Upper South Creek

Advanced Water Recycling Centre and Pipelines

PART A

CoA E92 Construction Water Reuse Strategy

Document No: USCP-JHG-PLN-ENV-0001

Revision No: A

Revisions and Distribution

Recommend Documents to be Read in Conjunction

This strategy is to be read in conjunction with the Construction Environmental Management Plan (USCP-JHG-MPL-ENV-0008), Soils & Contamination CEMP Sub-plan (USCP-JHG-MPL-ENV-0003), Biodiversity CEMP Sub-plan (USCP-JHG-MPL-ENV-0004), Commissioning Management Plan (USCP-MPL-G-0026) and the Project Sustainability Management Plan (USCP-JHG-MPL-PMY-0009).

Distribution

There are no restrictions on the distribution or circulation of this Water Reuse Strategy within John Holland.

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Revisions

Draft issues of this document shall be identified as Revision 01, 02, 03 etc. Upon initial issue (generally Contract Award) this shall be changed to a sequential lettering commencing at Revision A. Revision letters shall commence at Rev. A, B etc.

Date	**Rev**	**Remarks**	**Section**	**Prepared By**	**Reviewed & Approved By**
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Glossary & Abbreviations

Abbreviations	Meaning
AEC	Areas of Environmental Concern
Amendment Report	Upper South Creek Advanced Water Recycling Centre Amendment Report (March 2022)
Amendment RtS	Upper South Creek Advanced Water Recycling Centre Submissions Report – project amendments (April 2022)
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ARI	Average recurrence interval
ASS	Acid Sulfate Soil
Assessments related to*	<u>Hydrodynamics and water quality impacts</u> Hydrodynamics relates to the motion of water within the creeks and rivers, including how flows, velocities and water depths may be affected by structures, boundaries or changes in surrounding catchments (relevant project phase is Operation).
	<u>Surface water impacts</u> Assesses construction and operational impacts related to local runoff and stormwater management at the AWRC site and along the pipeline routes (relevant project phases are Construction and Operation).
	<u>Groundwater impacts</u> Assesses construction and operational impacts to local and regional groundwater sources from proposed activities at the AWRC site as well as along the pipeline routes (relevant project phases are Construction and Operation).
	<u>Ecohydrology and geomorphology impacts</u> Ecohydrology links flow patterns in a waterway to aquatic flora and fauna responses. Geomorphology is the study of landforms and analysis of how processes (such as running water) can shape and change landforms. Assesses how AWRC releases will impact the ecohydrology and geomorphology of the Hawkesbury Nepean River and South Creek. Also assesses impacts to the geomorphic attributes of waterways from the construction of pipelines and release structures (relevant project phases are Construction and Operation).
AWRC	Advanced Water Recycling Centre
BoM	Bureau of Meteorology
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAA	Commonwealth Controlled Activity Approval
CEMP	Construction Environmental Management Plan
CEMS	Contractors Environmental Management System
CIP	Community Involvement Plan
CLM	Contaminated Land Management
CLMP	Contaminated Land Management Plan
Compliance audit	Verification of how implementation is proceeding with respect to a Construction Environmental Management Plan (CEMP) (which incorporates the relevant approval conditions).
CoA	Minister's Conditions of Approval
CoPC	Contaminants of Potential Concern
CPESC	Certified Professional in Erosion and Sediment Control
CSSI	Critical State Significant Infrastructure
CWRS	Construction Water Reuse Strategy (this strategy)
D&C	Design and construct
DCC	Development Consent Condition
DEC	Department of Environment and Conservation
DECCW	Department of Environment, Climate Change and Water

Abbreviations	Meaning
DPE	NSW Department of Planning and Environment
DPI	Department of Primary Industries
DSI	Detailed Site Investigation
DTW	Depth to Water (groundwater)
EA	Environmental Assessment
TEC	Threatened Ecological Community
EHG	The Environment and Heritage Group (part of the NSW Department of Planning and Environment)
EIS	Upper South Creek Advanced Water Recycling Centre Environmental Impact Statement (September 2021)
EIS RtS	Upper South Creek Advanced Water Recycling Centre Submissions Report (March 2022)
EM	Environment Manager
EMS	Environmental Management System
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental incident	An unexpected event that has, or has the potential to, cause harm to the environment and requires some action to minimise the impact or restore the environment.
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental policy	Statement by an organisation of its intention and principles for environmental performance.
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ERG	Environmental Review Group
ESCP	Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statement
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater Dependent Ecosystem
GMR	Global Mandatory Requirements (John Holland)
HDD	Horizontal Directional Drilling
HEPA	Heads of EPAs Australia and New Zealand
HILs	Health Investigation Levels
HGL	Hydrogeological Landscape
Hold point	Verification point that prevents work from commencing prior to approval from Client / Verifier
HSLs	Health Screening Levels
JH	John Holland (the Principal Contractor)
JHET	John Holland Event Tracker
L/s	Litres Per Second
LGA	Local Government Area
MBGL	Metres Below Ground Level
Non-compliance	Failure to comply with the requirements of the Project approval or any applicable licence, permit or legal requirements.

Abbreviations	Meaning
Non-conformance	Failure to conform to the requirements of Project system documentation including this CEMP or supporting documentation.
NPW Act	National Parks and Wildlife Act 1974 (NSW)
NRAR	NSW Natural Resources Access Regulator
OCP	Organochlorine Pesticide
OEH	NSW Office of Environment and Heritage
OPP	Organophosphate Pesticide
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential acid sulfate soils
PCB	Polychlorinated Biphenyls
PFAS	Per-and poly-fluoroalkyl substances
PEI	Preliminary Environmental Investigation
PESCP	Progressive Erosion and Sediment Control Plan
PIRMP	Pollution Incident Response Management Plan
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
Project, the	Upper South Creek Advanced Water Recycling Centre and Pipelines Project
RAP	Remediation Action Plan
RUSLE	Revised Universal Soil Loss Equation
SAP	Sensitive Area Plan
SCCSP	Soils & Contamination CEMP Sub-plan
SEPP	State Environmental Planning Policy
SMART	Specific, Measurable, Achievable, Realistic and Timely
SWC	Sydney Water Corporation (the client and Proponent)
SWGCSP	Surface Water & Groundwater CEMP Sub-plan
SWL	Standing Water Level (elevation of groundwater table)
SWMP	Surface Water Monitoring Program
SWQ-CMP	Surface Water Quality Construction Monitoring Program
SWTC	Scope of work and technical criteria
TRH	Total Recoverable Hydrocarbons
TW	Treated water
UFP	Unexpected Find Protocol
UMM	Updated Management Measures
UPSS	Underground Petroleum Storage System
USC	Upper South Creek
UST	Underground Storage Tanks
VENM	Virgin Excavated Natural Material
WQO	Water Quality Objectives
WSP	Water Sharing Plan
WSUD	Water Sensitive Urban Design

1 Introduction

1.1 Context

This Construction Water Reuse Strategy (CWRS) has been prepared to address the requirements of the Minister's Conditions of Approval (MCoA) for the Upper South Creek Advanced Water Recycling Centre (AWRC) and associated Pipelines.

This CWRS considers water reuse options applicable to the construction phase of the Stage 1 of the Upper South Creek Project as detailed in the Upper South Creek AWRC Environmental Impact Statement (EIS), September 2021 and Amendment Report (March 2022). Operational water consumption, re-use and elimination are not considered within the scope of the report.

The CWRS for Upper South Creek Advanced Water Recycling Centre (AWRC) and Pipelines Project (refer to herein as the Project).

This CWRS has been prepared to address the requirements of:

- Minister's Conditions of Approval (CoA),
- *Upper South Creek Advanced Water Recycling Centre Environmental Impact Statement* (EIS) (September 2021)
- *Upper South Creek Advanced Water Recycling Centre Submission Report* (March 2022)
- *Upper South Creek Advanced Water Recycling Centre Amendment Report* (March 2022)
- *Upper South Creek Advanced Water Recycling Centre Submissions Report – Project Amendments* (April 2022)
- Response to DPE RFI 1, regarding responses to advice received on the Response to Submissions Report (dated 01 June 2022, 01 July 2022 and 11 July 2022)
- Response to DPE RFI 2, regarding additional information on Flood Impact Assessment (dated 11 July 2022)
- Modification of Infrastructure Approval CSSI 8609189, 26 May 2023 (herein referred to as Mod-1)
- Infrastructure Sustainability Council technical manual version 2.1 (ISC V2.1)
- Upper South Creek Commonwealth approval (EPBC 2020/8816), and
- All applicable legislation.

