

Water Reuse Strategy

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Document Control

The Project Manager is responsible for ensuring that this plan is reviewed and approved. The Project Sustainability Representative is responsible for updating this plan to reflect changes to the contract and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the Project Manager and/or client before being distributed / implemented.

Revision Details

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Acronyms and abbreviations

Term	Expanded text
BAU	Business as Usual
CEMP	Construction Environmental Management Plan
CoA	Condition of approval
CPB	CPB Contractors Pty Ltd
CGU	CPB Contractors, Ghella, UGL Engineer
EMS	Environmental Management System
ISCA	Infrastructure Sustainability Council of Australia
IS Rating	Infrastructure Sustainability Rating
ISP	Independent Sustainability Professional
MCA	Multi Criteria Analysis
SDG	United Nations Sustainable Development Goals
SMS	CPB Contractors Sustainability Management System

Part A: Overview

1. Introduction

1.1. Purpose

The purpose of this Water Reuse Strategy is to describe how CPB Contractors, Ghella, UGL Engineer (CGU) joint venture will consider and apply the sustainable water use practices during the delivery of the M6 Stage 1 Upgrade (the Project).

In doing so, this Plan addresses the relevant requirements of the Project Planning Approval, the Environmental Mitigation Measures (EMMs), applicable legislation, and contractual requirements, including the Project Deed and Scope of Work and Technical Criteria (SWTC), and water-related ISCA requirements.

1.2. Project description

The M6 Motorway is part of the 40-year vision of the NSW Government for transport outcomes in NSW. M6 Stage 1 will consist of twin road tunnels, approximately four kilometres in length, linking the New M5 Motorway at Arncliffe to President Avenue in Kogarah. The Project is described in detail in Section 6 of the EIS and the Project Management Plan.

The CPB Contractors, Ghella, UGL Engineering (CGU) joint venture will deliver the Project in partnership with Transport for NSW (TfNSW).

Key components of the Project outlined in Figure 1, include:

- Mainline tunnels are approximately 3.0km in length, sized for three lanes of traffic and line marked for two lanes on opening of the motorway
- Entry and exit ramp tunnels approximately 1.5km in length and a tunnel portal connecting the tunnels to a surface intersection with President Avenue
- Provision of a new intersection at President Avenue including the widening and raising of President Avenue at this location
- Upgrade of the President Avenue and Princes Highway intersection to improve capacity and network integration
- Provision of a new shared cycle and pedestrian pathways
- Mainline tunnel stubs for a future connection to extend the Project to the south
- Two motorway operation complexes (MOCs) as follows:
 - ▶ Arncliffe: including mechanical and electrical fit-out of the ventilation facility built by the New M5 Motorway project, and provision of a new water treatment plant and substation
 - ▶ Rockdale (south): including a ventilation building, Disaster Recover Site (DRS), substation and power supply, deluge tanks.
- A tunnel ventilation system, including ventilation facilities located at Marsh Street, Arncliffe and West Botany Street, Rockdale, and in-tunnel ventilation systems (jet fans and ventilation ducts)
- New Utility Services, and modifications and connections to existing Utility Services
- A permanent power supply connection to the Rockdale Ventilation Facility Site MOC from Ausgrid's Canterbury Sub-Transmission Substation
- Emergency access and evacuation facilities, including pedestrian and vehicular cross, long passages, fire and safety life systems
- Ancillary infrastructure for motorway operations including operations management and control systems, permanent power supply, communications, lighting, electronic toll

collection system, toll gantries and traffic control and signage (both fixed and variable signage)

- Drainage infrastructure to collect surface water and groundwater inflows for treatment
- Reinstatement of Bicentennial Park and recreation facilities
- Reinstatement and rehabilitation of construction leased areas within the Arncliffe Site
- Minor adjustments to local roads in the Project area

