

PROJECT MANAGEMENT PLAN

Water Reuse Strategy

Sydney Metro West – Western Tunnelling Package

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DOCUMENT CONTROL

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

Revision History

Revision	Date	Description of changes	Prepared by	Approved by
A	07.06.2022	Issued to SM for review		
B	06.07.2022	SM comments addressed		
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Management reviews

Review date	Details	Reviewed by

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Terms and Definitions

Term	Definition
CEMF	Construction Environmental Management Framework
CoA	(Minister's) Conditions of Approval
EIS	Environmental Impact Statement
GA	Gamuda Australia
GLC	Gamuda Australia and Laing O'Rourke Consortium
IS	Infrastructure Sustainability
ISC	Infrastructure Sustainability Council
MSF	Maintenance and Stabling Facility
(the) Project	Western Tunnelling Package
REMM	Revised Environmental Management Measures
SMP	Sustainability Management Plan
SMW	Sydney Metro West
SOP	Sydney Olympic Park
TBM	Tunnel Boring Machine
WRS	Water Reuse Strategy (the Strategy)
WTP	Water Treatment Plant

1 INTRODUCTION

1.1 Project Description

Sydney Metro West (SMW) is a new 24-kilometre metro line between Westmead and Sydney CBD providing turn-up-and-go metro services. The planning approvals and environmental impact assessment for SMW will be broken down into several stages recognising the size of SMW. This includes:

- SMW at a Concept level
- Stage 1 – All major civil construction works between Westmead and The Bays including station excavation and tunnelling
- Stage 2 – All stations, depots and rail systems between Westmead and The Bays.
- Stage 3 – Major civil construction works including station excavation, tunnels, stations, depots and rail systems between The Bays and the Sydney CBD Station, and operation of the line.

The Western Tunnelling Package (the Project) is an enabling package for SMW. It involves nine kilometres of twin railway tunnels between Sydney Olympic Park and Westmead. Key components of the package include the following:

- Westmead Station box excavation, including temporary support, stub tunnels, partially mined station cavern and crossover cavern including permanent lining and support
- Parramatta Station, including excavation of station box and associated support
- Clyde Maintenance and Stabling Facility (MSF), including permanent dive structure, portal, spur running tunnels, spur tunnel junction cavern, bulk earthworks, civil structures, utilities corridor, road crossing and creek diversion
- Rosehill Services Facility, including shaft excavation, permanent lining, and lateral support
- A precast segment manufacturing facility at Eastern Creek
- Demolition and site clearance works at the following construction sites:
 - Westmead metro station construction site
 - Parramatta metro station construction site
 - Clyde MSF.

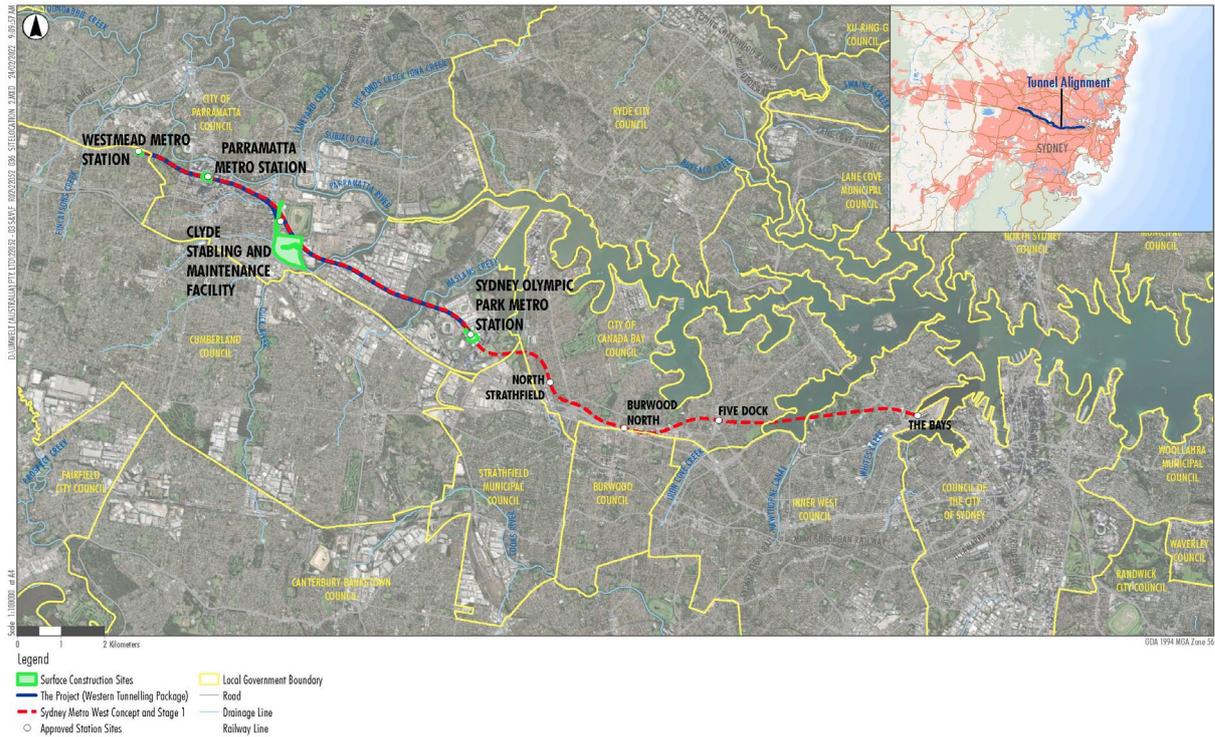


Figure 1 Western Tunnelling Package Project Sites

1.2 Context

This Water Reuse Strategy (WRS) has been developed as part of the Gamuda Australia Laing O'Rourke Consortium (GLC) Sustainability Management Plan (SMP) (SMWSTWTP-GLO-1NL-SB-PLN-000001) for the SMW Western Tunnelling Package (the Project). The SMP has been developed for the delivery of the Project.

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

2 PURPOSE AND SCOPE

2.1 Purpose

The WRS describes the water reuse management approach that will be utilised by GLC and subcontractors during construction of the Project. This strategy forms an integral part of the Project SMP. It applies to all works associated with the Project and establishes the environmental management controls relating to water reuse to be implemented by GLC and subcontractors.

The WRS will address the water reuse requirements of the:

- NSW Minister for Planning’s Conditions of Approval (COA)
- Sydney Metro Construction Environmental Management Framework (CEMF)
- Revised Environmental Management Measures (REMM)
- Station Boxes and Tunnelling Works Deed including the environmental requirements of the General Specification and Particular Specification.
- Infrastructure Sustainability Council (ISC) Infrastructure Sustainability (IS) Rating Tool requirements.

2.2 Scope

The WRS outlines the measures GLC will use to address water usage during the construction of the Project, while complying with relevant approvals, statutory and contract requirements.

2.3 Objectives and Targets

The key objectives of this Strategy are to ensure that potable water use is minimised, and non-potable alternatives are utilised whenever possible, in accordance with the CoA. The relevant condition and how it has been addressed in this Strategy, is outlined in Table 1.

Table 1: Ministers Conditions of Approval relevant to Water Reuse

Conditions	Description	Document Reference
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:	This document
	(a) evaluation of reuse options;	Section 4
	(b) details of the preferred reuse option(s), including volumes of water to be reused (please refer Appendix A), proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required;	Section 4.1
	(c) measures to avoid misuse of recycled water as potable water;	Section 6.2
	(d) consideration of the public health risks from water recycling; and	Section 4.1.2
	(e) time frame for the implementation of the preferred reuse option(s).	Section 4 and B

Conditions	Description	Document Reference
	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.	Section 4.1
	Justification must be provided to the Planning Secretary if it is concluded that no reuse options prevail.	Section 4
	A copy of the Water Reuse Strategy must be made publicly available.	Section 8.2
	Nothing in this condition prevents the Proponent from preparing separate Water Reuse Strategies for the construction phases of Stage 1 of the CSSI.	Noted

This Strategy has also been prepared to address the contractual requirements outlined in the Project General Specification and Particular Specification. The requirements and where they are addressed is outlined in Table 2 below.

Table 2 Project contractual requirements

Conditions	Description	Document reference
PS 3.4.4.1 a)	The Tunnelling Contractor must undertake a water balance study and submit it to the Principal's Representative (prior to the commencement of Project Works and Temporary Works) that identifies the sources, uses and estimated quantities of potable and non-potable water which will be either created or used in the performance of the Tunnelling Contractor's Activities.	Section 4 and Appendix A
PS 3.4.4.1 b)	The Tunnelling Contractor must ensure that the water balance study in Item (a) above identifies initiatives to reduce water demand and use non-potable water, which must be adopted in order to achieve the targets set out in Section 2.8.2 of the General Specification.	Section 6.1, Appendix A and Appendix B
PS 3.4.4.1 c)	The Tunnelling Contractor must undertake a water balance study and submit it to the Principal's Representative, prior to the commencement of Design Stage 2 and again prior to the commencement of Project Works and Temporary Works, that identifies the sources, uses and estimated quantities of potable and non-potable water which will be either created or used in the operation of the Project Works and Temporary Works.	Appendix A, Appendix B
PS 3.4.4.1 d)	The Tunnelling Contractor must ensure that the water balance study in Item (c) above identifies initiatives to reduce water demand and use non-potable water, which must be adopted in order to achieve both the design-stage sustainability rating and the performance targets set out in Section 2.8 (Sustainability) of the General Specification.	Appendix A, Appendix B

The following water management objectives and requirements, shown in Table 3, have been established through the project deed, in particular the Project General Specification and Particular Specification. The tool to measure performance and the forecasted progress against the requirement is also included in Table 3 below.

Table 3: Water use targets and performance criteria

Objective	Requirement	Measurement tool	Forecasted Response
Manage water wisely and maximise reuse.	At least 10% reduction in water use, based on an approved baseline	Measurement of water use against base case	10%
	At least 40% of water used is from non-potable sources	Measurement of water reuse, calculated as a proportion of total water use	52%
	Reuse a portion of concrete production water at onsite and offsite batching plants.	Measurement of water reuse at the concrete batch plant, calculated as a proportion of total water use	Captured water will be treated for reuse in the operation of the concrete batching plant and/or precast operations.
	Not exceeding 257,968 kilolitres of water from the potable water main in the Tunnelling Contractor's Activities	Measurement of water use	166, 930 kL
	Use at least 180,578 kilolitres of water from sources other than the potable water main in the Tunnelling Contractor's Activities	Measurement of water use	261, 498 kL

GLC's approach to managing water use in accordance with the Project Environment and Sustainability requirements in delivery of the Project also includes the IS rating tool requirements. GLC's targets and measurement tools are detailed in Table 4.

Table 4: IS Rating Tool Targets applicable to water usage

Objective	Targets	Measurement Tools
Meet IS rating tool requirements and objectives applicable to water usage detailed in the Sustainability Management Plan	<p>Level 2 for credit IS Wat-1 'Water use monitoring and reduction', demonstrating 10% reduction in water use compared to base case through monitoring and modelling of water use.</p> <p>Level 1.2 for credit IS Wat-2 'Replace potable water', demonstrating 40% of water use is from non-potable water sources through monitoring and modelling.</p>	<p>Water Modelling</p> <p>Water Metering</p>

3 WATER SOURCES

3.1 Potable Water (mains)

Potable water will be provided to the Project from the Sydney Water supply network. This supply is metered and is the cleanest and safest water to use from a human health perspective. Drinking and handwashing water will always be supplied by potable water. Where the use of recycled water sources is not reasonable and feasible, such as laundry services onsite, then potable water will also be used.

3.2 Surface Water

Due to space limitations, there is minimal opportunity to capture surface water in any significant volume except for Eastern Creek. At Parramatta, Westmead, Rosehill and Clyde, surface water will be treated through Blue Book compliant erosion and sediment controls and diverted to the existing stormwater system.

3.3 Groundwater

Treated groundwater presents the greatest opportunity amongst the water source options for water reuse due to the consistency and volume of supply.