The USC project will be built in stages, consisting of:

Stage 1

- building and operating the AWRC to treat a daily wastewater flow, known as the average dry weather flow (ADWF), of up to 50 megalitres per day (ML/day); and
- building the treated water and brine pipelines to cater for up to 100 ML/day flow coming through the AWRC (but only operating them to transport and release volumes produced by Stage 1).

Future Stages

It is expected that the AWRC will ultimately require expansion to treat wastewater flows up to 100 ML/day. Sydney Water will remain flexible on the size and timing of these future upgrades to accommodate changes in population projections over time. Future stages will be subject to further environmental assessment.

Further detail on project staging is provided in the EIS and the Staging Report developed in accordance with CoA A11. This CWRS applies to Stage1 detailed design, construction and commissioning only. John Holland has been appointed by Sydney Water to deliver the USC project works, including detailed design and construction for treating an operational daily wastewater flow of up to 35ML/day. Greater flow capacities (including up to 50ML/day and 100ML/day), as explored in the EIS, are not covered in this CWRS.

1.2 Project Description and Background

The Upper South Creek Advanced Water Recycling Centre and Pipelines project (the project) has been proposed to support the population growth and economic development of the Western Sydney Aerotropolis Growth Area (WSAGA or Aerotropolis), South West Growth Area (SWGA) and the new Western Sydney International Airport. The project will provide wastewater services to Western Sydney to produce high-quality treated water for non-drinking reuse and for release to local waterways.

The project will comprise the following components:

- A new Advanced Water Recycling Centre (AWRC) to collect wastewater from businesses and homes and treat it, producing high-quality treated water, renewable energy and biosolids for beneficial reuse.
- A new green space area around the AWRC, adjacent to South Creek and Kemps Creek, to support the ongoing development of a green spine through Western Sydney.
- New infrastructure from the AWRC to South Creek, to release excess treated water during significant wet weather events, estimated to occur about 3 – 14 days each year.
- A new treated water pipeline from the AWRC to Nepean River at Wallacia Weir, to release high-quality treated water to the river during normal weather conditions.
- A new brine pipeline from the AWRC connecting into Sydney Water's existing wastewater system to transport brine to the Malabar Wastewater Treatment Plant
- A range of ancillary infrastructure.

An overview of the project site and associated pipelines is presented in

Figure 1-1 and

Figure 1-2.

1.2.1 AWRC Site

The AWRC site is approximately 78 ha and is shown in Figure 1-3. The AWRC site is split into two areas. The operational area is approximately 40 ha and will contain the wastewater and advanced treatment infrastructure and a range of ancillary infrastructure including inlet works, tanks and process chambers, advanced treatment buildings, interconnecting pipelines, digesters, pumping stations, odour treatment units, and biosolids treatment units.

The operational area also includes a range of supporting infrastructure such as roads, carparking, an administration building, security fencing and visual screening. Other features ancillary to the main treatment process includes chemical handling facilities and photovoltaic cells for solar energy production.

The green space of the site is about 38 ha and is within the 1% Annual Exceedance Probability (AEP) flood level. As part of the project, it will be landscaped to develop a green space that enhances biodiversity, uses best practice water sensitive urban design (WSUD), and provides visual screening of the AWRC.

John Holland will be delivering some of the landscaping proposed to be undertaken in the green space, however, the remainder of it will be completed as part of future stages of the USC project and is not included in the scope of this CWRS.

1.2.2 Pipelines

The project includes pipelines to take treated water and the brine waste stream away from the AWRC and release and dispose of them responsibly.

Pipelines required include the treated water pipeline to the Nepean River at Wallacia Weir and the brine pipeline from the AWRC to the existing Sydney Water wastewater network at Lansdowne. All pipelines will be built to their full capacity (that is, for a 100 ML/day AWRC capacity) in Stage 1. The treated water pipeline is planned to be about 16.7 km long and up to 1.2 m in diameter. The treated water pipeline will transfer treated water from the transfer pumping station at the AWRC, to the release point at Nepean River, upstream of Wallacia Weir from where it will then serve as an environmental flow. The brine pipeline will be about 24 km in length and about 0.6 m in diameter. The advanced treatment process at the AWRC will produce a brine waste product, which will be transferred from the AWRC to the existing Malabar wastewater system at Lansdowne.

1.3 Purpose

This CWRS addresses the water use requirements and reuse options for the construction phase of Stage 1 of the project. Water reuse is limited to rainwater, stormwater and groundwater that falls and/or is collected within the project boundaries.

This CWRS addresses and details the following issues:

- Water use requirements for surface works,

- Water use requirements for specific construction activities of high materiality,
- Stormwater management and discharge during surface works construction activities, and
- Rainwater harvesting and management; and
- Treatment and reuse of saline groundwater (contaminated water).

This CWRS does not consider the:

- Treatment and reuse of sewerage, and
- Operational water reuse.

An Operational Water Reuse Strategy (OWRS) will be prepared separately prior to commencement of operations of the Project in accordance with CoA E92.

1.4 CWRS Development and Submission

This CWRS has been prepared in accordance with the relevant conditions of approval and EIS management measures, as detailed in Section 3.3 and Section 3.4, respectively. The CWRS will be submitted to the Planning Secretary for information before commencement of construction and before commencement of operation regarding the OWRS.

This CWRS has been prepared in accordance with the relevant Infrastructure Sustainability Council (ISC) requirements as detailed in Section 3.5 of this strategy. This CWRS has been prepared by suitably qualified professionals in sustainability and environment, Mark Trethewy (Sustainability Manager, John Holland) and Alyce Harrington (Environment and Approvals Manager, John Holland).

1.5 Relationship to Other Plans

This CWRS details opportunities, measures and project commitments and requirements to harvest, reuse and recycle where feasible and reasonable available water sources during the construction phase of the project. Whilst this CWRS is not directly linked to the CEMP, references to information contained within key CEMP sub-plans have been incorporated throughout this document to ensure a comprehensive and considered approach to the development of the CWRS, including:

- Soils and Contamination CEMP Sub-plan (SCCSP) – details controls and management measures related to the potential impact of the project on soils and contamination.
- Surface Water & Groundwater CEMP Sub-plan (SWGCSP) - includes detailed erosion and sediment controls and management measures required to be implemented during the construction of the project. Specific soil management not related to erosion prevention is detailed in the SCCSP.
- Biodiversity CEMP Sub-plan (BCSP) – details controls and management measures related to the potential impact of the project on biodiversity, including provision of controls around waterways.

This CWRS should also be read in conjunction with the Sustainability Management Plan for specific water reduction and reuse targets.