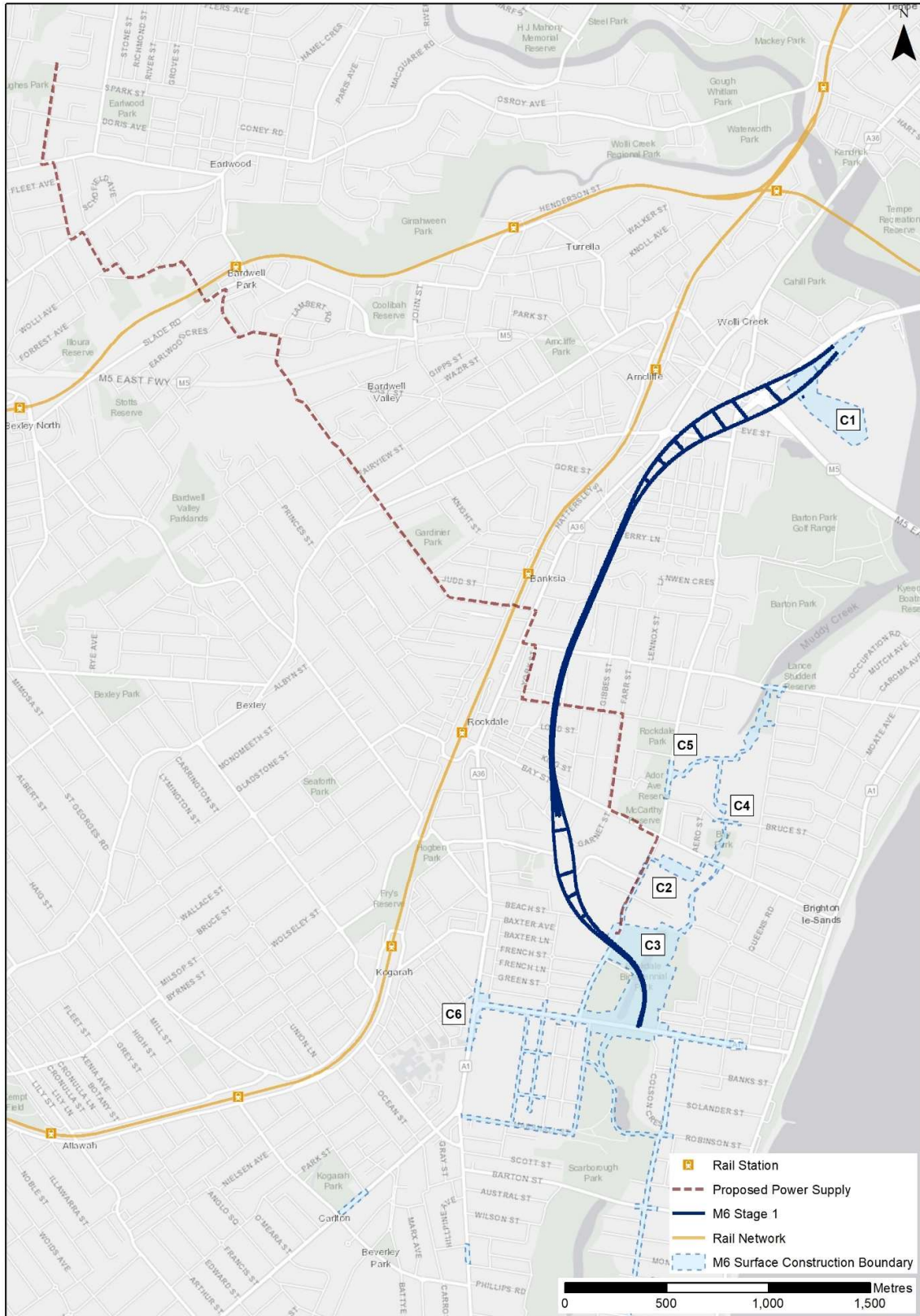


Figure 1 Project footprint

1.3. Scope

This Strategy addresses the water use requirements and re-use options for the construction and operation phases of the M6 Stage 1 Project.

This Strategy addresses and details the following issues:

- Water use requirements for surface and tunnelling works and operations;
- Water minimisation strategies to reduce water consumption; and
- Non-Potable water use, including
 - ▶ Rainwater collection, management and discharge during surface works construction and operation activities,
 - ▶ Groundwater management throughout the tunnelling works.