On the Project, groundwater will enter the tunnel construction areas from the surrounding water table. Groundwater ingress and any residual construction water (from mined tunnel activities, for example), along with any rainwater collected in the box excavations, will be combined, and pumped to the surface as one stream. This stream will then be processed through a water treatment plant to meet the NSW EPA endorsed site specific discharge criteria.

3.4 Rainwater

Rainwater is a highly variable water source and provides relatively small volumes compared to other water source options. Rainwater runoff from building rooves is considered a relatively clean source of water. Despite the variable nature of rainfall, some rainwater capture will be facilitated across the alignment with rainwater tanks connected to primary site shed rooves wherever practical.

In addition, rainwater tanks will be installed at the Eastern Creek precast concrete yard for reuse for batching plant operations.

3.5 Other Water Sources

Where Sydney Water recycled water network connections are available, these will be considered depending on water quality. A reticulated treated recycled water service may be available at the Sydney Olympic Park site, and this will be investigated further.

Alternative water sources such as blackwater (wastewater from toilet systems), greywater (wastewater from basins and sinks), and sewage are known to contain high microbial quality. As a result, these sources are not considered feasible for reuse.

4 EVALUATION OF WATER REUSE OPTIONS

GLC are committed to best practice water management on the Project. The use of recycled water will be prioritised over the use of potable water on all sites where suitable quality, volume, and flow is available. The supply of recycled water will be dependent on rainfall, groundwater inflow, construction activities, and storage capacity at each site.

4.1 Considerations for Water Reuse

The following water reuse considerations are based on best practice and advice has been sought from relevant agencies websites, as required.

4.1.1 Water Restrictions

The current status of water restrictions across New South Wales is displayed in the Bureau of Meteorology's Water Restrictions website, and for metropolitan Sydney:

<https://www.sydneywater.com.au/SW/water-the-environment/what-we-re-doing/waterrestrictions/index.htm>

According to the Sydney Water Corporation *Water Wise Guidelines* it is currently permissible for building and construction sites to use non-potable water to:

- clean paths, driveways, concrete or other paved areas for health, safety, emergency, or surface contamination reasons and for construction activities using a handheld hose fitted with an instant on-off mechanism, such as a trigger nozzle, or high-pressure water cleaning equipment
- for dust suppression if there is no alternative water source (such as recycled water) reasonably available
- safely operate cutting, drilling and tunnelling equipment, or for pipe jetting.

4.1.2 Public Health

According to NSW Health, all forms of household wastewater may pose a risk to human health and the environment:

<https://www.health.nsw.gov.au/environment/water/Pages/wastewater.aspx>

Because of the risk associated with these household types of wastewaters, these streams will not be reused on the Project.

4.1.3 Emergency Response Systems

To ensure the protection of human health, some emergency response systems, such as fire sprinkler systems and personal protection equipment (e.g., eye baths), are subject to specifications and standards (e.g., AS 2118.1:2017). Generally, these systems require potable water inputs to ensure there are no potential issues such as corrosion of lines, etc.

4.2 Non-potable and Potable Water Use

A detailed forecast of potable and non-potable water consumption across the Project has been completed at Design Stage 2 to determine the total projected water reuse quantities. The projected reduction in water use across the Project has also been determined. Table 5 below summarises potable and non-potable water use based on project sites, noting that the aim is to meet the 40% water reuse requirement. It is also noted that the data presented for Rosehill, Clyde Dive, TBM Tunnels and Clyde MSF is presented as a whole as water collected from each of these four sites will be treated via Water Treatment Plant 1 located at Rosehill site before being reuse in each of the sites, hence no differentiation can be established.

Further detail on water consumption per site, broken down into specific construction activities, is provided in Appendix A: Water balance study. Details around initiatives which have been implemented to reduce total water consumption are also provided in Appendix A (Water Use Reduction Waterfall Chart and Base Case Summary). The information presented in Appendix A has been obtained from the Design Stage 2 Water Model. A copy of the complete Design Stage 2 Water Model has been provided in Appendix B for reference.

Table 5: Non-potable and potable water use per site

Site/location	Total Water demand (kL)	Potable Water use (kL)	Non-potable water use (kL)	Percentage of Non-potable replacement
Project offices	6,332	6,332	-	0%
Site Offices (considered separately from site location)	14,203	12,380	1,823	12%
Precast Yard	53,912	19,847	33,747	63%
Westmead	46,264	24,230	22,033	48%
Parramatta	38,238	22,325	14,726	38%
Rosehill	28,808	81,815	189,168	70%
Clyde Dive + Spur tunnels and cavern junctions	31,410			
TBM Tunnels and cross passages	171,881			
Clyde MSF	38,899			
Total	429,947	166,930	261,498	52%

5 IMPLEMENTATION AND MONITORING

The following section describes the system of water reuse and the monitoring proposed for the Project construction works.

5.1 Rainwater Harvest

Where practicable, rainwater will be harvested off the roofs of all temporary site sheds and offices, including:

- Eastern Creek Precast Facility
- Clyde MSF
- Rosehill
- Westmead
- Parramatta
- Clyde Dive

Storage tanks will be installed at all compounds to facilitate reuse. For details on sizes and predicted water capture based off current weather data, please see Appendix A or Table 5.

5.2 Surface Water Capture

A sediment basin at Eastern Creek (Precast Yard) was constructed by the enabling contractor prior to GLC access to the site. The basin is licensed and currently in operation. Captured water is used for dust suppression, including water carts. It will not be in operation for the full delivery of the works.

Given the land constraints at the other sites, there are no current plans to install further sediment basins. If future basins are required, however, they will be designed in accordance with the Blue Book. The exact location, size and management of each sediment basin will be detailed in the site erosion and sediment control plan (ESCP).

5.3 Groundwater Reuse

During tunnel construction, groundwater ingress will not be significant until excavations are extended below the local groundwater table levels. At this point, the groundwater ingress will be collected and pumped to a specific water treatment plant where water will be treated to meet the NSW EPA endorsed discharge criteria. The water treatment system layout for construction is detailed in Figure 2 and Figure 4 and the handover network for operation is detailed in Figure 5. The staging of works in relation to the water treatment plants is summarised below:

- Tunnel excavation works will commence after approximately six months of construction. The Clyde Dive, Rosehill and Clyde MSF sites will transfer construction/groundwater water to a single large water treatment plant (WTP 1), and this will be operational at the commencement of the tunnel excavation.
- At the completion of the Rosehill Service Facility, the Tunnel Boring Machines (TBMs) will launch and migrate eastward to Sydney Olympic Park (SOP) station. Water generated by construction of the tunnel and from Rosehill Service facility will be directed to WTP 1, which will be located at Rosehill.
- Once the works between the Rosehill Service Facility and SOP station are finished, a new treatment plant will be put in place (WTP 5) that will receive water generated by the constructed tunnel at handover.
- The TBMs will then be taken back to Rosehill Service Facility and re-launched westward toward Westmead station, where they are expected to breakthrough at Westmead Station.

Water generated by construction of the tunnels and from Rosehill Station will be directed to WTP 1.

- After completion of the TBM tunnel works to Westmead, WTP 1 & WTP 2 (located at Rosehill and Parramatta respectively) will work in parallel treating water generated from the constructed tunnel between Rosehill and the tunnel spur junction, Rosehill Service Facility and the Clyde Dive site. WTP 1 will operate until handover.
- WTP 2 and WTP 3 will be located at Parramatta and Westmead stations respectively. They will collect water generated during construction of these stations. Once construction is completed for these stations and the TBMs have been retrieved, handover will occur.
- WTP2 will remain after handover and will manage water generated by the construction of the boxes and the tunnel alignment between Paramatta and Westmead.
- On handover, WTP 5 will remain and treat all tunnel water between Rosehill and Parramatta along with the spur junction and Clyde Dive.
- WTP 4 will be constructed at the Eastern Creek Precast Facility. This water treatment plant will be used for the sole purpose of collecting, treating, and providing re-use water for use within the facility
- In summary at handover the following water treatment plants will remain on the project:
 - WTP 5 at Rosehill service facility
 - WTP 2 at Parramatta Station
- The following water treatment plants will cease operation and be demobilised at the end of construction and will not be handed over to Sydney Metro:
 - WTP 1 at Rosehill
 - WTP 3 at Westmead
 - WTP 4 at Eastern Creek

The water treatment plants are further summarised in Table 6.

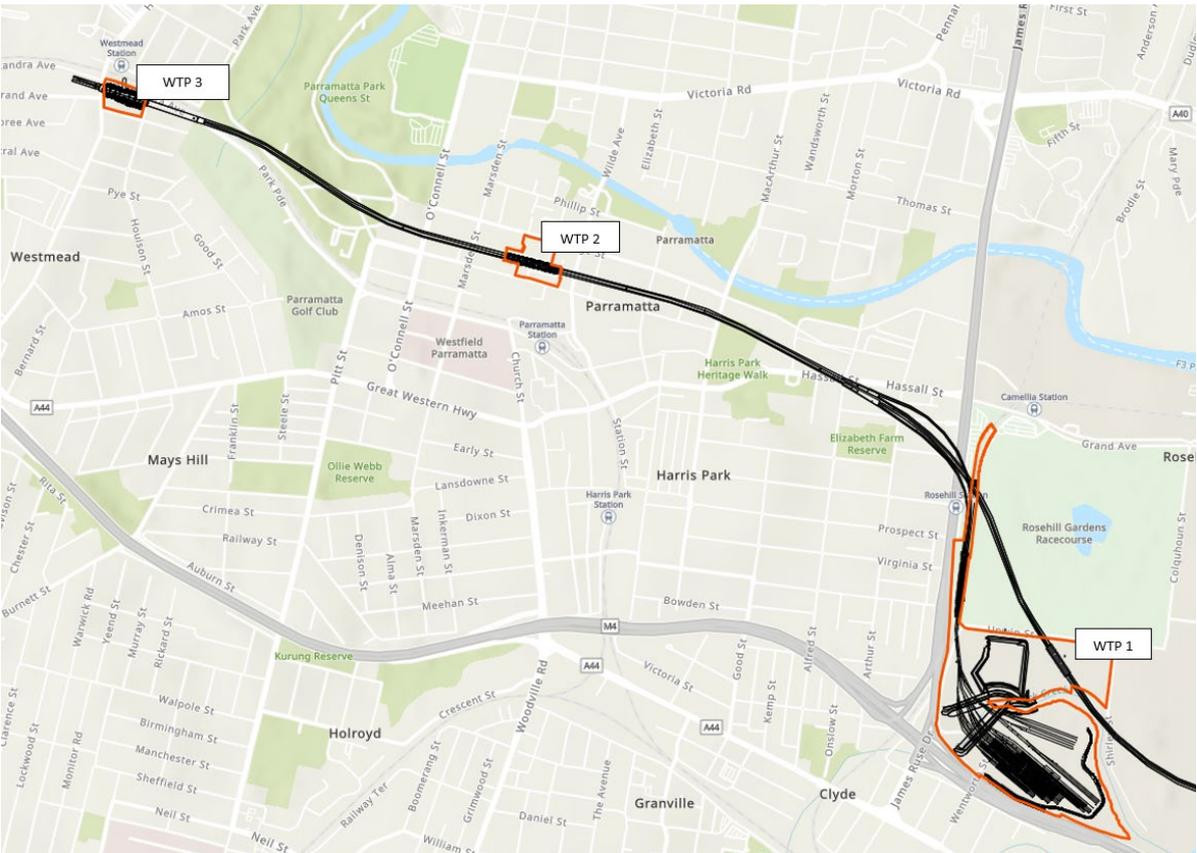


Figure 2: Location of WTP 1, 2 and 3.