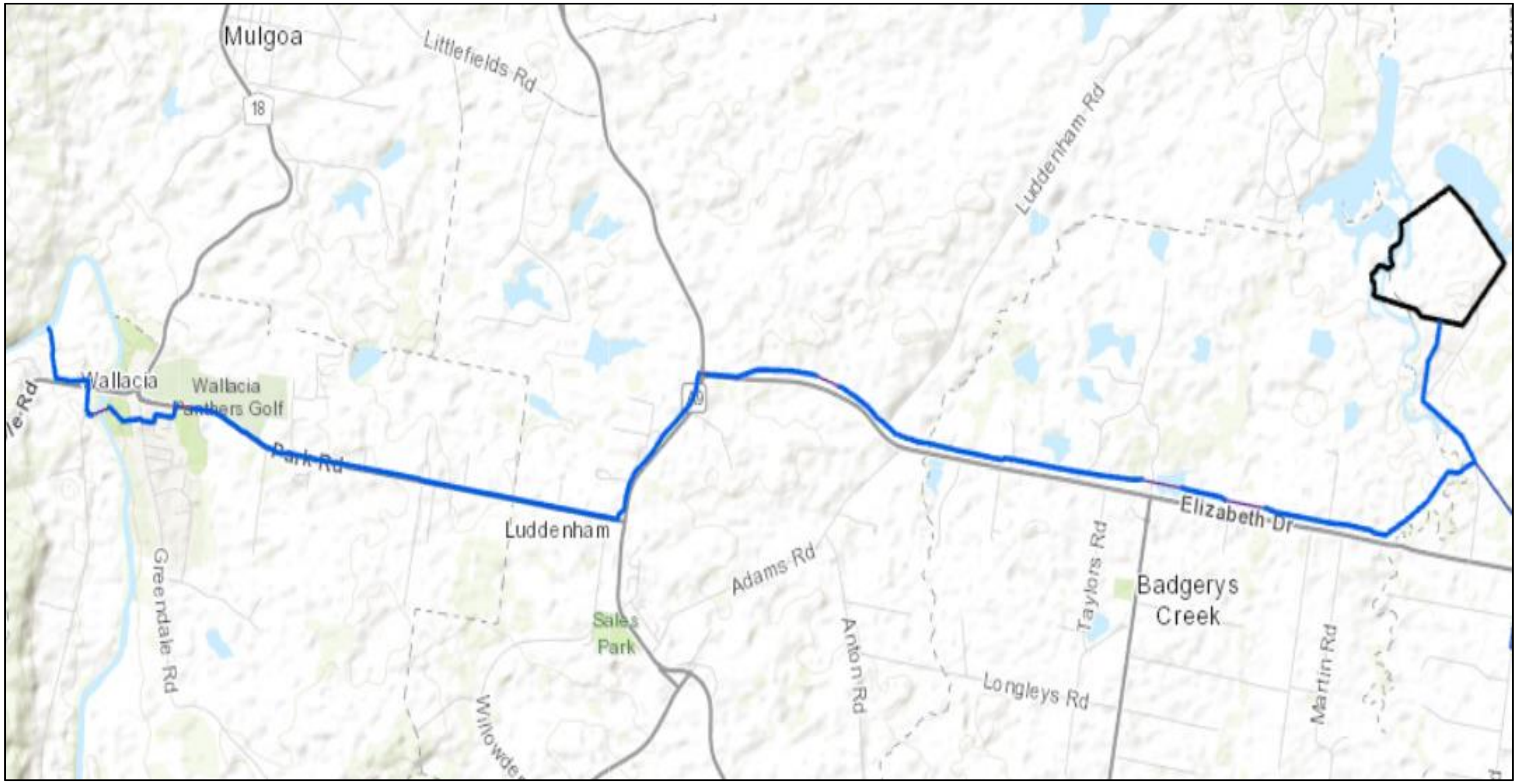

Figure 1-1 Indicative overview of the project site (AWRC) and treated water pipeline

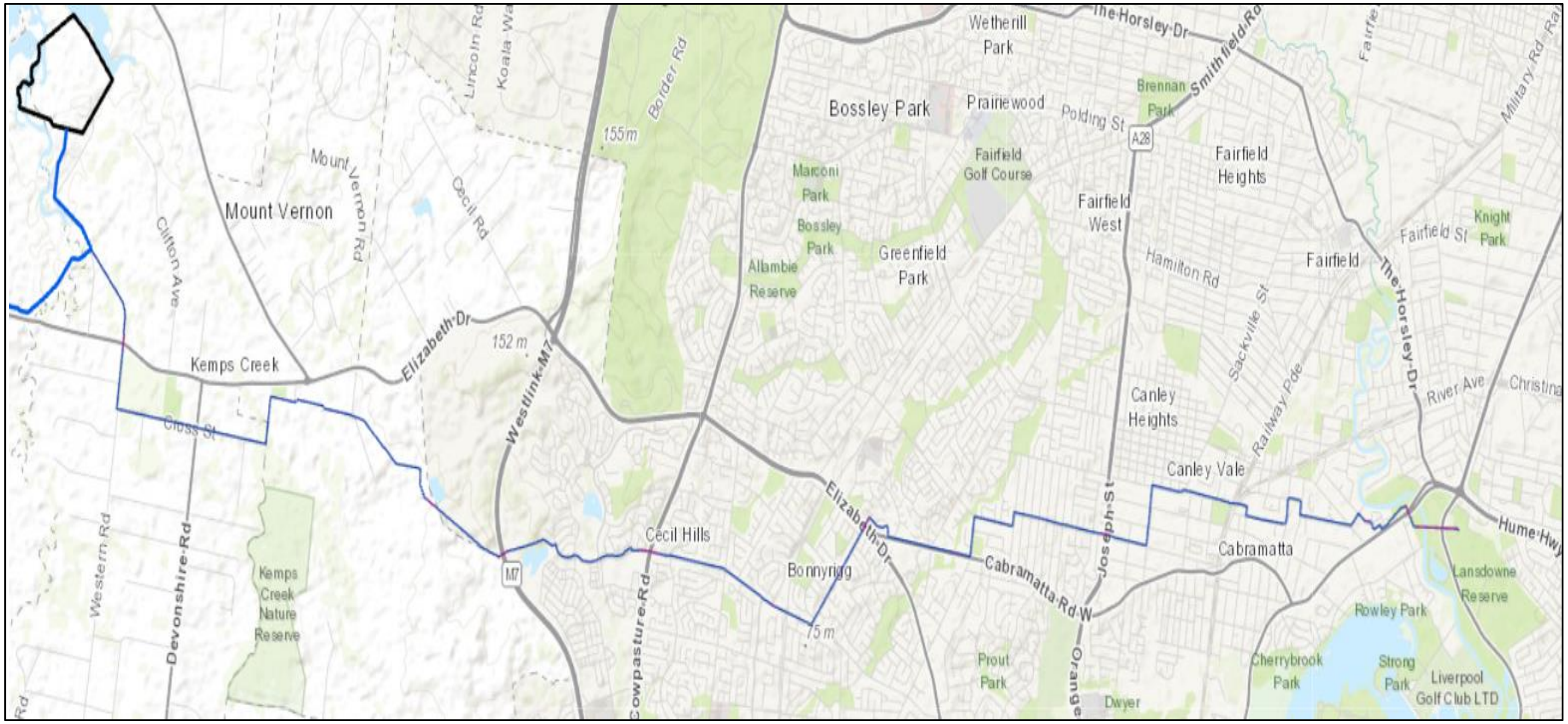

Figure 1-2 Indicative overview of the project site (AWRC) and brine pipeline

1	AWRC SITE ENTRY	6	BRINE TANKS
2	ADMINSTRATION CENTRE AND CAR PARKING	7	DIGESTORS
3	PARKLAND ACCESS ROAD	8	MBR
4	OVERLAND DISCHARGE ALIGNMENT	9	INLET WORKS
5	ONSITE BIO DETENTION AND RETENTION BASIN	10	OXIDATION DITCH

Figure 1.5-3 Indicative AWRC site arrangement (indicative and pending detailed design)

2 Objectives & Targets

This CWRS is applicable to the construction stage of work associated with the USC project and applies to John Holland and its subcontractors.

2.1 Objectives

The objective of this CWRS is to ensure that all water harvesting, reuse and recycling options relevant to the construction of Stage 1 of the project are investigated and adopted and implemented where feasible and reasonable:

- Demonstrate sustainability leadership and continuous improvement.
- Optimise resource efficiency (materials, energy, water, land, waste) throughout the project life cycles.
- Eliminate, reduce or substitute potable water with all possible alternative sources.
- Limit environmental impacts caused through water extraction and water harvesting from sources such as ground water and available water tables used by external stakeholders.
- Increase resilience to future climate.
- Encourage innovative construction and operation practices for water supply sourcing, treatment, and storage.
- Deliver on project Infrastructure Sustainability Rating objectives and targets.
- Deliver lasting value for stakeholders, and
- Implement innovative solutions in sustainable design and construction.

2.2 Targets

Targets associated with project-specific water reuse requirements are detailed in Section 3 of this CWRS and include tabulated references to where each requirement is addressed in this strategy.

3 Project Legislative and Guidance Requirements

The following sections summarise the legislative, guidance and standards, and project-specific requirements applicable to this CWRS.