This Strategy does not consider the following:

- Treatment and re-use of sewerage
- Treatment and re-use of leachate 'contaminated groundwater.'

1.4. Project requirements

1.4.1. Condition of Approval

A Water Reuse Strategy is required by the project CoA E179. A description of the requirement of the Condition of Approval (CoA) is provided in Table 1.

Table 1: CoA requirements

Requirement (E179)	Reference
The Proponent must prepare and implement a Water Reuse Strategy which sets out options for the re-use of collected stormwater and groundwater during construction and operation. The Water Reuse Strategy must include, but not be limited to:	This Plan
(a) evaluation of re-use options;	Section 3
(b) details of the preferred re-use option(s), including volumes of water to be re-used, proposed re-use locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required;	Section 3
(c) measures to avoid misuse of recycled water as potable water;	Section 2.1
(d) consideration of the public health risks from water recycling; and	Section 2.1
(e) a time frame for the implementation of the preferred re-use option(s).	Section 3
The Water Reuse Strategy must be prepared based on best practice and advice sought from relevant agencies, as required.	This Plan
Justification must be provided to the Planning Secretary if it is concluded that no re-use options prevail.	N/A
A copy of the Water Reuse Strategy must be made publicly available.	This Plan

1.4.2. Scope of Works Technical Criteria (SWTC)

The SWTC contains the project-specific targets related to sustainable water consumption in Appendix D.5 and are outlined in Table 2 below.

Table 2: SWTC water consumption related requirements

Requirement	Reference
2.6 a) The Contractor must undertake and report on, in accordance with section 2 and section 2.1 of Appendix C.2 (Contractor Documentation Schedule), a water balance	Section 7

Requirement	Reference
study to estimate the quantities of potable and non-potable water uses, volumes, sources that would be used and generated during the construction and operational stages of the Project	
2.6 b) The Contractor must demonstrate that opportunities to reduce water use (in particular potable water use) and re-use water (rainwater, stormwater, wastewater, and groundwater) during the construction (for both surface works and tunnelling works) and operational stages have been identified and analysed. Costs and benefits must be estimated for each opportunity identified	Section 3
2.6 c) The Contractor must monitor, record and report on, in accordance with section 2 and section 2.1 of Appendix C.2 (Contractor Documentation Schedule), the following during the construction stage: (i) quantities of water use (potable and non-potable); and (ii) quantities of water re-use, treatment and harvesting.	Section 6
2.6 d) The Contractor must document in the relevant Design Documentation, estimates of the quantities of the following items that will be used during the operational stage of the Project: (i) water use (potable and non-potable); and (ii) water re-use, treatment and harvesting.	Section 7
Table D5.2, (11) 15% of non-potable water demand which is sourced from non-potable water sources during construction	Section 1.5
Table D5.2, (12) 15% of non-potable water demand which is sourced from non-potable water sources during operation:	Section 1.5
Table D5.2, (13) 15% of water (rainwater, stormwater, wastewater, groundwater, tunnel inflow water) generated/collected during construction which is re-used, recycled or reclaimed	Section 1.5
Table D5.2, (14) 5% of water (rainwater, stormwater, wastewater, groundwater, tunnel inflow water) generated/collected during operation which is re-used, recycled or reclaimed	Section 1.5

1.4.3. Project Environmental Protection Licence

CGU will obtain an Environmental Protection Licence (EPL), which will prescribe water discharge requirements. Discharge will be carried out in accordance with approvals under the EPL or Trade Waste Agreement with Sydney Water. During Stage 1 Preliminary Construction, refer to the Soil and Surface Water Management Procedure (M6S1-CGU-NWW-PE-PRO-000421) for further information regarding water discharge measures. During Stage 2 Construction, refer to the Soil and Surface Water CEMP Sub-plan.

1.4.4. Environment Mitigation Measures

The Environment Mitigation Measures contains requirements related to sustainable water consumption are outlined below in Table 3.