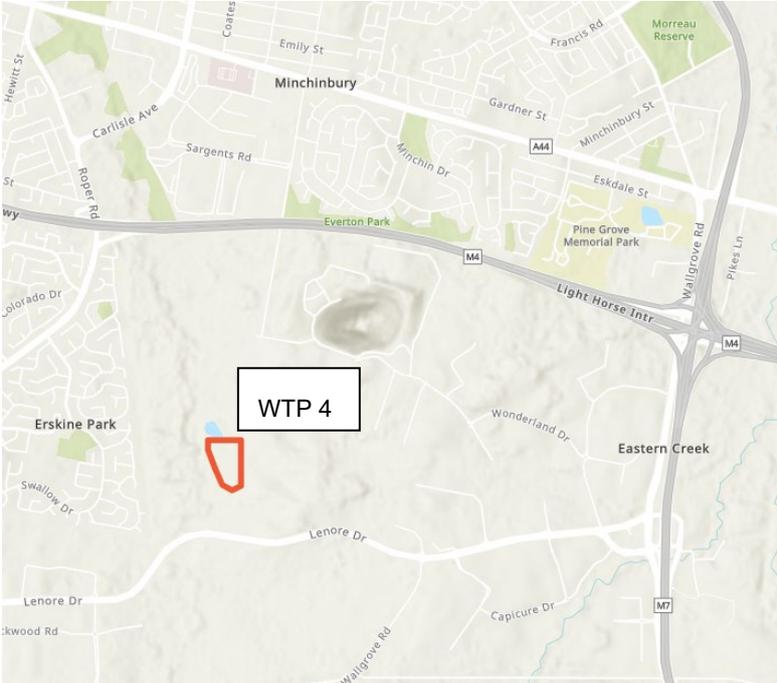


Figure 3 Location of WTP 4



Figure 4: Rosehill - Clyde Dive - Clyde MSF Recycled Water Network (Indicative)

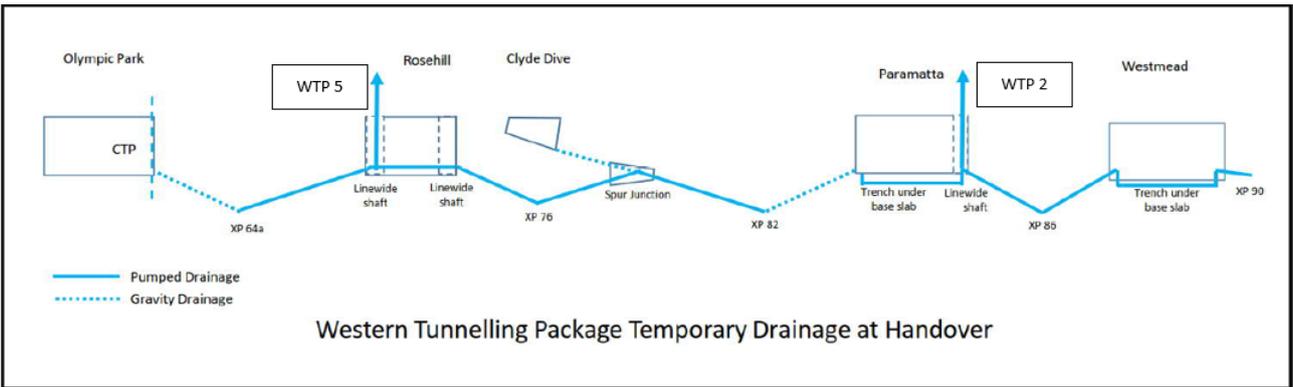


Figure 5: WTP handover dewater network

Table 6: Water treatment plant summary

WTP	WTP Inflow Description	Capacity	From Location	To Location	Post Construction (handover) Treatment Plant
1	TBM process water and groundwater seepage. Rosehill service facility groundwater seepage. Clyde dive, tunnel spurs and Clyde spur junction groundwater seepage, rainfall and washdown water Clyde MSF rainfall and washdown water	Treats 50L/s (Holds 50kL of recycled water)	Clyde Dive, MSF and TBM Tunnels between Rosehill - Paramatta	Rosehill	WTP 5
2	Paramatta Station Box excavation and TBM Tunnels between paramatta and Westmead Rainfall	Treats 10L/s (Holds 25kL of recycled water)	Westmead	Paramatta	Remain at handover
3	Westmead Station Box and Road header Spurs	Treats 10L/s (Holds 35kL of recycled water)	Westmead	Westmead	WTP 2
4	Eastern Creek Precast Facility	Treats 2L/s (Holds 10kL of recycled water)	Eastern Creek	Eastern Creek	N/A
5	TBM tunnel between SOP and Rosehill. Clyde Dive, MSF and TBM Tunnels between Rosehill -Paramatta	Treats 5L/s – 10L/s	Paramatta & SOP	Rosehill	Remain at handover

Once sufficient volumes of groundwater are captured and treated, water will be directed to holding tanks for reuse. Activities currently identified to utilise the treated groundwater include:

- TBM industrial circuit (please refer to Table 5, Appendix A or Appendix B for more details)
- Dust suppression during rock cutting
- Dust suppression and lubrication for underground activities
- Fill conditioning and compaction
- General surface and equipment washing
- Wheel washing, and
- Toilet flushing (if practical).

Table 7 lists the predicted maximum groundwater ingress rates at each of the station excavation sites and is the total amount possible to capture and reuse.

Table 7: Maximum groundwater ingress rates

Station Excavated Sites (Shaft or Station)	Estimated Inflow Rates (m ³ /day)
Rosehill	118.1
Clyde Dive	111
Parramatta	138.8
Westmead	100

At the Eastern Creek Precast Facility, all operationally used water will be cycled through the water treatment plant and at least 80% of this water will be reused in the precast washdown and yard operations.

6 MITIGATION MEASURES

6.1 Water Minimisation

GLC will reduce the amount of water required for construction works wherever possible to ensure sustainable water management. This will be achieved through implementing a range of initiatives throughout design and construction with the aim to reduce overall water use, including:

- Optimised design or scope to reduce water requirements during construction
- Utilising polymer for dust suppression to minimise water required to spray down stockpiles and dusty areas
- Utilising DGB/gravel on temporary pavements to minimise dust suppression requirements
- Installation of water efficient fittings such as taps, toilets, showers, and appliances
- Utilising dry vacuum trucks opposed to wet.

6.2 Monitoring Water Use

To measure consumption and ensure compliance, GLC will utilise existing mains connections and install additional metering devices at the following locations shown in Table 8:

Table 8: Potential water meter locations

Site/Scope	Potential metering locations
Pre-cast Yard	<ul style="list-style-type: none"> ● Mains supply ● Rainwater tank(s) ● Water Treatment Plant discharge point ● Water treatment plant reuse tank(s) ● Batch plant operations
Clyde	<ul style="list-style-type: none"> ● Mains supply ● Rainwater tank(s)
Rosehill	<ul style="list-style-type: none"> ● Mains supply ● Water treatment plant discharge point (with contribution from Clyde) ● Water treatment plant reuse tank(s) ● Rainwater tank(s)
Westmead	<ul style="list-style-type: none"> ● Mains supply ● Rainwater tank(s) ● Water Treatment Plant discharge point ● Water treatment plant reuse tank(s)
Parramatta	<ul style="list-style-type: none"> ● Mains supply ● Rainwater tank(s) ● Water Treatment Plant discharge point ● Water treatment plant reuse tank(s)

GLC will avoid the misuse of recycled water on site through taking the following actions:

- The water pipes will be marked to visually indicate the water type contained in each pipe
- Toolbox awareness training to inform work crews of the water reuse system

- Smart metering will be installed on critical junctions, and data will help determine flow rate trends, and determine water recycle rates. If unexpected trends occur, these will be investigated.

7 COMPLIANCE MANAGEMENT

7.1 Roles and Responsibilities

The GLC Project teams’ organisational structure and overall roles and responsibilities are outlined in the SMP. Key roles with regards to the management of water use are identified in Table 9.

Table 9: Roles and responsibilities relevant to water use

Roles	Authority and Responsibilities
Environment and Sustainability Manager	<ul style="list-style-type: none"> • Develop and implement this Strategy • Oversee water usage monitoring • Oversee compliance tracking and reporting • Oversee maintenance of all water usage records • Engage suitably qualified consultants to support implementation, as required • In consultation with the Construction Manager, drive the sustainability agenda, and oversee the investigation and reporting of incidents arising from water usage
Sustainability Manager / Sustainability Advisors	<ul style="list-style-type: none"> • Complete inspections and monitoring • Complete reporting and associated data collection • Respond to water use incidents and non-conformances • Review and improve water use practices • Educate the project team about resource scarcity and why it is relevant on the Project
Project Manager/s	<ul style="list-style-type: none"> • Ensure resources and directions are provided to workforce to implement water reuse options and measures described in this strategy
Supervisor/s	<ul style="list-style-type: none"> • Ensure teams are aware of the water network available on site (i.e., potable, and non-potable) and the safe and suitable uses of each water source.
Plant Manager/s	<ul style="list-style-type: none"> • Design/Implement a Project wide reuse water network • Ensure that water connections are labelled, and any recycled lines are clearly identified (e.g., different coloured pipes). • Ensure that water recycling is undertaken safely, and the appropriate metering is in place.
All personnel	<ul style="list-style-type: none"> • Notify Site Supervisor of any observations of water leakages, irregularities of water treatment plants including physical deformities, irregular odour, or visual difference in water quality of used water. • Identify further opportunities for water reuse.

7.2 Reporting Requirements

To ensure compliance with this Strategy and the Project sustainability commitments, GLC will prepare monthly sustainability data reports and quarterly sustainability performance reports which will both include the total potable and non-potable water consumed during the period.

Throughout construction, water consumption and reuse will be reviewed as part of quarterly internal sustainability audits. Annual external sustainability audits will also be conducted and will include review of water reuse performance against targets.

Data collected will form evidence for the Project ISC ratings.

8 REVIEW AND IMPROVEMENT

Continuous improvement of water recycling will be undertaken by the ongoing review and evaluation of water reuse performance against the Project sustainability targets. Continual improvement will be achieved through regular measurement, evaluation, audit, and management review.

8.1 Document Update

This strategy is a dynamic document. The processes described above may result in the need to update or revise the document. This will occur as needed and may only be approved by the Environment and Sustainability Manager, or delegate.

8.2 Distribution

All GLC personnel and contractors will have access to this Strategy via the Project document control management system.

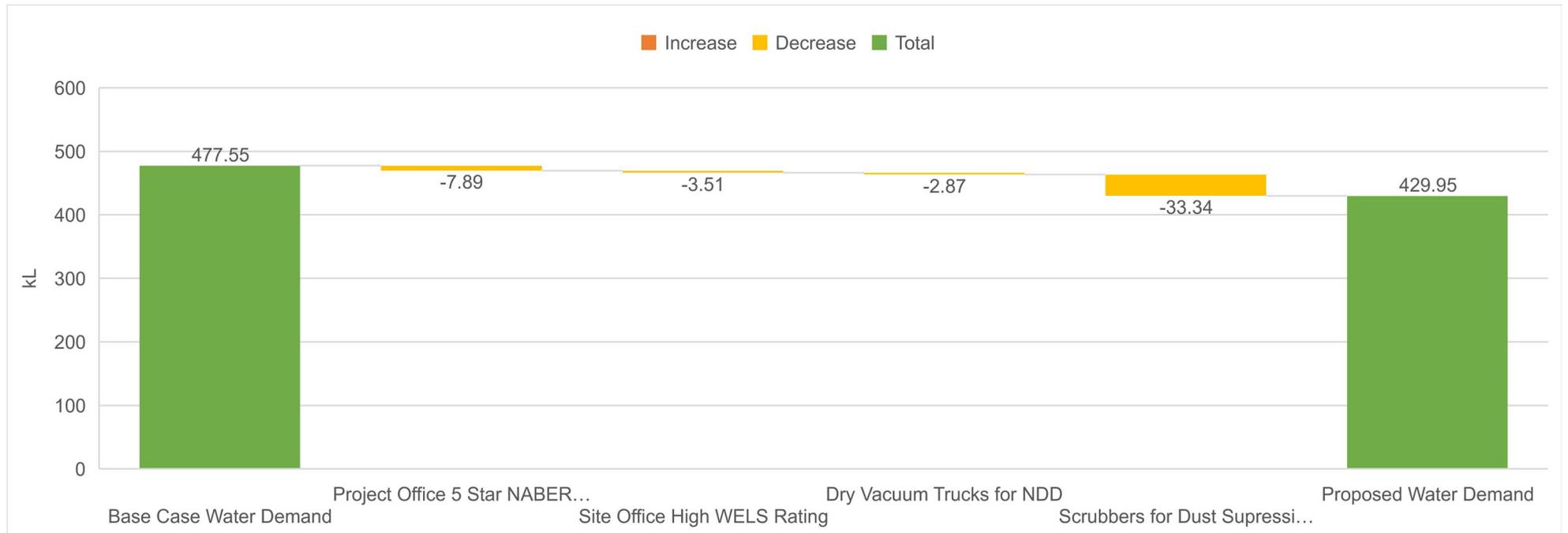
As required by CoA D79, this Strategy will also be made publicly available.