3.1 Project Specifications and Plans

The project specifications and plans relevant to the CWRS include:

Sydney Water Technical Specification – Civil v10.0 (CPDMS0023)
Sydney Water Management Specification (1041412)
Sydney Water Policy - Water Quality Management During Operational Activities (D0001667)
Sydney Water Work Instruction - Guide to Water Quality for Water Main Construction (D0001668)
Sydney Water Procedure – Water Quality when Commissioning/Returning Reservoirs to Service (D0001909)
USC Construction Environmental Management Plan (USCP-JHG-MPL-ENV-0008)
USC Soils & Contamination CEMP Sub-plan (USCP-JHG-MPL-ENV-0003)
USC Surface Water & Groundwater CEMP Sub-plan (USCP-JHG-MPL-0002)
USC Biodiversity CEMP Sub-plan (USCP-JHG-MPL-ENV-0004)
USC Commissioning Management Plan (USCP-MPL-G-0026)
USC Sustainability Management Plan (USCP-JHG-MPL-PMT-0009)

3.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to this CWRS include:

- EPA NSW Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - The stormwater order 2014;
- EPA NSW Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - The treated drilling mud order 2014;
- Australian Guidelines for Water Recycling Stormwater Harvesting and Reuse, National Water Quality Management Strategy, Document No 23, July 2009, (NWQMS 2009);
- ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments;
- AS/NZS 5667.1.1988 (R2016) Water quality Sampling Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples;
- Commonwealth of Australia (2012). Australian groundaling guidelines;
- DEC (1997). Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu";
- DEC (2004). Environmental Best Management Practice Guideline for Concreting Contractors;
- DECC (2022). Approved Methods for the Sampling and Analysis of Water Pollutants in NSW;
- DECCW (2008). Managing Urban Stormwater: Soils and Construction Volume 2A Installation of Services;
- DECCW (2008). Managing Urban Stormwater: Soils and Construction Volume 2C Unsealed Roads;
- DECCW (2008). Managing Urban Stormwater: Soils and Construction Volume 2D Main Roads Construction;
- DLWC (1998). Guidelines for the Use of Acid Sulfate Soil Risk Maps (2nd ed);
- DPE (2022) Technical guidance for achieving Wianamatta South Creek stormwater management targets;
- EPA NSW (1995). Bunding and Spill Management Guidelines contained within EPA Environmental Protection Manual for Authorised Officers;
- EPA NSW (2007) Guidelines for the Assessment and Management of Groundwater Contamination;
- EPA Vic. (2009). Acid Sulfate Soil and Rock – Victorian EPA Information Bulletin, Publication 655.1;
- EPA NSW (2020). Guidelines for Consultants Reporting on Contaminated Land;
- Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries;
- Hazelton, P.A. and Murphy, B. W., (2016). What Do All the Numbers Mean? A Guide for the Interpretation of Soil Test Results (3rd ed) CSIRO Publishing, Melbourne;
- HEPA (2020), PFAS National Environmental Management Plan Version 2.0

- IECA (2008). Best Practice Erosion and Sediment Control: Appendix P - Land-Based Pipeline Construction; Isbell, R.F. and the National Committee on Soil and Terrain (2016). The Australian Soil Classification (2nd ed) CSIRO Publishing, Clayton South;
- Landcom (March 2004). Managing Urban Stormwater: Soils and Construction (4th Edition) (reprinted 2006), Volume 1 (the “Blue Book”);
- National Environment Protection Council (2013). National Environment Protection Measures for the Assessment of Site Contamination;
- National Uniform Drillers Licensing Committee, (2020). Minimum construction requirements for water bores in Australia, 4th edition;
- NRAR (2018). Guidelines for controlled activities on waterfront land – Riparian Corridors;
- NSW ASSMAC (1998).Acid Sulfate Soil Manual;
- NSW ASSMAC, QASSIT / QLD NRM&E / SCU / NatCASS / QASSMAC(2004). Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1;
- NSW DPI (2013). Policy and guidelines for fish habitat conservation and management (update 2013);
- NSW DPI (Fisheries) (2003). Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings;
- NSW DPI (Fisheries) (2003). Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings;
- NSW DPIE (2021). Minimum requirements for building site groundwater investigations and reporting;
- NSW DPI (2012). Guidelines for controlled activities on waterfront land;
- NSW Office of Water (2012). NSW Aquifer Interference Policy;
- NSW Office of Water (2012). Guidelines for watercourse crossings on waterfront land;
- NSW Soil Conservation Service (1982). Design Manual for Soil Conservation Earthworks – Technical Handbook No. 5;
- Standards Australia Committee CE/28 (1990). AS2368—1990 Test pumping of water wells;
- Standards Australia, Joint Technical Committee EV/8, (R2016). AS/NZS 5667:11 1998 Water quality - Sampling - Guidance on sampling of groundwaters, Sydney;
- Sundaram, B. et al., (2009). Groundwater Sampling and Analysis—A Field Guide, Canberra: Commonwealth of Australia;
- W.A. Department of Health (2021). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia;
- WorkCover NSW (2005). Storage and Handling of Dangerous Goods Code of Practice

3.3 Minister’s Conditions of Approval

Table 3-1 below provides a summary of the CoA relevant to water reuse and how and where these items are addressed in this CWRS.

Table 3-1 Minister’s Conditions of Approval

Condition	Condition Requirement	Document Reference	Evidence
E92	A Water Reuse Strategy must be prepared, which sets out options for the reuse of collected stormwater and groundwater during construction and operation. The Water Reuse Strategy must include, but not be limited to:	This document	This strategy addresses the construction phase of the project. A separate strategy will be prepared for the operational phase prior to commencement of operation of the CSSI.
	a) evaluation of reuse options;	Section 6	Section 6 provides a detailed assessment of identified potential water reuse options and assesses the applicability and feasibility of each opportunity within the context of project constraints and considerations.
	b) details of the preferred reuse option(s), including volumes of water to be reused, proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required;	Section 7.2, 8 & 10 Appendix A	Section 7.2 & 10 detail preferred reuse options, treatment where required, and any additional licensing or approvals required for each option. Volumes of water, locations and activities are summarised in section 8 and detailed in Appendix A – Water Balance Study.

Condition	Condition Requirement	Document Reference	Evidence
	c) measures to avoid misuse of stormwater or groundwater as potable water;	Section 6 & 7.2	Stormwater measures for avoidance of misuse are discussed in section 6 and 7.2. Groundwater won't be utilised in place of potable water for the project.
	d) consideration of the public health risks from reuse of stormwater or groundwater recycling; and	Section 7.1.2, 7.1.4 & 7.1.5	The project has determined the reuse of groundwater unviable due to certain limitations related to its existing / background quality. As itis not proposed for reuse, public health risks are deemed to be negligible. Sources and end uses of stormwater selected by the project for reuse have done so in consideration of potential health risks to the public. The project has selected no application of reuse that would pose a potential health risk as a result of contact or downstream effects to the public incurred by water pollution.
	e) a time frame for the implementation of the preferred reuse option(s).	Section 7-2	Table 7-1 details the timing for both investigation and implementation of feasible opportunities.
	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 and operation.	Section 7.1.10	Section 7.1.19 highlights the considerations utilised to determine potential reuse options and summarises the correspondence and consultation completed by John Holland with relevant agencies for specific reuse opportunities.
	Justification must be provided to the Planning Secretary if it is concluded that no reuse options prevail.	Section 10	Reuse options have been identified and implementation committed to. Opportunities under investigation have been identified and timelines for investigation provided.
	A copy of the Water Reuse Strategy must be made publicly available prior to the commencement of construction. If reuse is only proposed during operation, then the Strategy must be made publicly available prior to the commencement of operation.	A copy will be provided on the project website post submission to DPE.	https://www.sydneywatertalk.com.au/uppersouthcreek
	Note: Nothing in this condition prevents the Proponent from preparing separate Water Reuse Strategies for the construction and operational phases of the CSSI.	Note	The Project has opted to prepare separate Water Reuse Strategies for the construction and operational phases of the CSSI.

3.4 Updated Management Measures (UMMs)

Table 3-2 below provides a summary of the relevant Updated Management Measures (UMMs) and how and where these items are addressed in this CWRS.

Table 3-2 Updated Management Measures (UMMs)

Ref	Management Measure	Reference	Evidence
GW10	Develop a Drilling Fluid Management procedure to avoid impacts, including: • potential risk for 'frac-outs' at tunnelled crossings • approach to identify and manage frac-outs • contain and monitor drilling fluid at entry/exit points until it can be transported to a licensed waste facility • **reuse and/or disposal of drilling fluids by appropriately qualified personnel to a licensed facility** prioritising the use of fluids that reduce the risk of seepage into groundwater from boreholes.	Section 7.1 & 7.2	A project-specific waste tracking register is to be implemented as part of the project's environmental management system. Where a project feasibility assessment and evaluation for use of drilling fluid and mud deems reuse appropriate, the reuse / handling of the various constituents of drilling fluid will be tracked accordingly. All relevant requirements, including reuse, will be considered in the Drilling Fluid Management Procedure developed as part of the Surface Water and Groundwater CEMP Sub-plan.
W01	Develop and implement a Waste Management Plan as part of the project's CEMP. This plan will include: • opportunities to minimise the generation of spoil including suitability for reuse within the project • **targets for different waste streams with disposal being the least preferred approach, including diverting 75% of spoil from landfill (eg through offsite reuse), recycling rates of 80% for construction and demolition waste and reuse of stormwater for construction activities** • classification of all waste generated by the project in accordance with the EPA waste classification guidelines • site specific measures (in accordance with the compound locations) for waste segregation, storage, handling, collection and transport according to their waste classification, including for liquid wastes • instructions on clear signage to be provided at construction compounds to encourage correct recycling and reduce contamination. • measures to ensure safe storage and transport of waste materials and avoid or minimise any risk of waste or contaminated materials creating dust or other impacts to the community or surrounding sensitive environments • regular monitoring and auditing to assess the performance of waste management activities against the determined targets • training and awareness for all construction personnel • a record keeping system on site so that waste tracking systems can be maintained. This should include the use of the NSW EPA's online waste tracking system where required. Keep records of receipts to prove that waste diversion and recycling targets have been met.	Section 7.2	Stormwater reuse opportunities for construction activities that have been assessed as viable at this stage or under assessment for the viability of implementation are detailed within section 7.2

3.5 Infrastructure Sustainability Targets

Table 3-3 below details the Infrastructure Sustainability (IS) credit targets John Holland is pursuing to contribute to the achievement of a Gold Design and As Built rating under the Infrastructure Sustainability Council Design and As-Built rating. As part of the project's Sustainability Strategy, John Holland is targeting the following IS Rating benchmarks relating to the Water Category. Note that these targeted credits and levels may alter throughout the life of the project as materiality adjusts as a result of dynamic and unforeseen project changes.

