this section assumes discharge will be into estuaries. Project documents (both the Groundwater Plan and the Flora and Fauna Plan) must confirm that groundwater will not be discharged into the Northern Water Feature - Comment by KD
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 6.3.5	AFJV have not yet determined exactly where the WTP will be situated and therefore where the discharge point will be. This will be determined as part of the Temporary Works Design and the the EPL. Location of discharge point will need to discussed in detail with SOPA as part of the ongoing consultation and ongoing working relationship AFJV will have with SOPA.
16/09/2021	SOA	JCURREY	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Table 4-1	Table 4-1 notes the presence of contaminated groundwater approx. 200m from the construction site. However tunnelling works will go directly beneath the Golf Driving Range which will contain contaminated groundwater (leachate) this groundwater may potentially interact with the project migrating through fractured rock. The risk of leachate being present or migrating into deeper aquifers and potentially interacting with tunnelling works should be acknowledged.
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Table 4-1	Note that this Monitoring Program is currently only for the civil component of the works, and therefore, the site establishment and station box excavation. AFJV are aware of the potential drawdown from the station box excavation as well, and are aware that there is a risk of contaminated groundwater migrating towards the station box. AFJV is currently investigating this in more detail through the development of the Revised Groundwater Modelling Report and Detailed Site Investigations. The WTP is being designed to treat all groundwater to a standard that is currently listed in the GW Monitoring Program, however, these parameters as trigger values are subject to change as a result of this discharge impact assessment that is required and the Project's EPL requirements. Ongoing consultation with SOPA will occur throughout the Project to ensure potential impacts are minimised.
16/09/2021	SOA	JCURREY	SMWSTCTP-AFJ-1NL-PE-PLN-000006	General	Routine groundwater monitoring undertaken by SOPA in the area of the Former Golf Driving Range Landfill and P3 car park is not referenced as a source of data.
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	General	Groundwater background data was either documents in the EIS or received by SM as an information document. Additional groundwater data from SOPA will be welcomed and will be used to assist in the management of groundwater in the SOP area.
16/09/2021	SOA	JCURREY	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 6.3	Section 6.3 - Should acknowledge that fs landfill leachate is encountered this cannot be lawfully discharge to receiving waters.
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 6.3	If landfill leachate is encountered during tunnelling, this will be managed as part of the contaminated land scope. Further consultation around this matter will occur over the coming months.
16/09/2021	SOA	JCURREY	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 3.3.2	Section 6.3.2 indicated groundwater monitoring w=ill be undertaken for EC. How will the project monitor for leachate migration into the area of the tunnelling works?
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 3.3.2	Groundwater quality monitoring around the station box will be undertaken, which will assist in determining the migration of both saline water and any contaminated groundwater migration.

DATE	COMPANY	RAISED BY	REVIEW DOC. NO.*	DOCUMENT REF*	COMMENTS / RESPONSE
16/09/2021	SOA	JCURREY	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 6.3.3	Section 6.3.3 - when tunnelling underneath the landfill at SOP leachate ingress into the tunnel works may occur in the period before the tunnel is sealed. Any leachate contamination would result in all groundwater being treated as leachate. What is proposed to minimise this risk?
11/10/2021	AFJV	CW	SMWSTCTP-AFJ-1NL-PE-PLN-000006	Section 6.3.3	Note that this Monitoring Program is currently only for the civil component of the works, and therefore, the site establishment and station box excavation. As stated, if there is leachate ingress into the tunnel, groundwater will need to be managed as leachate and will be managed as part of the contamination scope.