A APPENDIX – WATER BALANCE STUDY

Summary

Item	Unit	Value	Notes / source
Design life	years	100	Not used - Construction water only
Delivery period (design and construction)	months	39	GLC construction program (April 2022 - July 2025)
Actual case			
Total water uses during delivery	ML	430	
Monthly water uses during delivery	ML/month	11	
Annual operational water use	ML/year	0.0	Not Applicable to Western Tunnelling Package
Total water uses over the full infrastructure lifecycle (BCD)	ML	430	
Base case			
Total water uses during delivery	ML	478	
Monthly water uses during delivery	ML/month	NA	
Annual operational water use	ML/year	0.0	Not Applicable to Western Tunnelling Package
Total water uses over the full infrastructure lifecycle (ACD)	ML	478	
Summary			
Water Use Monitoring and Reduction			
Percentage reduction compared to base case	%	10%	
ISCA level claimed for Wat-1	#	2.00	
Replace Potable Water			
Total water uses over the full infrastructure lifecycle	ML	430	Limited to water use where substitution with non-potable is feasible
Total non-potable water uses over the full infrastructure lifecycle	ML	261	
Percentage substitution with non-potable water	%	52%	
ISCA level claimed for Wat-2	#	1.56	

Water Use Reduction Waterfall Chart



Base Case Adjustments

ID	Site	Initiative	Base Case assumption	Comment	Water saving (kL)
1	Project Office	Selected project office has a 5 Star NABERS Water rating	3 Star NABERS is considered BAU		7,886
2	Site offices	Site offices have high WELS rating for fixtures, particularly for washing machines	Green Star standard practice efficiencies used for Base Case		3,507
3	All	Use of Dry vacuum trucks for Non-destructive digging activities, potholing, trenching	Wet vacuum trucks	The first 4 month of data across all sites have been collected to establish an average daily demand for activities necessitating vacuum trucks. Water saving data over wet vacuum trucks have been communicated by Ward Group (subcontractor) https://www.wardgroup.com.au/dryvacs/	2,867
4	Spur tunnels and Junction caverns	Use of tunnel scrubbers for dust suppression	Mist for road headers		33,339
Total					47,600

Non-Potable Water Summary

Item	Value	Unit
Recycled Water Available	62,281	kL
Rainwater Available	7,146	kL
Groundwater/reclaimed water Available	327,993	kL
Total Re-usable Water Available	397,419	kL
Total Water use	429,947	kL
Recycled Water Used	223,903	kL
Substitutable Construction Demand met by Recycled Water	52%	%

Offices

Project Offices

Project Offices	Base Case	Actual Case	Units
	Total Demand	Total Demand	
Main (60 Station Street)	10,374	2,488	kL
Other	3,844	3,844	kL
Total Project Offices	14,218	6,332	kL

Site Offices

Site Facility - End Use	Base Case	Actual Case	Units
	Total Demand	Total Demand	
Toilets	1,339	1,153	kL
Urinals	1,339	670	kL
Basins	1,750	1,519	kL
Showers	7,151	6,626	kL
Dishwashers	0	0	kL
Drinking water	196	196	kL
Laundry	2,885	990	kL
Cleaning	791	791	kL
Portaloo	2,257	2,257	kL
Total Site Facilities	17,710	14,203	kL

Precast Yard

Activity	Sent back to WTP4 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to Rainwater tank? (Yes/No)	Connected to recycled water from WTP4? (Yes/No)	Total (kL)
Dust suppression	No	Yes	No	No	6,850
Wheel wash	Yes	No	Yes	Yes	12,675
Road sweepers	No	Yes	No	No	2,283
Washdown	Yes	No	Yes	Yes	4,650
Washdown	Yes	No	Yes	Yes	16,740
Curing Chamber	Yes	No	No	No	10,714

Westmead

Activity	Description	Sent back to WTP3 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP2? (Yes/No)	Total (kL)
Road sweepers	Site adjacent roads cleaning	No	Yes	No	2,417
Wheel wash	Wheel wash bays at site entrances and exits	Yes	No	Yes	14,808
Plant washdown	Plant washdown	Yes	No	Yes	1,580
Dust suppression	Surface Dust suppression activities	No	Yes	No	7,250
Tunnelling - Crossover cavern	Cooling of Plant	No	Yes	Yes	3,706
Tunnelling - Crossover cavern	Road header - mist for dust control	No	Yes	Yes	6,468
Tunnelling - Crossover cavern	Road headers - Washdown of cut face	No	Yes	Yes	647
Tunnelling - Crossover cavern	Drilling Rigs / Bolters	No	Yes	Yes	1,421
Tunnelling - Cavern/Nozzle enlargements	Cooling of Plant	No	Yes	Yes	1,437
Tunnelling - Cavern/Nozzle enlargements	Road header - mist for dust control	No	Yes	Yes	2,508
Tunnelling - Cavern/Nozzle enlargements	Road headers - Washdown of cut face	No	Yes	Yes	251
Tunnelling - Cavern/Nozzle enlargements	Drilling Rigs / Bolters	No	Yes	Yes	341
Tunnelling - Stub tunnels	Cooling of Plant	No	Yes	Yes	756
Tunnelling - Stub tunnels	Road header - mist for dust control	No	Yes	Yes	1,320
Tunnelling - Stub tunnels	Road headers - Washdown of cut face	No	Yes	Yes	132
Tunnelling - Stub tunnels	Drilling Rigs / Bolters	No	Yes	Yes	1,222

Parramatta

Activity	Description	Sent back to WTP2 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP2? (Yes/No)	Total (kL)
Piling/Grouting	Bentonite for diaphragm wall - East end	No	No	No	6,900
Piling/Grouting	Bentonite for diaphragm wall - West end	No	No	No	5,700
Road sweepers	Site adjacent roads cleaning	No	Yes	No	2,267
Wheel wash	Wheel wash bays at site entrances and exits	Yes	No	Yes	14,198
Plant washdown	Plant washdown	Yes	No	Yes	1,490
Dust suppression	Surface Dust suppression activities	No	Yes	No	6,800
Tunnelling - Nozzle enlargements Cycle 1	Cooling of Plant	No	No	Yes	227
Tunnelling - Nozzle enlargements Cycle 1	Road header - mist for dust control	No	No	Yes	396
Tunnelling - Nozzle enlargements Cycle 1	Road headers - Washdown of cut face	No	No	Yes	40
Tunnelling - Nozzle enlargements Cycle 2	Cooling of Plant	No	No	Yes	76
Tunnelling - Nozzle enlargements Cycle 2	Road header - mist for dust control	No	No	Yes	132
Tunnelling - Nozzle enlargements Cycle 2	Road headers - Washdown of cut face	No	No	Yes	13

Rosehill

Activity	Description	Sent back to WTP1 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP1? (Yes/No)	Total (kL)
Piling/Grouting	Bentonite for diaphragm wall - East end	No	No	No	3,600
Piling/Grouting	Bentonite for diaphragm wall - West end	No	No	No	3,150
Road sweepers	Site adjacent roads cleaning	No	Yes	No	2,167
Wheel wash	Wheel wash bays at site entrances and exits	Yes	No	Yes	13,102
Plant washdown	Excavation machines washdown (excludes tunnelling machines)	Yes	No	Yes	290
General washdown	Estimated demand from activities in spoil shed area, TBM laydown area, fabrication workshop, precast segments area etc	Yes			-
Dust suppression	Dust suppression activities during excavation works (excluding tunnelling works)	No	Yes	No	6,500

Clyde Dive & Spur Tunnels

Activity	Description	Sent back to WTP1 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP1? (Yes/No)	Total (kL)
Tunnelling - Temp shaft to Junction SRT01	Cooling of Plant	No	No	Yes	4,538
Tunnelling - Temp shaft to Junction SRT01	Road headers - Washdown of cut face	No	No	Yes	396
Tunnelling - Temp shaft to Junction SRT01	Drilling Rigs / Bolters	No	No	Yes	700
Tunnelling - Temp shaft to Junction SRT02	Cooling of Plant	No	No	Yes	4,991
Tunnelling - Temp shaft to Junction SRT02	Road headers - Washdown of cut face	No	No	Yes	436
Tunnelling - Temp shaft to Junction SRT02	Drilling Rigs / Bolters	No	No	Yes	608
Tunnelling - STJ01&02 junction caverns concurrently	Cooling of Plant	No	No	Yes	4,235
Tunnelling - STJ01&02 junction caverns concurrently	Road headers - Washdown of cut face	No	No	Yes	370
Tunnelling - STJ01&02 junction caverns concurrently	Drilling Rigs / Bolters	No	No	Yes	1,262
Tunnelling - temp shaft to Dive structure SRT01	Cooling of Plant	No	No	Yes	2,420
Tunnelling - temp shaft to Dive structure SRT01	Road headers - Washdown of cut face	No	No	Yes	211
Tunnelling - temp shaft to Dive structure SRT01	Drilling Rigs / Bolters	No	No	Yes	167

Tunnelling - temp shaft to Dive structure SRT02	Cooling of Plant	No	No	Yes	3,025
Tunnelling - temp shaft to Dive structure SRT02	Road headers - Washdown of cut face	No	No	Yes	264
Tunnelling - temp shaft to Dive structure SRT02	Drilling Rigs / Bolters	No	No	Yes	83
Plant Washdown	Clyde Dive excavation plant Washdown	Yes	No	No	325
Road sweepers	Site adjacent roads cleaning	No	Yes	No	1,992
Wheel wash	Wheel wash bays at site entrances and exits	Yes	No	Yes	3,071
Dust suppression	Dust suppression activities during excavation works (excluding tunnelling works)	No	Yes	No	2,317

TBM & Cross Passages

Activity	Description	Sent back to WTP1 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Served by recycled water from WTP1? (Yes/No)	Totals
TBM Cooling Water	Make-up water to compensate Drift Loss, Evaporation Loss, and Purge bleed	No	No	Yes	4,095
TBM Cooling Water	Make-up water to compensate Drift Loss, Evaporation Loss, and Purge bleed	No	No	Yes	4,269
TBM Industrial Water	Includes TBM foam water, TBM cleaning water, conveyors water (+sprinklers). Cross passage water (19.45kL/day) accounted for separately	No	No	Yes	36,789
TBM Industrial Water	Includes TBM foam water, TBM cleaning water, conveyors water (+sprinklers). Cross passage water (19.45kL/day) accounted for separately	No	No	Yes	38,355
Grout Batching Plant	Grout for TBM rings external volume fill	No	No	Yes	39,457
Grout Batching Plant	Grout for TBM rings external volume fill	No	No	Yes	41,136
Cross Passages Works	Includes water usage for excavation, rock sawing, rock bolting	No	No	Yes	7,780

Clyde MSF

Activity	Description	Sent back to WTP1 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP1? (Yes/No)	Total (kL)
General site works	Hydro-demolition and other water use throughout demolition works (East of Wentworth Street) and through construction of piles, capping beams, retaining walls, WCS etc.	No	No	Yes	356
General site works	Hydro-demolition and other water use throughout demolition works (East of Wentworth Street) and through construction of piles, capping beams, retaining walls, WCS etc.	No	No	No	89
Earthworks	Soil moisture control for fill material	No	No	Yes	18,000
Dust suppression	Dust suppression throughout earthworks	No	Yes	No	7,080
Plant Washdown	Plant washdown	Yes	No	Yes	560
Street Sweeper	Site adjacent roads cleaning	No	Yes	No	1,967
Wheel wash	Wheel wash bays at site entrances and exits	Yes	No	Yes	10,847