Table 3-3 Indicative design phase IS targets.

Credit	Name of credit	Target Level	Target Score	Comments	Reference
Wat-1	Avoiding Water Use	2.5 (25% reduction in water demand from Base Case scenario)	3.78	Monitoring of potable and non-potable water usage to take place as part of monthly tracking processes and annual public reporting. The Project will continue to pursue opportunities to avoid and/or reduce water consumption.	Section 6 Section 7 Section 9
Wat-2	Appropriate Use of Water Sources	2.0 (20% reduction in potable water use from Base Case scenario)	3.02	Feasible alternative water sources with a financial payback will be reviewed and considered for implementation.	Section 6 Section 7

4 Water requirements

Water will be required throughout the construction phase of the project for general construction activities and site ablutions. Water use will primarily be for the purposes of earthworks, site ablutions, hydrostatic testing, pipe trenching, drilling and dust suppression.

Water will also be required to supply ancillary sites for ablutions and other ancillary activities. Potable and non-potable will be required for the following activities:

- Dust suppression on construction activities, exposed surfaces, stockpiles, and roads.
- General wash down and wheel wash.
- Maintenance of access points and roadways.
- Dust suppression during demolition activities.
- Non-destructive digging.
- Generation of drilling fluid.
- Compaction and general earthworks.
- Concreting and concrete curing.
- Conditioning of fill material.
- Hydrostatic testing of the AWRC site, brine & treated water pipelines and associated infrastructure.
- Site ablutions including toilets, showers, cleaning, and drinking; and
- Establishment of landscaping.

Water demand from site offices and ablutions will depend on the number of personnel based at a particular site and the hours of operation. Section 8 summarises the water balance study provided in Appendix A and estimates quantities based on current project personnel forecasts and baseline assumptions.

5 Initial water use assessment

Over the course of construction, several water sources will be utilised for the purposes described in Section 4. The project will adopt the Water Use and Sourcing Hierarchy illustrated in Figure 5-1 during construction. For the assessment undertaken as part of this CWRS, the project will utilise the definition of potable and non-potable water from the ISC v2.1 manual and the NSW Environment Protection Authority (EPA) definition of stormwater, as detailed below:

- Potable Water: High quality water that is suitable, safe, and approved for domestic consumption as set and regulated by national health and water quality standards. This is the standard supplied by water utilities which may also be referred to as town water or reticulated water.
- Non-potable Water: Lower quality water suitable for purposes other than domestic consumption (see potable water), such as toilet flushing or dust suppression.
- Stormwater: Stormwater means rainfall that runs off all urban surfaces such as roofs, pavements, carparks, roads, gardens, and vegetated open spaces.

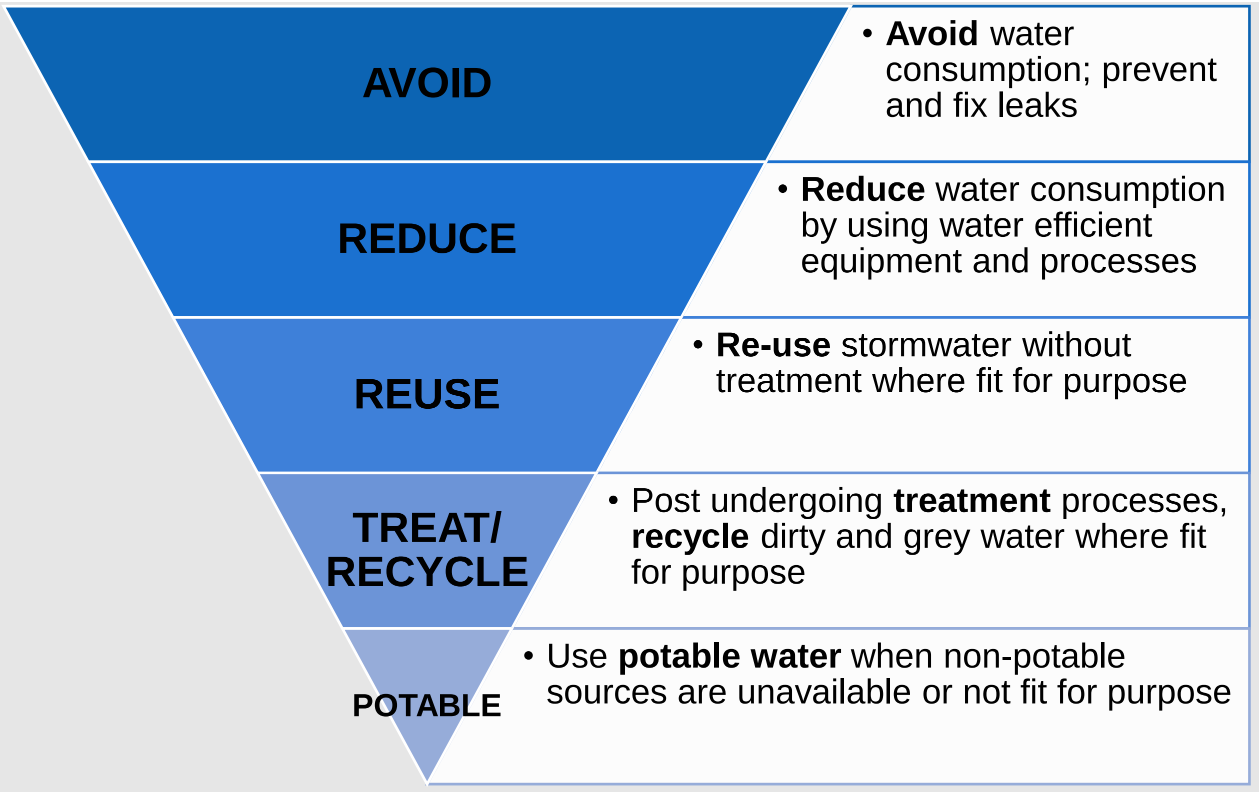

Figure 5-1 Water use and sourcing hierarchy

All construction sites will have access to potable water through metered connections from the Sydney Water network. During construction, potable water will serve as the primary supply for all water requirements detailed in Section 4. If non-potable sources are identified and the water source is feasible, the requirement will be filled from non-potable source collected and/or available.

Opportunities for the use of non-potable water in place of potable water have been assessed in accordance with the project's Sustainability Strategy.

The viability to which non-potable sources can be utilised is dependent on:

- Project personnel and public health and safety wellbeing.
- Economic feasibility and return on investment for the project.
- Relevant permanent or temporary design and manufacturers specifications.
- Availability and quality of non-potable water, and
- Environmental legislative and approval limitations and restrictions.

Given that minimal to no groundwater sources will be accessed by the project, non-potable water, if possible, will be sourced primarily from rainwater harvesting or portable water reuse as most sites have no stormwater system.

There is a high priority during construction on minimising the project footprint and associated area of disturbance. This in turn will minimise site capacity for containment and treatment, which may limit the above opportunities. Further feasibility will be conducted throughout construction and balanced against environmental, social, and economic factors.

Due to the spatial limitations of the pipelines short term drilling and material storage sites, there will be limited capacity for capture of stormwater on site. Earthworks trenches, sumps and sediment basins will capture relatively small volumes of water after rainfall events. This water will be beneficially used where feasible in accordance with the project's Surface Water & Groundwater CEMP Sub-plan (USCP-JHG-MPL-ENV-0001).

Water supplied during the construction phase, including water for bulk earthworks will be provided from a combination of harvested stormwater runoff from within construction sediment basins and potable water. An On-Site Detention (OSD) Basin, several sub basins, and a High Efficiency Sediment Basin (HES) are proposed at the main AWRC site.