Table 3 - Environment Mitigation Measures water consumption related requirements

Requirement	Reference
GW9 - Sustainable water re-use options will be reviewed for treated groundwater during operations.	Section 0

1.4.5. Infrastructure Sustainability targets

CGU is targeting an *excellent* IS Rating. CGU is utilising Infrastructure Sustainability (IS) Rating v1.2, including Wat-1 and Wat-2 credits relating to water management. Table 4, shows the target and stretch scores.

Table 4: Indicative IS targets

Credit	Name	Target	Stretch
Wat-1	Water use monitoring and reduction	1.0	3.0
Wat-2	Replace potable water	0.0	2.0

1.5. Objectives and Targets

CGU has a sustainability objective to maximise efficiencies to reduce our footprint in relation to water. The Strategy we will adopt to support sustainable consumption of water during delivery and operations of the Project is based on the following four principles:

1. Understand the project water demand, including identification aspects with high demand;
2. Reduce the volume of water required during project delivery and operations, to the greatest extent practicable;
3. Replace potable water with sustainable non-potable sources, where feasible; and
4. Monitor and measure water consumption during project delivery.

This approach will ensure a holistic approach to water management and best practice environment and sustainability outcomes.

CGU water targets based on the SWTC D.5, Table D.5-2 requirements. Targets are as follows:

- 15% of non-potable water demand which is sourced from non-potable water sources during construction; operation and
- 15% of water (rainwater, stormwater, wastewater, groundwater, tunnel inflow water) generated/collected during construction which is re-used, recycled or reclaimed
- 5% of water (rainwater, stormwater, wastewater, groundwater, tunnel inflow water) generated/collected during operation which is re-used, recycled or reclaimed

1.6. Plan structure

This Plan structure is detailed in Table 5 below.

Table 5: Water Reuse Strategy Structure

Part A	<p>Introduction</p> <ul style="list-style-type: none"> ▪ Purpose ▪ Project description ▪ Scope ▪ Project requirements ▪ Objectives ▪ Sustainability Management System ▪ Plan structure <p>Project water sources</p> <p>Evaluation and selection of preferred water re-use options</p> <p>Water minimisation Measure</p> <p>Measuring and Reporting</p> <p>Evaluation and improvement</p>
Part B	Water Balance Study
Part C	<p>Appendices</p> <ul style="list-style-type: none"> ▪ Water re-use evaluation

1.6.1. Interactions with other Project Plans

This Strategy is part of an integrated set of Project Plans. Table 6 below outlines key sustainability items/content addressed within other relevant Plans.

Table 6: Project Plan Interfacing

Management Plan	Sustainability items/content addressed
Construction Environmental Management Plan (M6S1-CGU-NWW-PE-PLN-000400)	Sets out governance, monitoring, reporting, auditing and corrective action processes applicable to sustainability and environment management practices in relation to water management
Sustainability Management Plan (M6S1-CGU-NWW-SB-PLN-001400)	Sets of governance, monitoring, reporting, auditing and corrective action processes applicable to sustainability
Groundwater CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000412)	Details strategies to be applied to minimise water usage and manage groundwater resources during the M6 Stage 1.
Soil and Surface Water CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000409)	Details strategies to be applied to minimise water usage, manage soil and surface water and maximise water re-use during the M6 Stage 1.
Waste CEMP Sub-plan (M6S1-CGU-NWW-PE-PLN-000414)	Details strategies to be applied to minimise and manage waste during the M6 Stage 1.

Urban Design and Landscape Plan	Describes how CGU will design and deliver urban and landscape.
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2. Project water sources

Over the course of the project, a number of water sources will be utilised. CGU will adopt the water use and sourcing hierarchy illustrated in Figure 2 during the construction and operation of the project.