B APPENDIX – DESIGN STAGE 2 WATER MODEL

Summary tab

Version	Date	Author	Notes
For Stage 2 issue	31/10/2022	Larso Horvath	



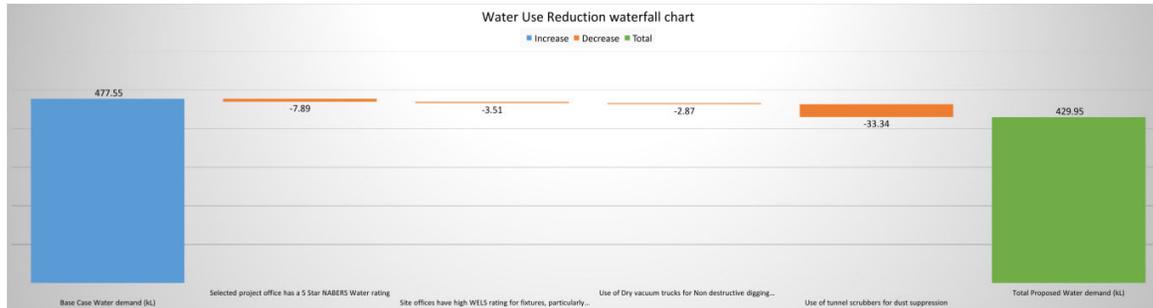
A. Water Summary

Name	Unit	Value	Notes / Source
Design life	years	100	Not used - Construction water only
Delivery period (design and construction)	months	39	GLC construction program (April 2022 - July 2025)
ACTUAL CASE			
Total water use during delivery	ML	430	
Monthly water use during delivery	ML/month	11	
Annual operational water use	ML/year	0.0	Not Applicable to Western Tunnelling Package
Total water use over the full infrastructure lifecycle (BC _L)	ML	430	
BASE CASE			
Total water use during delivery	ML	478	
Monthly water use during delivery	ML/month	NA	
Annual operational water use	ML/year	0.0	Not Applicable to Western Tunnelling Package
Total water use over the full infrastructure lifecycle (AC _L)	ML	478	
Summary			
Water Use Monitoring and Reduction			
Percentage reduction compared to base case	%	10.0%	
BCA level claimed for Wat-1	#	2.00	
Replace Potable Water			
Total water use over the full infrastructure lifecycle	ML	430	Limited to water use where substitution with non-potable is feasible (i.e. no significantly negative environmental, social or economic impacts)
Total non-potable water use over the full infrastructure lifecycle	ML	224	
Percentage substitution with non-potable water	%	52.1%	
BCA level claimed for Wat-2	#	1.96	

B. Breakdown per site

Site/location	Total Water demand (kL)	Potable Water demand (kL)	Non-potable water demand	Potable Water use (kL)	Non-potable water use (kL)	Note
Project offices	6,112	6,112	-	6,112	-	
Site Offices (considered separately from site location)	14,203	11,380	1,823	12,390	1,823	
Precast Yard	53,912	19,847	34,065	19,847	33,747	
Westmead	46,364	9,667	36,697	24,230	22,018	
Carramatta	38,238	11,667	16,572	-	22,575	
Roughley	28,908	11,417	13,992	-	-	
Cyde Drive - Spur tunnels and cavern junctions	13,410	4,623	26,777	-	-	
TBM Tunnels and cross passages	171,881	-	171,881	-	-	
Cyde MSF	38,899	9,135	29,763	83,815	189,188	Water collection from each of these four sites are treated via Water Treatment Plant 3 located at Roughley site before being reuse in each of the sites, hence no differentiation can be established
Total	429,947	59,677	330,870	146,530	514,458	

C. Water Use Reduction waterfall chart



Base Case adjustments for Water

Version	Date	Author	Notes
For Stage 2 issue	21/10/2022	Laszlo Horvath	



A. Initiatives summary and associated savings

ID	Site	Initiative	Base Case assumption	Comment	Water saving (kL)
1	Project Office	Selected project office has a 5 Star NABERS Water rating	3 Star NABERS is considered BAU		7,886
2	Site offices	Site offices have high WELS rating for fixtures, particularly for washing machines	Green Star standard practice efficiencies used for Base Case		3,507
3	All	Use of Dry vacuum trucks for Non destructive digging activities, potholing, trenching	Wet vacuum trucks	The first 4 month of data across all sites have been collected to establish an average daily demand for activities necessitating vacuum trucks. Water saving data over wet vacuum trucks have been communicated by Ward Group (subcontractor) https://www.wardgroup.com.au/dryvac/	2,867
4	Spur tunnels and junction caverns	Use of tunnel scrubbers for dust suppression	Mist for roadheaders		33,339
<insert above>	<insert above>	<insert above>	<insert above>	<insert above>	<insert above>
Total					47,600

B. Initiatives calculations details

ID	Initiative
3	Use of Dry vacuum trucks for Non destructive digging activities, potholing, trenching

Site	Vac trucks activities start date	Vac trucks activities end date	Total months	Average of water saved/trucks.day (L)	Trucks.days per month	Estimated savings (kL)
Precast Yard	NA	NA	NA	NA	NA	0
Westmead	NA	NA	NA	NA	0	0
Parramatta	20/07/2022	28/01/2023	6	3000	1	19
Rosehill	19/04/2022	14/12/2022	8	4957	12	468
Clyde Dive	2/05/2022	7/11/2022	6	3429	3.5	75
Clyde MSF	26/05/2022	14/12/2023	19	4946	25	2306

ID	Initiative
4	Use of tunnel scrubbers for dust suppression

Item No	Activity	Description	Average consumption per appropriate unit (/day, /week, /no etc)	Unit	Equivalent weekly demand (kL/week)	Comment/assumption	Start	Finish	Duration (weeks)	Estimated savings (kL)
1.2	Tunnelling - Temp shaft to Junction SRT01	Roadheader - mist for dust control		48 kL/day	264	10 Nozzles x 50L/hr x 4 faces	14/02/2023	7/09/2023	29	7731
2.2	Tunnelling - Temp shaft to Junction SRT02	Roadheader - mist for dust control		48 kL/day	264	10 Nozzles x 50L/hr x 4 faces	13/03/2023	30/10/2023	33	8712
3.2	Tunnelling - ST.J01&02 junction caverns concurrently	Roadheader - mist for dust control		96 kL/day	528	10 Nozzles x 50L/hr x 4 faces, 2 roadheaders	8/09/2023	15/12/2023	14	7392
4.2	Tunnelling - temp shaft to Dive structure SRT01	Roadheader - mist for dust control		48 kL/day	264	10 Nozzles x 50L/hr x 4 faces	1/05/2023	22/08/2023	16	4262
5.2	Tunnelling - temp shaft to Dive structure SRT02	Roadheader - mist for dust control		48 kL/day	264	10 Nozzles x 50L/hr x 4 faces	31/10/2023	18/03/2024	20	5242

Western Tunnelling Package - Non-potable water use summary

Construction

To substitute potable water with non-potable water, the quality of the non-potable water must be suitable for it's purpose, and it must be possible to source the water in a sustainable, sensible manner (i.e. no significant negative environmental, social or economic impacts)

The following approach has been used for Non-potable water usage calculations of the construction aspect of the project:

Therefore, the following approach has been used for Wat-2 calculations of the construction aspect of the project:

a) Determine all potential sources of non-potable water for use on site, and assess whether they are feasible and sensible.

b) For all possible and sensible non-potable water sources, quantify the weekly amount available, based on Construction Program, rainfall data, hydrogeological reports and reasonable assumptions

c) Establish all water storage capacity available for each project site

d) On a weekly basis, interrogate the availability of non-potable water from off-site, non-potable water available in storage capacities, total harvested non-potable water throughout the given week and establish the total non-potable water demand met with available supplies.

This approach, established on a weekly time step, significantly reduces the likelihood of overestimation of non-potable water supply availability vs demand and better replicates the expected activities on site.

For details of non-potable water sources identified, investigated and adopted for use, refer to WTP Water reuse strategy SMWSTWTP-GLO-1NL-WA-STG-000001

Item	Value	Unit	Notes / source
Recycled Water Available	62,281	kl	Recycled water mains (purple line) connection is under investigation for a number of sites. At this stage it is conservatively assumed that no purple line connection is used. Only water carts (dust suppression) and road sweepers) use non-potable water sourced from off-site
Rainwater Available	7,146	kl	See 'Recycled water use tab, item B
Groundwater/reclaimed water Available	327,993	kl	See 'Recycled water use tab, item A
Total Re-usable Water Available	397,419	kl	calculated
Total Water use	429,947		calculated
Recycled Water Used	223,903	kl	See 'Recycled water use tab, item A
Substitutable Construction Demand met by Recycled Water	52%		calculated

Operations

Western Tunnelling Package (WTP) is an enabling package for Sydney Metro West. The Sydney Metro West line future operational water demand is not influenced by the works undertaken as part of WTP and will be best addressed by follow on station fit-outs contractors. As such the assessment is entirely focused on Construction phase water uses.

Total

Item	Value	Unit	Notes / source
Total Water use	429,947	kl	Based on the full lifecycle of the infrastructure
Recycled Water Used	223,903	kl	Based on the full lifecycle of the infrastructure
Substitutable Demand met by Recycled Water	52%		

Site Offices

Version	Date	Author	Notes
For Stage 2 issue	21/10/2022	Laszlo Horvath	



Section A **Results Summary**
 Section B **Methodology & Info**
 B1: Fixtures & Fittings
 B2: Site Personnel
 B3: Site Offices
 Section C **Metered and Modelled Water Use**
 C1: Worker Related
 C2: Cleaning of Site Offices
 C3: Portaloos

A. Results Summary

Site Facility - End Use	Base Case	Actual Case	Units	Notes / Sources	Non potable water used?
	Total Demand	Total Demand			
Toilets	1,339	1,153	kl	Section C1	Yes
Urinals	1,339	670	kl	Section C1	Yes
Basins	1,750	1,519	kl	Section C1	No
Showers	7,151	6,626	kl	Section C1	No
Dishwashers	0	0	kl	Section C1	No
Drinking water	196	196	kl	Section C1	No
Laundry	2,885	990	kl	Section C1	No
Cleaning	791	791	kl	Section C2	No
Portaloos	12,257	12,257	kl	Section C3	No
Total Site Facilities	17,710	14,203	kl		

B. Methodology & Info

B1. Fixtures & Fittings

B1.1 Green Star Values - for information

Values from Green Star Potable Water Calculator

Sanitary Fittings

GREEN STAR - POTABLE WATER CALCULATOR USAGE RATES (IN OFFICE SETTINGS) - FOR REFERENCE

End use	Uses/person/day (for 9.5 hour office)	Uses per person per hour	Duration per use (mins)
Toilet - no Urinals	2.3	0.24	n/a
Toilet - with Urinals	1.3	0.14	n/a
Urinal	1	0.11	n/a
Indoor taps	2.5	0.26	0.15
Showers by cyclists	by cyclists %	n/a	5

Shift (hours)	9.5
female ratio	50%
male ratio	50%

	Uses (ratio)	L/flush
Full Flushes	1	6
Half Flushes	2	3

Clothes Washing Machine

Source: WELS water efficiency

Washing Machine - Star rating	Washing machine (L/kg)	Notes / Sources
2 Star	21.00	
2.5 Star	17.57	
3 Star	14.70	Green Star Standard Practice Value (for 5kg capacity or greater). Only 2.5 Star if capacity less than 5kg.
3.5 Star	12.30	
4 Star	10.29	
4.5 Star	8.61	
5 Star	7.20	
5.5 Star	6.03	
6 Star	5.04	

6.3 Standard Practice Water Efficiency - White goods

The water efficiency of whitegoods used to determine the total standard practice water consumption is presented in Table 5. These values have been taken from a combination of the minimum allowable WELS ratings under AS 6400:2005 Water efficient products - Rating and labelling, and the GBCA's recommendations for the baseline performance of these appliances within the rating tool.