For Blue Book-compliant sediment basin sizing, the disturbed area at the main AWRC site is approximately 10 ha, with several sub-basins, excavations and sumps proposed to be established to detain water, prior to being transferred to the main OSD basin and/or HES basin. The calculations indicate a required storage volume of approximately 1,420m^3. This is significantly less than the current proposed OSD volume of 9,680m^3 and thus the initial use of these areas for sedimentation purposes is expected to be adequate.

In addition to the information presented above for Blue Book compliant sediment basins, calculations based on the approved design to be constructed confirms that the flood detention basin to be constructed as part of the operational design, also provide sufficient volume for sediment controls during construction, should the project choose to implement HES basins. These flood detention basin volumes provide the required 196 m^3/ha of storage to achieve the site sediment management approach, if operated as HES.

Based on the project's current erosion and sediment control strategy and the Environmental Protection License (EPL 21800), the discharge of water from the site is not permitted. The project is currently preparing an application to vary EPL 21800 to introduce conditions to permit construction-phase stormwater discharges from the site. A HES basin is designed to capture sediment entrained stormwater runoff by adding clarifying agents (coagulants and flocculants) to increase the settlement of suspended sediments. HES basins use automated dosing to promote sedimentation of colloidal clay particles and are designed to prevent re-suspension of settled particles. The design proposed will be able to meet the construction phase stormwater targets related to Total Suspended Solids (TSS) 50 mg/L or less) prior to each planned discharge following stormwater and runoff events from the construction area. This design negates the traditional 5-day post rainfall discharge criteria often required for EPA licenced sediment basins and may provide an opportunity to re-use water from the HES on site over longer periods.

The AWRC Stage 4 erosion and sediment control plan (ESCP) is included in Appendix E. The Stage 4 ESCP comes into effect following approval of the EPL variation and water is permitted to be discharged from the site, via an operational HES basin. The HES basin has been designed in accordance with the Type B Basin from the International Erosion Control Association (IECA) 2008, Appendix B – sediment basin design and operation. The ESCP details the consideration of 2 design options, including calculations based on a settlement coefficient (KS) of:

- KS 12000
- KS 8000

IECA 2008, Appendix B as referenced above, requires that in the absence of a known site-specific soil type, projects should conservatively select a KS value of 12000. Following commencement of construction, soil testing will be completed onsite to confirm the appropriate settlement rate to be applied to the HES basin (i.e., KS 12000 or KS 8000), and subsequently inform the overall volume of the basin to be excavated. When determined and approved by the EPA, outcomes of the variation application process will be incorporated into this CWRS.

During construction, the OSD will primarily function as a water storage facility, where surface and stormwater runoff can be readily available for re-use on site, pending the water is of suitable quality as per the Dewatering Procedure (Appendix A SWGCSP). Whilst the reuse of local runoff is expected to reduce the external demand for potable water significantly, minimum requirements for any reuse activity must not cause ponding or runoff of water, which may generate concentrated runoff and unauthorised discharge offsite.

6 Alternative Water Use, Reuse & Reduction Opportunities

The Upper South Creek project will assess all viable reduction and reuse opportunities to facilitate infrastructure construction and operation that reduces water use, encourages substitution of potable water with appropriate alternative sources, and minimises environmental impacts of local water extraction/harvesting.

The project notes that throughout construction and operation, water demand and quality vary. As a result, the project has generated a robust water balance and outlined potential reduction and reuse opportunities that will support achievement of project sustainability requirements, as listed below:

- Investigate water efficient dust suppressants and soil binders to prevent repetitive application of potable or non-potable water for dust generation prevention to haul roads, stockpiles and fill areas.
- Schedule water-consuming activities such as dust suppression during cooler periods of the day to avoid evaporation.
- Cost benefit analysis and compound setup for rain harvesting and reuse in site ablutions (toilets and urinals), vehicle washdown and general cleaning.
- Capture rainwater and stormwater in strategic locations for reuse.
- Install water efficient taps within site facilities (push button with aerators) with a minimum WELS rating of 6 Stars or 3.5L/min or less. (In accordance with the Responsible Construction Leadership Guidelines, Site Facilities Requirements, Version 4.)
- Install water-efficient toilets within site facilities with a minimum WELS rating of 4 Stars or 3/4.5L dual flush. (In accordance with the Responsible Construction Leadership Guidelines, Site Facilities Requirements, Version 4.)
- Install water efficient showers within site facilities with a minimum WELS rating of 4 Stars, flow rate of 7.5l/min (In accordance with the Responsible Construction Leadership Guidelines, Site Facilities Requirements, Version 4.)
- Earlier engagement with project suppliers and sub-contractors to identify water avoidance and substitution initiatives for construction activities.
- Strategic planning of exposed site areas and the installation of erosion and sediment control measures to maximise construction water run-off capture from rainfall events for Project reuse.
- Investigation of mobile site-based treatment plants capable of separating liquid fractions and fines (aggregates and sands).
- Non-destructive digging fluid/waste treatment and reuse through portable on-site water treatment tanks to allow reuse.
- Reuse of drilling mud through application to land. Separation of bentonite from water through dehydration or water treatment to allow reuse of bentonite solution through application to land and potentially treated water.
- Selection of drought tolerant and temporary and permanent grasses, spray grass and plantings that minimal water to establish; and
- Strategic retention, transfer, and recycling of hydrostatic and wet commissioning water.

7 Evaluation of reuse options

7.1 Considerations for water reuse

7.1.1 Climatic and seasonal conditions

Construction of the project will occur over a two-and-a-half-year timeframe and therefore seasonal variation and climatic events will affect the volume and quality of water available for reuse at any time (Table 7-1). As per the Climate Change Risk Assessment (CCRA) in Appendix Y of the EIS, large wet seasons generally occur in the winter months and produce rainfall that exceeds the evaporation rate, increase groundwater recharge and water levels. A water reuse strategy reliant on rainwater and stormwater will therefore be opportunistic to enable beneficial reuse when conditions allow.

In addition, any water collected on-site after a rainfall event may not be usable for irrigation or dust suppression if the site has become saturated. Any reuse activity must not cause the ponding or runoff of water, increase ponding and runoff may generate the potential unauthorised discharge of concentrated runoff offsite as a result. Storage of captured water would only be required for reuse after the site has dried out sufficiently.

Table 7-1 Annual rainfall and evaporation statistics - Appendix N of the EIS

Statistics	Annual Rainfall (mm)	Annual Pan Evaporation (mm)	FAO-56 Potential Evaporation (mm)
Mean	746	1456	1227
Minimum	314	1257	N/A
Median	725	1445	N/A
Maximum	1725.5	1881	N/A

(Source: Table 4-1 of Appendix H of the Updated Groundwater Report by Aurecon Arup, March 2022)

7.1.2 Soil and Contamination

When considering water reuse in construction, it is essential to assess the quality of the water, potential contaminants, and the intended reuse application. There are certain types of construction water that may be inappropriate and limit ability for reuse within the project due to contamination or quality concerns. Several potential reuse options regarding contaminated and quality of water are discussed below, including limitations of pursuing water reuse.

Concrete wastewater, a biproduct of the concrete placement process, commonly referred to as concrete washout, refers to water that is generated during the mixing, pouring, and cleaning of concrete equipment and tools. This wastewater has significant variation in its quality and can contain various additives. Including chemicals from concrete admixtures, cement particles, suspended solids, and pH altering substances. Concrete wastewater will be generated from several sources during the construction phase including:

- Washout water - washout water is generated from cleaning concrete equipment, such as mixers, pumps, and trucks, and after the concrete has been poured.
- Concrete cutting and grinding - when concrete is cut or ground during construction or demolition activities, wastewater can be generated.
- Concrete curing water - concrete curing involves maintaining adequate moisture and temperature conditions to ensure proper hydration and strength development. The water utilised for curing must be clean water and curing compounds used must conform to AS 3799 (Liquid membrane-forming curing compounds for concrete).

Potable water contaminated by use in activities such as non-destructive digging, surface washing, grit blasting, drilling, washing vehicles and plant typically has limited reuse opportunities due to the risk of potential contamination. Inconsistent or insubstantial quantities can result in limited capture, application and/or storage options. Discharges of such potentially contaminated site water will be strictly controlled. A portion of the quantity encountered will be evaporated, and other smaller captured sources will be sent to a licenced waste facility. Sources such as non-destructive digging that can be captured are possible for water treatment with the limitation that volumes must be consistent (based on a project's construction methodology and scope), site area allows for the spatial impact of a temporary water treatment plant and the process is financially viable through a whole of life cost analysis.