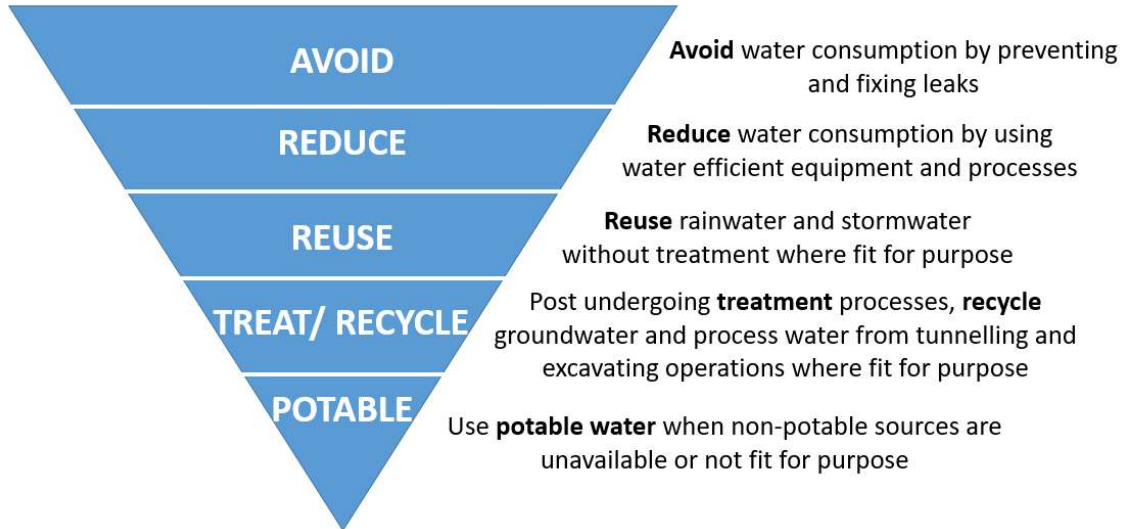


Figure 2: Water Use and Sourcing Hierarchy

There is a range of water sources available during the construction and operations phases, including:

- Connection to mains supply (potable water);
- Captured surface water
- Rainwater harvest;
- Onsite construction water treatment and re-use; and
- Treated groundwater.

Other water sources considered include

- Recycled water mains, due to no local availability

2.1. Consideration to suitability

All water sources will be evaluated for suitability. The use of non-potable water will be prioritised over the use of potable where suitable quality and supply is available and practical. CGU notes the following considerations for water re-use suitability. The table below (Table 7) highlights the consideration and measure to deem a water source suitable within the evaluation process.

Table 7: Consideration to suitability

Consideration	Description	Measure to deem suitable
Health and safety (Project)	The potential health risks associated with non-potable water on site have been considered and appropriate strategies have been identified to mitigate these risks. Following best	Assurance of non-potable water quantity to meet health and safety requirements.

Consideration	Description	Measure to deem suitable
Health and safety (Public)	<p>practices and lessons learnt from previous projects, these risks are best avoided</p> <ul style="list-style-type: none"> ▪ by separating the recycled water system from the potable water system, ▪ controlling the direction of flow where potable water is required to top up the recycled waste supply. ▪ ensuring no possible consumption of non-potable 	The public must not have contact with treated or re-used water sources
Specification	<p>Certain activities may require water to meet specifications or compliance requirements detailing water quality parameters. Non-potable water quality will be reviewed to required parameter, however where consistent water quantity cannot be assured to meet specification, non-potable water will be deemed not suitable and potable water will be required for activities. This may include technical and or manufacturing specifications.</p>	Assurance of non-potable water quantity to meet functionality requirements.
Demand and reliability	<p>Water demand (quantities of water) and reliability (constant supply of water) from source must be able to be met by the proposed water use.</p>	For water to be deemed suitable, the water source must meet appropriate water demand and reliability.
Financial feasibility	<p>The economic viability of the proposed water source and use will be considered. This will include</p> <ul style="list-style-type: none"> ▪ Connectivity of water source to demand ▪ Capital cost ▪ Program impacts 	Financial review of the whole of life costing will consider where appropriate and feasible the total costs and potential benefits of the initiative across its life cycle. Further details are provided in the Sustainability Management Plan.

3. Evaluation and selection of preferred water re-use options

CGU completed an evaluation for water re-use opportunities during the construction phases of the Project. The use of re-used water will be prioritised over the use of potable water on all sites where suitable quality and quantity is available.