Table 5 Standard Practice water efficiency - White goods

White Goods	Water efficiency WELS rating
Clothes washing machine	3 Star (5kg capacity or greater) 2.5 Star (capacity less than 5kg)
Dishwasher	3.5 Star

The baseline for both the clothes washing machine and dishwasher will score based on the capacity of the machine entered by the project team. In the case of the clothes washing machines, this is related to the weight of clothing that can be accommodated per cycle. For dishwashers, the baseline is linked to the number of place settings that the machine can accommodate in one cycle.

B2. Personnel

Water use for sanitary fixtures and fittings depends on the time spent on-site by employees. The indicative values below extrapolated from the GLC resourcing histogram below are also used for the Base Case.

Sources: 'Total manhours' figures derived from GLC resourcing histogram for each site.

Project start (offices) 1/04/2022

Project finish (offices) 1/01/2026

Project duration: 156 weeks

Site	Activity	Site Office	Total Manhours	Site supplier
WMD	Tunnel	Westmead site	52,275	Select
WMD	Surface Works	Westmead site	233,218	Select
PTA	Surface Works	Paramatta site	270,869	Select
CU - Dive	Tunnel	Clyde Dive	376,082	Select
CU - Dive	Surface Works	Clyde Dive	180,579	Select
CU - MSF	Surface Works	MSF - Early Temporary offices	180,579	Select
CU - MSF	Surface Works	MSF - Long term offices	180,579	Select
ECR	Surface Works	Precast Yard	90,350	Coates
RSH	Tunnel	Rosehill site	451,299	Coates
RSH	Surface Works	Rosehill site	216,695	Coates
All	Tunnel	All	879,656	
All	Surface Works	All	1,352,809	
			2,232,465	

Paste data from WTP Resource Modelling Histogram here

WMD	Tunnel	622,32663
PTA	Tunnel	0
CU - Dive	Tunnel	447717
CU - MSF	Tunnel	0
ECR	Tunnel	0
RSH	Tunnel	5372,604
WMD	Surface Works	3854,84337
PTA	Surface Works	447717
CU - Dive	Surface Works	2984,78
CU - MSF	Surface Works	2984,78
ECR	Surface Works	1492,39
RSH	Surface Works	3581,736

Supplier	Manhours
Coates	758,283
Select	1,474,182

B3. Sites

Toilets	0.12	0.12	0.12	0.12	0.60	0.60	0.52	0.52
Urinals	0.30	0.30	0.30	0.30	0.60	0.60	0.30	0.30
Taps	0.71	0.69	0.11	0.10	0.80	0.78	0.69	0.67
Showers	0.08	0.01	0.83	0.05	7.50	0.41	6.95	0.38
Dishwashers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drinking water	0.08	0.09	0.08	0.09	0.08	0.09	0.08	0.09
Laundry	0.08	0.09	0.08	0.09	1.23	1.34	0.42	0.46

The water use intensities per manhour for each end use are then multiplied by the manhours forecasts to obtain total predicted site offices amenities water use for the project.

End Use	Base Case Water Use (kL)			Actual Case Water Use (kL)		
	Tunnel	Other	Total	Tunnel	Other	Total
Toilets	528	812	1,339	454	699	1,153
Urinals	528	812	1,339	254	406	670
Taps	701	1,049	1,750	608	911	1,519
Showers	6,597	553	7,151	6,113	513	6,626
Dishwashers	0	0	0	0	0	0
Drinking water	73	123	196	73	123	196
Laundry	1,078	1,808	2,885	370	620	990
All Site Office amenities	9,505	5,157	14,662	7,883	3,271	11,154

Rosehill Only (requested by GLC)

End Use	Base Case Water Use (kL)			Actual Case Water Use (kL)		
	Tunnel	Other	Total	Tunnel	Other	Total
Toilets	271	130	401	233	112	345
Urinals	271	130	401	135	65	200
Taps	360	168	528	312	146	458
Showers	3,385	89	3,473	3,236	82	3,219
Dishwashers	0	0	0	0	0	0
Drinking water	38	20	57	38	20	57
Laundry	553	290	842	190	99	289
Rosehill Only	4,876	826	5,702	4,044	524	4,568

C2. Portaloo's

Note, most toilet use considered to be in the dedicated site blocks (covered in Section C1.)

Item	Value	Units	Notes / Sources
Portaloo use - daily	24	uses per day	Assumption. Most toilet use considered to be in the dedicated site blocks (covered in Section C1.)
Portaloo use - monthly	730	uses per month	calculated
Water use intensity	5	L/use	Flush + Handwash
Portaloo water use (Actual Case)	3650	L/month	
Portaloo water use (Base Case)	3650	L/month	GLC use considered to be standard practice . Therefore Base Case set equal to Actual Case.
Feasible Recycled Water use (Actual Case)	0	L/month	Assumed that all water needs to be potable if single tank used for handwash and flushing

Site	Portaloo's			
	Max duration (months)	Portaloo's (#)	Base Case Water Use (kL)	Actual Case Water Use (kL)
WMD	34	4	501	501
PTA	34	4	500	500
RSH	29	4	422	422
CLJ - Dive	32	4	474	474
CLJ - MSF	25	4	360	360
Tunnel	0	1	0	0
All Site Facilities	n/a	21	2,257	2,257

C3. Cleaning - Site offices

Note, this does not include cleaning of project offices, nor cleaning of the site itself.

Cleaning scope	Value	Units	Notes / Sources
Site offices (Actual Case) - daily	0.2	L/m2 per day	Assumption
Site offices (Actual Case) - monthly	6	L/m2 per month	calculated
Site offices (Base Case) - monthly	6	L/m2 per month	GLC use considered to be standard practice . Therefore Base Case set equal to Actual Case.

Station	Cleaning			
	Max duration (months)	Floor area	Base Case Water Use (kL)	Actual Case Water Use (kL)
WMD	34	850	177	177
PTA	34	930	194	194
RSH	29	1,200	211	211
CLJ - Dive	32	600	118	118
CLJ - MSF	25	600	90	90
Tunnel	0	0	0	0
All Site Facilities	n/a	4,180	791	791

Project Offices

Version	Date	Author	Notes
For Stage 2 issue	21/10/2022	Laszlo Horvath	



Section A	Results Summary
Section B	Methodology & Info B1: Methodology B2: General Information B3: GLC Project Offices Info
Section C	Metered and Modelled Water Use C1: Actual Case C2: Base Case

A. Results Summary

Project Offices	Base Case	Actual Case	Units	Notes / Sources
	Total Demand	Total Demand		
Main (60 Station Street)	10,374	2,488	kl	Sections C1.1 and C2.1
Other	3,844	3,844	kl	Sections C1.2 and C2.2
Total Project Offices	14,218	6,332	kl	

B. Methodology & Information

B1. Methodology

Project offices: permanent offices occupied by design, construction, admin teams (not for construction workers)
 Base case: 3 Star NABERS Water rating ('standard practice')
 For large project offices (e.g. 60 station Street): GLC / Actual usage based on annual NABERS ratings & pro-rated on NLA leased to rated NLA.
 For small project offices: no NABERS rating expected & water use anticipated to be minor vs. total project usage -> estimated usage equal to 3 Star NABERS rating and 12m2 / person occupancy.

B2. General Information

NABERS Water - NSW
 Data sourced from NABERS Reverse calculator (<https://www.nabers.gov.au/>)

Stars	0 Star	3 Star	5 Star	5.5 Star
Standard Litres / m2	2041	1022	342	257
Additional Litres / m2 per hour per week	0		0	0

General Info

ISC Scope	Start date	End date	Notes / Sources
Project offices	28/02/2022	1/12/2025	Detailed TARGET Program - Status Updated 08-Aug-22 - demob date assumed
Occupancy hours	50	h/week	Default value if unknown in NABERS, i.e. 10h per week
Occupants Density	10	m2/person	Typical office occupant density

B3. GLC Project Offices

Data entry cells
 Default values
 Calculated values
 Used if actual values are not known

Address	NLA (m2) building	NLA (m2) leased	Occupants	m2/person	Start date	End date	Months	Notes / Sources
60 Station Street	25,156	2,648	148	17.9	28/02/2022	1/12/2025	45	Levels 7 and 8 leased, https://www.60stationstreet.com.au/office-availability/eclipse-tower
DIV office	n/a	1,000	100	10	1/03/2022	1/08/2023	17	DIV office, end date assumed based on detailed program TARGET
Not used	n/a	0	0	10			0	
Not used	n/a	0	0	10			0	

C. Project Offices - Metered and Calculated Water Use

C1. Actual Case

C1.1 Main Project Office (60 Station St)
 The building owner of the main GLC project office commissions annual operational NABERS water ratings to be undertaken for the building (only feasible as a whole). This publicly available data is then apportioned pro-rata by floor area to estimate GLC's tenancy water use.

60 Station Street - Building Total						GLC tenancy at 60 Station						
Start Rating	End Rating	Rated Usage (kl p.a.)	Rated Area (m2)	Rated Hours (hr/wk)	Recycled Water Use	GLC - Leased Area (m2)	GLC usage (kl p.a.)	GLC usage (kl per month)		GLC Months	GLC usage (kl)	Notes / Sources
Nov-21	Oct-22	6,166.9	25,156	50	0	2648	649.1			9	487	NABERS rating for may 2017 - apr 2018 (only 4 months of delivery period)
Nov-22	Oct-23	6,166.9	25,156	50	0	2648	649.1		54	12	649	NABERS rating for may 2018 - apr 2019
Nov-23	Oct-24	6,166.9	25,156	50	0	2648	649.1		54	12	649	estimate of water intensity per m2 based on previous NABERS ratings
Nov-24	Oct-25	6,166.9	25,156	50	0	2648	649.1		54	12	649	estimate of water intensity per m2 based on previous NABERS ratings
Nov-25	Oct-26	6,166.9	25,156	50	0	2648	649.1		54	1	54	estimate of water intensity per m2 based on previous NABERS ratings

Summary of GLC water use at 60 Station Street over Delivery Period:

Average Leased Area (m2)	Average Water Use (kl p.a.)	Average Water Use (kl per month)	Total (months)	Total Water Use (kl)	Notes / Sources
2648	649	54	46	2,488	Averages all weighted by months of lease.

C1.2 Other Project Offices

For the Design IS rating, water use in the smaller project offices is estimated using standard practice water use intensities for commercial offices. Benchmarks from the NABERS Water rating tool have been used.

Item	Value	Units	Notes / Sources
BAU NABERS Water Rating	3 Star		NABERS Star rating system (0 to 6 Star) based on a 3 Star rating being 'standard practice' / Business-as-Usual.
3 Star NABERS Allowance	1022	L/m2 p.a.	Calculated using water use intensity for 3 Star rating and default operating hours (SDH/week)

Address	NLA (m2) leased	3 Star Allowance (kl p.a.)	3 Star Allowance (kl per month)	Duration Lease (months)	GLC Water Use (kl)
D/W office	1,000	1,022	85	45	3,844
Not used	0	0	0	17	0
Not used	0	0	0	0	0
Total Smaller Project Offices	1,000	1,022	85		3,844

C2. Base Case

For the base case, water use in all project offices is estimated using standard practice water use intensities for commercial offices. Benchmarks from the NABERS Water rating tool have been used.