Water can also accumulate from stockpile treatment and the management of saturated material. The water can be or become impacted by a range of pollutants including sediment, trace metals, oil, grease, hydrocarbons and chemicals, depending on the nature of the construction activities on the site. The water also has the potential to become acidic or basic depending on the presence of acid sulphate materials or tannins. Contaminated site water must be treated to an acceptable standard as outlined in the Surface and Groundwater CEMP Sub-Plan before it can be re-used on site and/or discharged from the site to the environment. If this water is unable to be treated to an acceptable quality, it will be taken to a licenced waste facility for disposal.

If not treated or managed correctly reuse of contaminated water could result in the migration of contaminates via leaching, overland flow or subsurface flow which may cause localised soil, surface water or groundwater contamination and result in possible downstream ecological impacts.

7.1.3 Saline Sodic Soil Conditions

Soil testing undertaken as part of geotechnical investigations in the EIS, indicated a potential risk of saline and sodic soils at the AWRC site and along the pipelines, at varying depths and extent (i.e., low, moderate, and high). Saline and sodic soils typically exhibit high levels of soluble salts, which results in soil with excessive sodium (particularly in the case of saline sodic soils). Soil high in sodium prohibits water absorption and infiltration by causing the dispersion of soil particles, which generates poor soil structure making it susceptible to compaction, reduced porosity, and limited water infiltration.

Saline sodic soil conditions pose challenges for water reuse due to the high salt and sodium content of the soil profile. The presence of both high salt and sodium content in the soil has the potential to significantly affect water quality and prevent the reuse of water in various ways:

- Increased Soil Salinity: Saline sodic soils have elevated levels of soluble salts, including sodium chloride (table salt) and other mineral salts. When water is applied to these soils, it can dissolve these salts, resulting in an increase in soil salinity. High soil salinity negatively impacts plant growth and can lead to water stress for plants, reducing crop yields and overall productivity.
- Reduced Water Infiltration: Sodic properties of the soil cause soil particles to disperse, leading to poor soil structure and reduced water infiltration rates. As a result, water is less likely to penetrate the soil and may accumulate on the surface or run off, leading to potential waterlogging and wastage.
- Soil Dispersion and Crusting: In saline sodic soils, sodium causes soil particles to disperse, leading to the breakdown of soil aggregates. When the dispersed particles recombine, they can form a surface crust that hinders water infiltration, increases surface runoff, and further reduces the soil's ability to absorb and retain water.
- Salt Accumulation in Water Sources: When water is used to irrigate saline sodic soils, it can dissolve the salts present in the soil and carry them away with the runoff. Over time, this can lead to the accumulation of salts in nearby water bodies, such as rivers, lakes, and groundwater sources. The increased salinity in these water sources can be harmful to aquatic life, affect water quality, and limit the usability of water for various purposes, including drinking and irrigation.
- Water Quality Concerns: Reusing water that has encountered saline sodic soils can be problematic due to the increased salinity and potential presence of other contaminants. The high salt content and dispersed soil particles in the reused water can negatively affect the health and productivity of plants, making it unsuitable for irrigation and other agricultural purposes.

7.1.4 Rainwater & Stormwater capture and site storage capacity

Rainwater runoff from site shed roof canopies may be captured in rainwater tanks for use in toilet flushing, cleaning, irrigation, and dust suppression excluding use as drinking water. The capacity of rainwater storage at each of the compound areas will depend on available space and the size of the roof catchment available at each ancillary facility as detailed in Table 7.2-2.

Installation of rainwater capture will be subject to a return on investment (ROI) assessment per site (Appendix B). Indicatively a roof space of 1450m^2 is required to provide a return on investment over a two-and-a-half-year Project construction phase considering the annual rainfall defined in Table 7-1.

In regard to rainfall detention, an Environmental Protection License (EPL 21800) is currently in place for the project, as work constitutes scheduled development work under the Protection of the Environment Operations Act 1997 (NSW). EPL 21800 includes specific construction-phase erosion and sediment control requirements and water protection requirements. The project will be constructed to meet the requirements documented in EPL 21800. Stormwater runoff will generally be captured in drains, creeks, stormwater systems, basins, trenches and open excavations and would be managed in accordance with EPL 21800. Under the currently approved license, water is not permitted to be discharged from the site.

As discussed in Section 6, the project is currently preparing an application to vary EPL 21800 to introduce conditions to permit construction-phase stormwater discharges from the site. A HES basin is designed to capture sediment entrained stormwater runoff by adding clarifying agents (coagulants and flocculants) to increase the settlement of suspended sediments. The HES basin design negates the traditional 5-day post rainfall discharge criteria often required for EPA licenced sediment basins and may provide an opportunity to reuse water from the HES on-site over longer periods. Nonetheless, rainwater and stormwater captured on-site may involve the reuse of the water for dust suppression, irrigation within the project boundary or discharging it after appropriate treatment of the water so that it meets EPL-compliant discharge water quality requirements.

The existing topography indicates a minor ridge line dividing the South Creek and Kemps Creek catchments, as depicted in Figure 7-1. The split may limit the ability to capture and store the maximum amount of viable water. The infrastructure footprint indicated in the reference design is primarily located west of this divide. Runoff from this area naturally drains towards Drainage Line 1, where it ponds within a billabong and any excess spills over to South Creek via the connecting spillway channel (see EIS Appendix K Figure 5-19 and Figure 5-20). Runoff generated east of the ridge naturally flows towards Drainage Line 2 and discharges to Kemps Creek upstream of the farm dam.

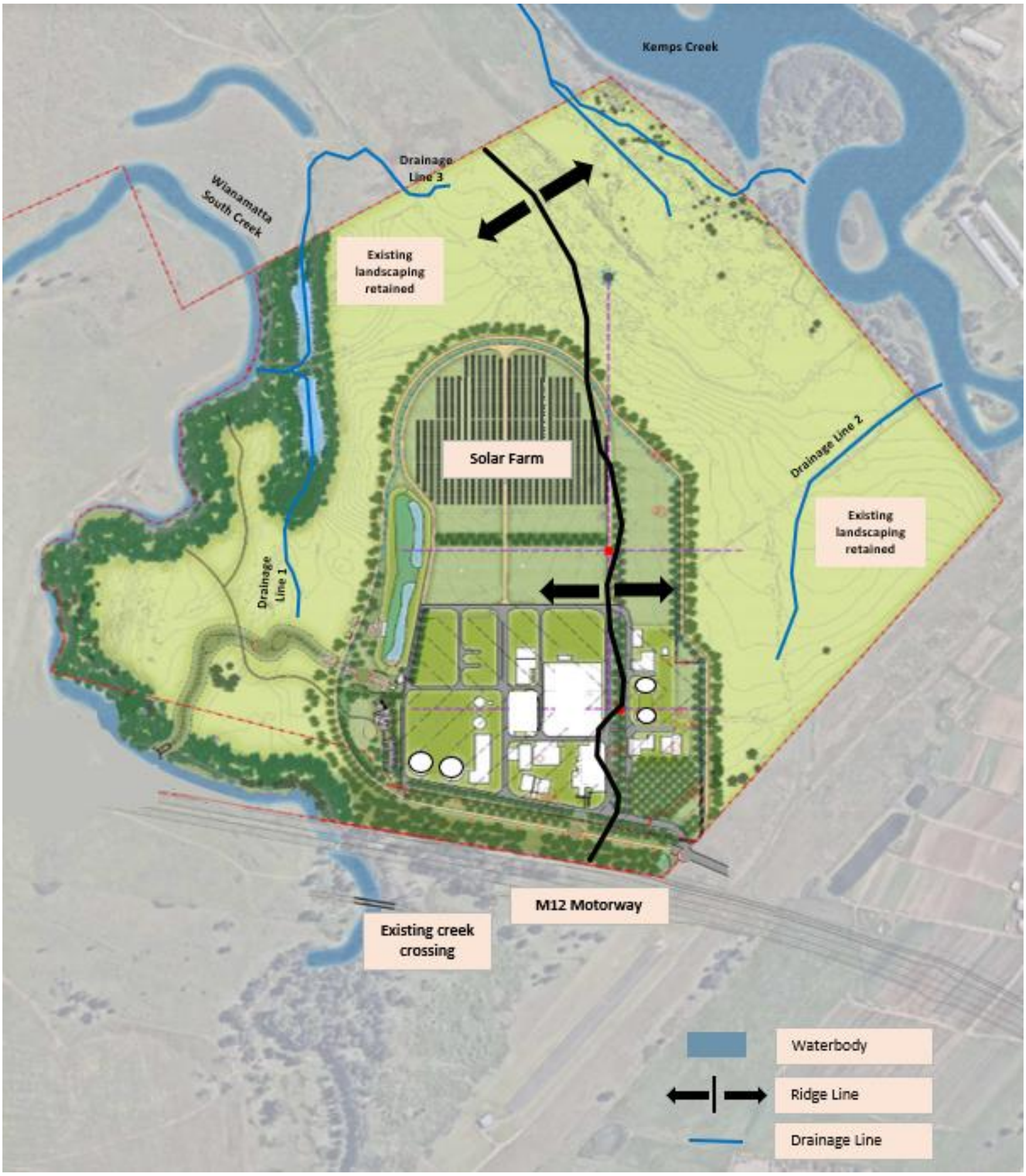

Figure 7-1 existing topography indicates a minor ridge line dividing the South Creek and Kemps Creek catchments

Storage of captured stormwater within the OSD, sub-basins, trenches and sumps, and the HES basin will be monitored and assessed ongoingly during construction as the ability to adjust capacities on site, for example via the placement of tanks, increase basin sizing, etc. is dependent on project spatial limitations onsite.