The subsections below highlight the evaluation process in determining a preferred water source, including non-potable water. Water consumption estimates are calculated in the Project's Water Balance Study and will be updated as detailed design progresses. The supply of non-potable water will be dependent on rainfall, groundwater inflow, construction activities, and availability of storage at each site. It is noted that water demand relates to total demand, not non-potable water demand. Appendix A summarises non-potable water estimates.

3.1. Mains supply potable water

All construction sites will have access to potable water supplies through metered connections to the Sydney Water network. During construction and operations, potable water will supply the site offices and amenities and be used to supplement non-potable water supplies as needed. Where manufacturers' or technical specifications require, potable water will also be required for certain construction activities.

Due to health and safety considerations, potable water will be exclusively used in underground environments

3.2. Surface water capture

The M6 Stage 1 Project has no scope for construction sediment basins onsite which enable capture and re-use of surface water. Nonetheless, where surface water is collected on site in sumps, water will be re-used where appropriate.

3.3. Rainwater harvesting

Rainwater has been identified as a potential source of non-potable for both construction and operation. Rainwater can be harvested from site and acoustic sheds during construction and operational buildings.

3.3.1. Rainwater harvesting: Construction

Rainwater has been identified as a potential source for site amenities such as toilet flushing during and construction support activities

Consistent water quality measures from rainwater are not possible to achieve, and therefore there is no assurance to water parameters. Consequently, rainwater harvest is deemed unsuitable activities requiring technical specification, i.e. grout production.

Table 8 estimates quantities of water demand and estimated rainwater capture. This was based on the estimated roof area and calculated using Tankulator, an online rain harvesting calculator which uses local BOM weather station data.

Table 8 - Estimated rainwater harvest quantities for construction

Sites	Estimated water demand (kL)	Estimated non-potable available (kL)	Implementation period
Civil Construction			
Arncliff (C1)	11,673	1307.3	

Sites	Estimated water demand (kL)	Estimated non-potable available (kL)	Implementation period
Depot (C2)	14,007	894.4	3 months after site establish up until demobilisation
Bicentennial Park	16,731	1107.4	
C4 Bruce Street Facility / C5 West Botany Street Facility	3,891	6.1	
C6 Princes Highway	12,840	41.9	

Further feasibility and practicality of rainwater harvest will be completed on a site-by-site basis, taking into account:

- positioning of tanks and required infrastructure, in relation to potential water demand;
- potential contaminants, such as faecal coliform from wildlife; and
- cost-benefit analysis.

3.3.2. Rainwater harvesting: Operation

Rainwater harvesting will be installed at West Botany Street Depot, Rockdale Ventilation Facility Site and Arncliffe Ventilation Facility Site. Rainwater will be provided to supply as a minimum:

- toilet flushing;
- cleaning and wash down;
- make-up water supply to mechanical cooling systems; and
- landscape irrigation.

Further feasibility analysis will be completed during design development. Information, including estimated quantity, will be included in further revisions of this strategy.

3.4. Treated tunnel water

Treated tunnel water describes all water that will enter the tunnel from the water table during tunnel excavation, construction activities or operation. Once tunnelling commences, the groundwater and any residual construction water (for example, from rock bolting activities) will be combined, pumped to the surface as one stream and processed within the construction Water Treatment Plants (WTP). CGU intends to use commercially available 23% ammonia and 10% sodium hypochlorite solutions to achieve 5 mg/l chloramines in the water. All WTP will allow for water recycling and re-use for suitable activities. WTP will be installed during site establishment and will require commissioning prior to operation.

CGU has identified this water source as a potential non-potable water source. Potential activities which could utilise treated tunnel water include:

- Above for ground construction support and
- Groundwater injection processes;

Further investigation will be conducted to determine opportunities for re-use of treated water during operation. This will be included in future revisions of this Strategy.

3.4.1. Construction support

Water is required for construction support works to ensure works met safety and environmental requirements. This includes dust suppression, site management, and wash down activities.

Feedback and lessons learnt from previous projects suggest that treated water may not be suitable for wheel wash systems as water has higher hardness/mineral content in the water, can cause damage to plants and trucks.

For public health and safety considerations, for water to be deemed suitable, water must have no potential to leave the premises. Activities using treated water will be reviewed for risk of leaving the premises.