Item	Value	Units	Notes / Sources
BAU NABERS Rating	3 Star		NABERS Star rating system (0 to 6 Star) based on 3 Star rating being 'standard practice' / Business-as-Usual.
3 Star NABERS Allowance	1022	l/m2 p.a.	Calculated using water use intensity for 3 Star rating and default operating hours (50h/week)

C2.1 Main Project Office (60 Station St)

Period	Leased Area (m2)	3 Star Allowance (kl p.a.)	3 Star Allowance (kl per month)	Duration Lease (months)	Base Case Water Use (kl)
Nov-21 to Oct-22	2648	2,706	226	9	2,030
Nov-22 to Oct-23	2648	2,706	226	12	2,706
Nov-23 to Oct-24	2648	2,706	226	12	2,706
Nov-24 to Oct-25	2648	2,706	226	12	2,706
Nov-25 to Oct-26	2648	2,706	226	1	226
Total 60 Station Tenancy					10,374

C2.2 Other Project Offices

Start Rating	Area Leased (m2)	3 Star Allowance (kl p.a.)	3 Star Allowance (kl per month)	Duration Lease (months)	Base Case Water Use (kl)
D/W office	1,000	1,022	85	45	3,844
Not used	0	0	0	17	0
Not used	0	0	0	0	0
Total Smaller Project Offices	1,000	1,022	85		3,844

Precast Yard water demand

Version	Date	Author	Notes
For Stage 2 Issue	21/10/2022	Jacki Horvath	



Notes:

Offices water usage is considered separately
All concrete mixes including any shotcrete are mixed off-site
Water usage in precast segments is considered as embodied water in accordance with the IS Technical Manual, given the batching plant is operated by third

Item No	Activity	Description	Average consumption per appropriate unit (L/day, Aweek, No etc)	Unit	Equivalent weekly demand (kL/week)	Comment/Assumption	Start	Finish	Duration	Sent back to WTP4 for treatment?	Served by off-site non-potable water source? (Yes/No)	Connected to Rainwater tank? (Yes/No)	Connected to recycled water from WTP4? (Yes/No)	Totals	Precipitations																						
															18.0 2022	18.0 2022	18.0 2022	18.0 2022																			
1	Dust suppression	Dust suppression activities during excavation works (excluding tunnelling works)		10 L/day	50	1 x 50kL Water carts used per day - reduced by 40% from 2024 onwards - use site assumed to be reduced by 50% when in rainy season (November to March)	5/05/2022	1/01/2025	972	No	Yes	No	No	6,850	0	0	0	0																			
2	Wheel wash	Wheelwash bays at site entrances and exits	24 377	L/day	121 876	Wheelwash bays (1 per site assumed) water replaced twice a day	1/01/2021	1/01/2025	731	Yes	No	Yes	Yes	112,675	0	0	0	0																			
3	Roadsweepers	Site adjacent roads cleaning	3 333	L/day	17	1 x 50kL sweepers used per day for all sites to 100% - use site assumed to be reduced by 50% when in rainy season (November to March)	5/05/2022	1/01/2025	972	No	Yes	No	No	2,283	0	0	0	0																			
4	Washdown	Plant Washdown		10 L/day	50	Batching plant mixers (2) will be washed using water from WTP	22/03/2021	1/01/2025	651	Yes	No	Yes	Yes	4,650	0	0	0	0																			
5	Washdown	Machine washdown in Carusel Area		36 L/day	180	Based on 2 shifts. Cover washing 24kL/day & Hopper washing 12kL/day (total of 36kL/day). This water may be beneficially re-used, which will be further investigated once production commences.	22/03/2021	1/01/2025	651	Yes	No	Yes	Yes	16,740	0	0	0	0																			
6	Curing Chamber	Kraft Curing System		23 L/day	115	Potable water used as vapour then condensed & treated to be used for washing	22/03/2021	1/01/2025	651	Yes	No	No	No	10,714	0	0	0	0																			
														<table border="1"> <tr> <td colspan="4">Total Water demand (kL/week)</td> </tr> <tr> <td>53,912</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>				Total Water demand (kL/week)				53,912	0	0	0												
Total Water demand (kL/week)																																					
53,912	0	0	0																																		
														<table border="1"> <tr> <td colspan="4">Total off-site non-potable water use (kL/week)</td> </tr> <tr> <td>7,200</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>				Total off-site non-potable water use (kL/week)				7,200	0	0	0												
Total off-site non-potable water use (kL/week)																																					
7,200	0	0	0																																		
														<table border="1"> <tr> <td colspan="4">Total Non-potable water demand (kL/week)</td> </tr> <tr> <td>34,065</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="4">Onsite</td> </tr> <tr> <td colspan="4">Total Water used harvested for recycling (50% loss assumed)</td> </tr> <tr> <td>40,361</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>				Total Non-potable water demand (kL/week)				34,065	0	0	0	Onsite				Total Water used harvested for recycling (50% loss assumed)				40,361	0	0	0
Total Non-potable water demand (kL/week)																																					
34,065	0	0	0																																		
Onsite																																					
Total Water used harvested for recycling (50% loss assumed)																																					
40,361	0	0	0																																		

Commencement date 1/12/2022

Westmead site water demand

Version	Date	Author	Notes
For Stage 2 Issue	21/10/2022	Jacso Horvath	



Notes:

Offices water usage is considered separately
All concrete mixes (including any shotcrete) are mixed off-site

Precipitations		
2022	2022	2022
4	4	4
6/04/2022	13/04/2022	#####
1	2	3

Item No	Activity	Description	Average consumption per appropriate unit (l/day, /week, /m ² etc)	Unit	Equivalent weekly demand (kL/week)	Comment/assumption	Start	Finish	Duration	Sent back to WTP3 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP2? (Yes/No)	Totals					
1	Road sweepers	Site adjacent roads cleaning	3.3333	kL/day	17	2 x 10 kL sweepers used per day for all sites (6 total) - use rate assumed to be reduced by 50% when in rainy season (November to March)	20/06/2022	26/06/2025	1102	No	Yes	No	2,417	0	0	0		
2	Wheel wash	Wheelwash bays at site entrances and exits	24.375	kL/day	121.875	Wheelwash bays (1 per site assumed) water replaced twice a day	1/01/2023	26/06/2025	907	Yes	No	Yes	14,808	0	0	0		
3	Plant washdown	Plant washdown	2	kL/day	10	20kL/day for machine washdown on average during excavation, 10kL/day otherwise	20/06/2022	26/06/2025	1102	Yes	No	Yes	1,580	0	0	0		
4	Dust suppression	Surface Dust suppression activities	30	kL/day	50	3 x 10 kL Water carts used per day - reduced by 80% from -3/2023 onwards - use rate assumed to be reduced by 50% when in rainy season (November to March)	20/06/2022	26/06/2025	1102	No	Yes	No	7,350	0	0	0		
5.1	Tunnelling - Xover caverns	Cooling of Plant	13.75	kL/day	75.625	12 hours a day, 5.5 days a week	9/06/2023	21/05/2024	347	No	Yes	Yes	1,708	0	0	0		
5.2	Tunnelling - Xover caverns	Roadheader - mist for dust control	24	kL/day	132	10 Nozzles x 50L/hr x 4 faces	9/06/2023	21/05/2024	347	No	Yes	Yes	6,468	0	0	0		
5.3	Tunnelling - Xover caverns	Road headers - Washdown of cut face	2	kL/day	13.2	5mins @ 2L/s x 4 faces	9/06/2023	21/05/2024	347	No	Yes	Yes	647	0	0	0		
6.1	Tunnelling - Xover caverns	Drilling Rigs / Bolters	14.38	Total kL during drilling	28	10mins per drilled hole @ 0.5*95L/min	9/06/2023	21/05/2024	347	No	Yes	Yes	1,423	0	0	0		
6.2	Tunnelling - Cavern/Nozzle enlargements	Cooling of Plant	13.75	kL/day	75.625	24 hours a day, 5.5 days a week	16/01/2024	24/05/2024	129	No	Yes	Yes	1,417	0	0	0		
6.3	Tunnelling - Cavern/Nozzle enlargements	Roadheader - mist for dust control	24	kL/day	132	10 Nozzles x 50L/hr x 4 faces	16/01/2024	24/05/2024	129	No	Yes	Yes	2,568	0	0	0		
7.1	Tunnelling - Cavern/Nozzle enlargements	Road headers - Washdown of cut face	2.4	kL/day	13.2	5mins @ 2L/s x 4 faces	16/01/2024	24/05/2024	129	No	Yes	Yes	251	0	0	0		
7.2	Tunnelling - Cavern/Nozzle enlargements	Drilling Rigs / Bolters	331	Total kL during drilling	118	10mins per drilled hole @ 0.5*95L/min	16/01/2024	24/05/2024	129	No	Yes	Yes	341	0	0	0		
7.3	Tunnelling - Sub tunnels	Cooling of Plant	13.75	kL/day	75.625	24 hours a day, 5.5 days a week	28/02/2024	2/05/2024	64	No	Yes	Yes	750	0	0	0		
8.1	Tunnelling - Sub tunnels	Roadheader - mist for dust control	24	kL/day	132	10 Nozzles x 50L/hr x 4 faces	28/02/2024	2/05/2024	64	No	Yes	Yes	1,320	0	0	0		
8.2	Tunnelling - Sub tunnels	Road headers - Washdown of cut face	2.4	kL/day	13.2	5mins @ 2L/s x 4 faces	28/02/2024	2/05/2024	64	No	Yes	Yes	132	0	0	0		
8.3	Tunnelling - Sub tunnels	Drilling Rigs / Bolters	1118	Total kL during drilling	122	10mins per drilled hole @ 0.5*95L/min	28/02/2024	2/05/2024	64	No	Yes	Yes	1,222	0	0	0		
-insert above-													Total Water demand (kL/week)	46,264	0	0	0	
-insert above-													Commencement date 1/12/2022	Total off-site non-potable water use (kL/week)	28,442	0	0	0
-insert above-													Total Non-potable water demand (kL/week) - Onsite	36,597	0	0	0	
-insert above-													Total Water used harvested for recycling (10% loss assumed)	14,749	0	0	0	

Parramatta

Version	Date	Author	Notes
For Stage 2 Issue	21/10/2022	Laslo Horvath	



Notes:

Offices water usage is considered separately
All concrete mixes (including any shotcrete) are mixed off-site

Precipitations	18.0	18.0
2022	4	4
6/04/2022	1	2

Item No	Activity	Description	Average consumption per appropriate unit (l/day, /week, /no etc)	Unit	Equivalent weekly demand (kl/week)	Comment/assumption	Start	Finish	Duration	Sent back to WTP2 for treatment?	Served by off-site non-potable water sources? (Yes/No)	Connected to recycled water from WTP2? (Yes/No)	Totals																																																															
1	Piling/Grouting	Bentonite for diaphragm wall - East end	300	kl/week	300	46 panels in total, with 2 panels (300kl) completed per week.	13/02/2023	24/07/2023	161	No	No	No	6,900	0	0																																																													
2	Piling/Grouting	Bentonite for diaphragm wall - West end	300	kl/week	300	38 panels in total, with 2 panels (300kl) completed per week.	28/06/2023	7/11/2023	132	No	No	No	5,700	0	0																																																													
3	Road sweepers	Site adjacent roads cleaning	3.3333	kl/day	17	2 x 10kl sweepers used per day for all sites (6 total) - use rate assumed to be reduced by 50% when in rainy season (November to March)	18/07/2022	24/05/2025	1041	No	Yes	No	2,267	0	0																																																													
4	Wheel wash	Wheelwash bays at site entrances and exits	24.375	kl/day	121.875	Wheelwash bays (1 per site assumed) water replaced twice a day	1/01/2023	24/05/2025	874	Yes	No	Yes	14,198	0	0																																																													
5	Plant washdown	Plant washdown	2	kl/day	10	2kl/day for machine washdown on average during excavation, 'kl/day otherwise	18/07/2022	24/05/2025	1041	Yes	No	Yes	1,480	0	0																																																													
7	Dust suppression	Surface Dust suppression activities	30	kl/day	162	1 x 10 kl. Water carts used per day - reduced by 80% from 3/2023 onwards - use rate assumed to be reduced by 50% when in rainy season (November to March)	18/07/2022	24/05/2025	1041	No	Yes	No	6,800	0	0																																																													
8.1	Tunnelling - Nozzle enlargements Cycle 1	Cooling of Plant	13.75	kl/day	75.625	12 hours a day, 5.5 days a week	27/05/2024	19/06/2024	23	No	No	Yes	227	0	0																																																													
8.2	Tunnelling - Nozzle enlargements Cycle 1	Roadheader - mist for dust control	24	kl/day	132	10 nozzles x 50l/hr x 4 faces	27/05/2024	19/06/2024	23	No	No	Yes	396	0	0																																																													
8.3	Tunnelling - Nozzle enlargements Cycle 1	Road headers - Washdown of cut face	2.4	kl/day	13.2	5mins @ 2L/s x 4 faces	27/05/2024	19/06/2024	23	No	No	Yes	40	0	0																																																													
8.1	Tunnelling - Nozzle enlargements Cycle 2	Cooling of Plant	13.75	kl/day	75.625	24 hours a day, 5.5 days a week	18/07/2024	30/07/2024	12	No	No	Yes	76	0	0																																																													
8.2	Tunnelling - Nozzle enlargements Cycle 2	Roadheader - mist for dust control	24	kl/day	132	10 nozzles x 50l/hr x 4 faces	18/07/2024	30/07/2024	12	No	No	Yes	132	0	0																																																													
8.3	Tunnelling - Nozzle enlargements Cycle 2	Road headers - Washdown of cut face	2.4	kl/day	13.2	5mins @ 2L/s x 4 faces	18/07/2024	30/07/2024	12	No	No	Yes	13	0	0																																																													
<table border="1"> <tr> <td colspan="13">Total Water demand (kl/week)</td> <td>28,238</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="13">Total off-site non-potable water use (kl/week)</td> <td>7,900</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="13">Total Non-potable water demand (kl/week) - Onsite</td> <td>16,572</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="13">Total Water used harvested for recycling (10% loss assumed)</td> <td>14,120</td> <td>0</td> <td>0</td> </tr> </table>													Total Water demand (kl/week)													28,238	0	0	Total off-site non-potable water use (kl/week)													7,900	0	0	Total Non-potable water demand (kl/week) - Onsite													16,572	0	0	Total Water used harvested for recycling (10% loss assumed)													14,120	0	0
Total Water demand (kl/week)													28,238	0	0																																																													
Total off-site non-potable water use (kl/week)													7,900	0	0																																																													
Total Non-potable water demand (kl/week) - Onsite													16,572	0	0																																																													
Total Water used harvested for recycling (10% loss assumed)													14,120	0	0																																																													

Clyde Dive + Spur tunnels water demand

Version	Date	Author	Notes
For Stage 2 Issue	21/10/2022	Lucy Horvath	



Notes:

Off-site water usage is considered separately
All concrete mixes (including any shotcrete) are mixed off-site

2022	2022	2022
4	4	4
6/04/2022	13/04/2022	#####
1	2	3

Item No	Activity	Description	Average consumption per appropriate unit (l/day, /week, /m ²)	Unit	Equivalent weekly demand (kl/week)	Comment/assumption	Start	Finish	Duration	Sent back to WTPs for treatment?	Served by off-site non-potable water source? (Yes/No)	Connected to recycled water from WTPs? (Yes/No)	Totals	2022	2022	2022																									
1.1	Tunnelling - Temp shaft to Junction SRT01	Cooling of Plant	27.5	kl/day	151.25	24 hours a day, 5.5 days a week		14/02/2023	7/09/2023	205	No	No	Yes	4,538	0	0	0																								
1.2	Tunnelling - Temp shaft to Junction SRT01	Road headers - Washdown of cut face	2.4	kl/day	13.2	5mins @ 2L/s x 4 faces		14/02/2023	7/09/2023	205	No	No	Yes	396	0	0	0																								
1.3	Tunnelling - Temp shaft to Junction SRT01	Drilling Rigs / Bolders	684	Total kl during drilling	23	10mins per drilled hole @ 0.5*95L/min, 1439 bolts in total		14/02/2023	7/09/2023	205	No	No	Yes	700	0	0	0																								
2.1	Tunnelling - Temp shaft to Junction SRT01	Cooling of Plant	27.5	kl/day	151.25	24 hours a day, 5.5 days a week		13/03/2023	30/10/2023	231	No	No	Yes	4,903	0	0	0																								
2.2	Tunnelling - Temp shaft to Junction SRT01	Road headers - Washdown of cut face	2.4	kl/day	13.2	5mins @ 2L/s x 4 faces		13/03/2023	30/10/2023	231	No	No	Yes	435	0	0	0																								
2.3	Tunnelling - Temp shaft to Junction SRT01	Drilling Rigs / Bolders	684	Total kl during drilling	18	10mins per drilled hole @ 0.5*95L/min, 1281 bolts in total		13/03/2023	30/10/2023	231	No	No	Yes	658	0	0	0																								
3.1	Tunnelling - S1 J01402 junction caverns concurrently	Cooling of Plant	65	kl/day	302.4	24 hours a day, 5.5 days a week, 2 roadheaders		8/09/2023	15/12/2023	98	No	No	Yes	4,233	0	0	0																								
3.2	Tunnelling - S1 J01402 junction caverns concurrently	Road headers - Washdown of cut face	4.8	kl/day	26.4	5mins @ 2L/s x 4 faces, 2 roadheaders		8/09/2023	15/12/2023	98	No	No	Yes	370	0	0	0																								
3.3	Tunnelling - S1 J01402 junction caverns concurrently	Drilling Rigs / Bolders	1262	Total kl during drilling	90	10mins per drilled hole @ 0.5*95L/min, 2170 bolts in total		8/09/2023	15/12/2023	98	No	No	Yes	1,262	0	0	0																								
4.1	Tunnelling - temp shaft to Dive structure SRT01	Cooling of Plant	27.5	kl/day	151.25	24 hours a day, 5.5 days a week		1/05/2023	22/08/2023	113	No	No	Yes	2,420	0	0	0																								
4.2	Tunnelling - temp shaft to Dive structure SRT01	Road headers - Washdown of cut face	2.4	kl/day	13.2	5mins @ 2L/s x 4 faces		1/05/2023	22/08/2023	113	No	No	Yes	211	0	0	0																								
4.3	Tunnelling - temp shaft to Dive structure SRT01	Drilling Rigs / Bolders	168	Total kl during drilling	10	10mins per drilled hole @ 0.5*95L/min, 355 bolts in total		1/05/2023	22/08/2023	113	No	No	Yes	167	0	0	0																								
5.1	Tunnelling - temp shaft to Dive structure SRT02	Cooling of Plant	27.5	kl/day	151.25	24 hours a day, 5.5 days a week		31/10/2023	18/03/2024	130	No	No	Yes	3,025	0	0	0																								
5.2	Tunnelling - temp shaft to Dive structure SRT02	Road headers - Washdown of cut face	2.4	kl/day	13.2	5mins @ 2L/s x 4 faces		31/10/2023	18/03/2024	130	No	No	Yes	264	0	0	0																								
5.3	Tunnelling - temp shaft to Dive structure SRT02	Drilling Rigs / Bolders	82	Total kl during drilling	4	10mins per drilled hole @ 0.5*95L/min, 173 bolts in total		31/10/2023	18/03/2024	130	No	No	Yes	83	0	0	0																								
6	Plant Washdown	Clyde Dive excavation plant Washdown	1	kl/day	5.5	1kl/day conservatively assumed		8/03/2023	23/05/2024	408	No	No	No	325	0	0	0																								
7	Road Sweepers	Site adjacent roads cleaning	3.3	kl/day	17	2 x 10 kl sweepers used per day for all sites (6 total) - use rate assumed to be reduced by 50% when in rainy season (November to March)		1/07/2022	3/06/2023	196	No	Yes	No	1,982	0.0	0.0	0.0																								
8	Wheel wash	Wheelwash bays at site entrances and exits	24.4	kl/day	121.875	Wheelwash bays (1 per site assumed) water replaced twice a day		1/03/2023	3/06/2023	88	Yes	No	Yes	3,071	0.0	0.0	0.0																								
9	Dust suppression	Dust suppression activities during excavation works (excluding tunnelling works)	8	kl/day	41	4 x 10 kl Water carts used per day - reduced by 40% from 2024 onwards - use rate assumed to be reduced by 50% when in rainy season (November to March)		1/07/2022	3/06/2023	196	No	Yes	No	2,317	0.0	0.0	0.0																								
<table border="1"> <tr> <td colspan="2">Total Water Demand (kl/week)</td> <td>31,410</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="2">Total off-site non-potable water use (kl/week)</td> <td>4,308</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="2">Total Non-potable water demand (kl/week) - Onsite</td> <td>26,777</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="2">Total Water used harvested for recycling (10% loss assumed)</td> <td>3,056</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>													Total Water Demand (kl/week)		31,410	0	0	0	Total off-site non-potable water use (kl/week)		4,308	0	0	0	Total Non-potable water demand (kl/week) - Onsite		26,777	0	0	0	Total Water used harvested for recycling (10% loss assumed)		3,056	0	0	0	Commencement date		1/12/2022		
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TBM tunneling and cross passages water demand

Version	Date	Author	Notes
For Stage 2 Issue	21/10/2022	Laxito Horvath	



TBM+XPs

Notes:

All concrete mixes (including any shotcrete) are mixed off-site

Item No	Activity	Description	Average consumption per appropriate unit (l/day, /week, /no etc)	Unit	Equivalent weekly demand (kl/week)	Comment/assumption	Start	Finish	Duration	Sent back to WTP1 for treatment?	Served by off-site non-potable water sources?	Served by recycled water from WTP1? (Yes/No)	Totals	18.0	18.0																																																													
1	TBM Cooling Water	Make-up water to compensate Drift Loss, Evaporation Loss and Purge bleed		0.22 L/s	87.12	For TBM 1, running 22 hours a day, 5 days/week. No consumption accounted for during retrievals, relaunch and push through sequences.	4/09/2023	5/02/2025	520	No	No	Yes	4,095	0	0																																																													
2	TBM Cooling Water	Make-up water to compensate Drift Loss, Evaporation Loss and Purge bleed		0.22 L/s	87.12	For TBM 2, running 22 hours a day, 5 days/week. No consumption accounted for during retrievals, relaunch and push through sequences.	4/10/2023	6/03/2025	519	No	No	Yes	4,269	0	0																																																													
3	TBM Industrial Water	Includes TBM foam water, TBM cleaning water, conveyors water (sprinklers), Cross passage water (19.49kl/day) accounted for separately		8.00 kl/h	783	For TBM 1, running 22 hours a day, 5 days/week. Minimum flow (40% *20kl/hr*20hrs/day) is assumed per discussion with Plant manager. No consumption accounted for during retrievals, relaunch and push through sequences.	4/09/2023	5/02/2025	520	No	No	Yes	36,289	0	0																																																													
4	TBM Industrial Water	Includes TBM foam water, TBM cleaning water, conveyors water (sprinklers), Cross passage water (19.49kl/day) accounted for separately		8.00 kl/h	783	For TBM 2, running 22 hours a day, 5 days/week. Minimum flow (40% *20kl/hr*20hrs/day) is assumed per discussion with Plant manager. No consumption accounted for during retrievals, relaunch and push through sequences.	4/10/2023	6/03/2025	519	No	No	Yes	38,355	0	0																																																													
5	Grout Balchng Plant	Grout for TBM rings external volume fill		2.12 L/s	840	For TBM 1, running 22 hours a day, 5 days/week. No consumption accounted for during retrievals, relaunch and push through sequences.	4/09/2024	5/02/2025	520	No	No	Yes	39,657	0	0																																																													
6	Grout Balchng Plant	Grout for TBM rings external volume fill		2.12 L/s	840	For TBM 2, running 22 hours a day, 5 days/week. No consumption accounted for during retrievals, relaunch and push through sequences.	4/10/2023	6/03/2025	519	No	No	Yes	41,136	0	0																																																													
7	Cross Passages Works	Includes water usage for excavation, rock sawing, rock bolting		19.45 kl/day	97	Assumed to run 5 days/week. No consumption accounted for during retrievals, relaunch and push through sequences.	24/10/2023	22/04/2025	540	No	No	Yes	7,780	0	0																																																													
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