Table 9 estimates quantities of water demand and estimated treated tunnel water.

Table 9 - Estimated treated tunnel water quantities for above-ground construction support activities

Sites	Estimated demand kL	Estimated non-potable available (kL)	Indicative implementation period
Civil construction			
C1 (Arncliffe)	11,673	2334.56	June 2022 to December 2024
C2 (RMS Depot)	14,007	2801.47	May 2022 to October 2024
C3 (Bicentennial Park)	16,731	3346.21	May 2022 to October 2024
M&E Works	15,631	3126.14	June 2022 to October 2024

3.4.2. Groundwater injection

Groundwater injection is being investigated with non-potable water preferred. Investigation is currently being undertaken to determine quantities of water. This section will be updated when water recharge demand is identified.

Table 10 estimates quantities of water demand and availability.

Table 10 - Estimated treated tunnel water quantities for groundwater injection

Sites	Estimated demand kL/ Month	Estimated non-potable available Volume/Day	Implementation period
C2 (RMS Depot)	TBA	TBA	August 2022 to January 2023
C3 (Bicentennial Park)	TBA	TBA	

4. Water Minimisation Measure

The second principle of sustainable water management is to reduce the volume of water required during delivery, to the greatest extent practicable. Reduction in water use can be achieved through various initiatives such as machinery efficiency, response to leakage, etc. This section focuses on beyond business-as-usual opportunities aiming to reduce the Project water use. Potential initiatives include;

Construction

- Polymer reducing water use for dust suppression;
- Use of dry flow during commissioning works;
- Installation of efficient water fittings such as taps, hoses, and appliances;

Operation

- Native Plants to avoid landscaper irrigation during operation;
- Water efficient fitting for operations; and
- Sub and smart metering to identify potential leaks and inefficiencies.

At the detailed design phase, CGU will develop a base case model to demonstrate reductions in water consumption.

5. Measuring and Reporting

Measuring and reporting will be undertaken as detailed in Section 5 of the Sustainability Management Plan, which includes the publicly available annual report.

6. Evaluation and improvement

Audits, inspections, and reviews will be undertaken as detailed in Section 6 of the Sustainability Management Plan.

Part B: Water balance study

7. Water demand

This water balance model evaluates the whole of life during the delivery and operations of the Project.

Water use during construction delivery included:

- Site offices water use (toilets, showers, sinks and laundry); and
- Construction activities including dust suppression, silica dust management, compaction, roadheader cutting, shotcrete scaling, excavating and landscaping establishment.

Water use modelled for the operations and maintenance phase includes:

- Tunnel and building cleaning and washing
- 2 Motorway Operations Complex (MOCs)
- Flushing of frog habitat ponds
- Periodic testing of hydrant valves
- Periodic testing of deluge zones
- Periodic testing of fire pumps

A preliminary water balance model has been prepared to analyse the water needs of the Project and identify opportunities for potable water replacement and for minimising water needs.

Table 11: Project water footprint

	Construction Water Footprint	Operational
Water reduction		
Total water demand(kL)	608,632	TBA
Reduction compared to Base Case	TBA	
Water replacement		
Total demand for non-potable water (kL)	62,182	TBA
Estimated Non-Potable Water consumption (kL)	14,965	
Replacement rate	24%	

The water model will be further refined during detailed design, construction planning, and initiatives may be refined, altered and modified during delivery.

Part C: Appendices

Appendix A Water re-use evaluation

Use	Water source	Water quality parameters for non-potable to be deemed suitable	Total water demand	Non-potable water	
Above ground construction support and amenity use	Rainwater harvest	<ul style="list-style-type: none"> No visible oil or grease. 	46,302	1,407	6%
	Treated Water	<ul style="list-style-type: none"> No visible oil or grease No potential for water to leave the premises. 		8482.24	14%
M&E Works	Treated Water	<ul style="list-style-type: none"> No visible oil or grease No potential for water to leave the premises. 	15,631	3126.14	20%
Tunnelling works	Potable water	Potable water deemed not suitable	533,859	N/A	0%
Ground water recharge	Treated Water	TBA	TBA	TBA	TBA