The capture, harvesting and reuse of all rainwater and stormwater will be undertaken in accordance with the industry best practice guidelines, "The safe harvesting water and urban stormwater will be completed in accordance with best practice guidelines, specifically the Australian Guidelines for Water Recycling, Stormwater Harvesting and Reuse (NWQMS 2009)" and the NSW EPA resource recovery order - stormwater order 2014.

7.1.5 Water Access and Extraction from Local Waterways, Creeks & Neighbouring properties

Should the project require use of surface water (stormwater) during construction, no water will be taken from waterways sources without obtaining all required approvals and/or written acknowledgement of public authority exemptions from the regulator, specifically the NSW Natural Resources Access Regulator (NRAR).

A Water Access Licence (WAL) has been obtained by Sydney Water for the purpose of the project, including the security of relevant shares as detailed in WAL 44469. The project is currently liaising with representatives from DPE Water to obtain a Miscellaneous Work (MW) number for the USC CSSI project and this will be used to link the project to a new WAL. Should John Holland or Sydney Water require regulator acknowledgement of a public authority exemption, it will likely only be for the following specific scenarios and only if it can be demonstrated that legislative requirements of the public authority exemption under the Water Management (General) Regulation 2018 (NSW) have been met, as summarised in the below Table 7-2.

Table 7-2 Public authority water access licence exemptions (NSW)

Public Authority Water Access Licence	Exemption Requirement	Regulation Reference
Dust suppression by public authorities	• This exemption applies to public authorities that are lawfully engaged in dust suppression activities. • The taking of water must be required for dust suppression.	Clause 21(1) of the Water Management Regulation 2018 Clause 5 of Schedule 4 of the Water Management Regulation 2018

Adjacent and nearby neighbouring properties to the AWRC on the eastern side have stormwater detention basins to service their businesses. As do areas adjacent and near to the pipeline's compounds and drilling locations. The extraction and use of water from dams would be subject to landowner consent. Water availability will be subject to the seasonal limitation mentioned in section 7.1.1 and the landowner ability to provide a provision of water additional to their own needs for livestock and produce.

7.1.6 Water Quality

Baseline water quality has been established by the Sydney Water monitoring program as detailed in the Hydrodynamic and Water Quality Impact Assessment report (EIS Appendix F). Baseline water quality results covering the period July 2017 to January 2023 from the sites depicted in Figure 7-2 below are summarised based on the results documented in EIS Appendix K in Table 7-3. The turbidity of the water in Kemps Creek, Badgerys Creek and South Creek limits the use to applications such as dust suppression or compaction that can utilise water with a high content of total suspended solids that cannot be used in applications such as hydrostatic testing without treatment. Water sourced from the Nepean River could serve as a potential source of water to serve a multitude of applications as a result of the higher quality.

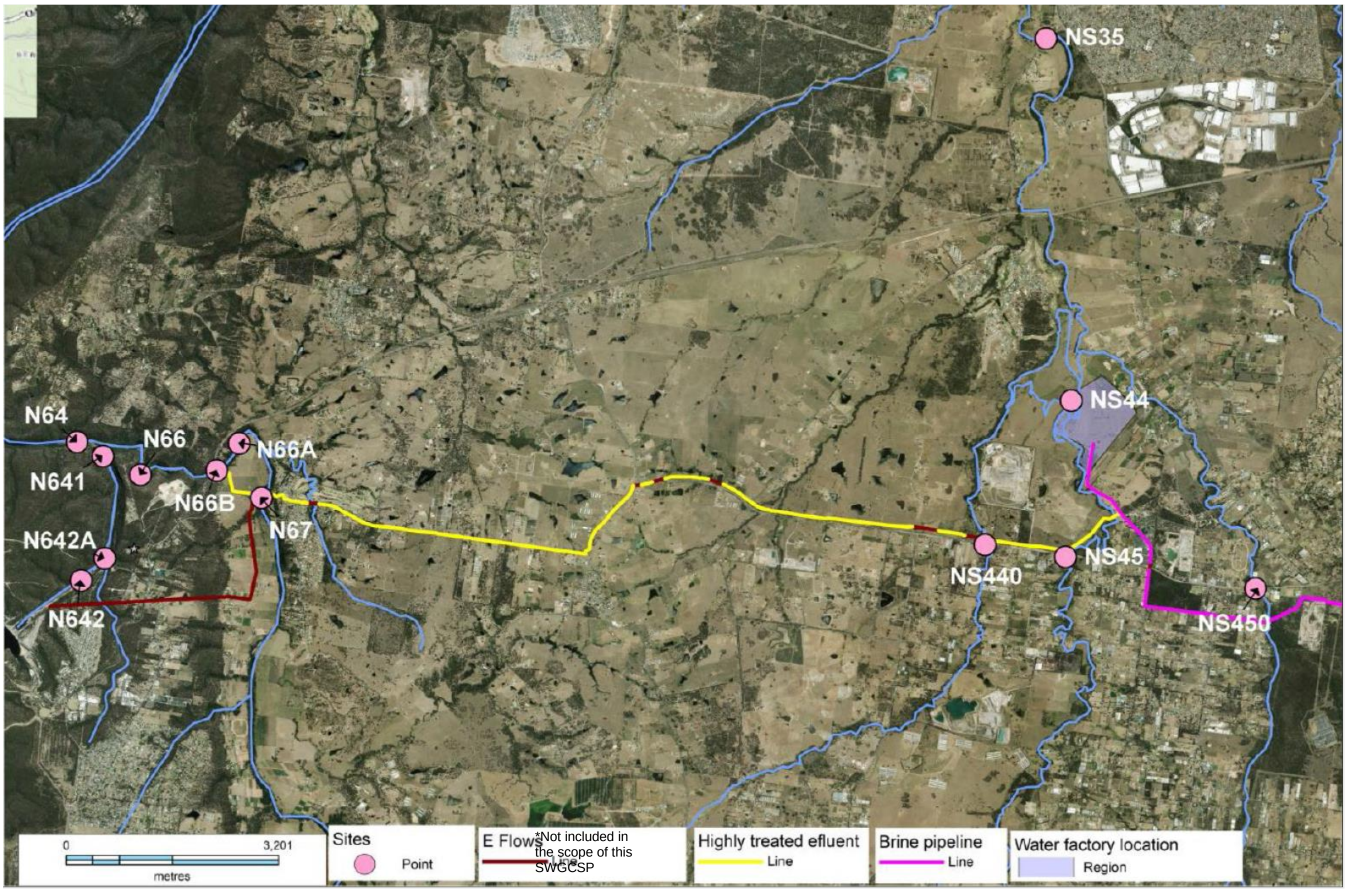

Figure 7-2 Water quality monitoring sites for AWRC baseline monitoring program (Source: EIS Appendix K)

Table 7-3 Baseline monitoring program water quality data (95th percentile values)

Location	DO (% satn)	EC (µS/cm)	pH (pH units)	Turbidity (NTU)	TN (mg/l)	TP (mg/l)
South Creek						
NS45 (upstream)	98	1,268	7.6	130	2.58	0.36
NS44 (immediately downstream)	119	1,203	8.2	131	2.31	0.29
NS35 (further downstream)	91	1,171	7.6	225	2.53	0.24
Kemps Creek						
NS450 (upstream)	94	2,660	7.7	114	6.99	0.85
Badgery's Creek						
NS440 (upstream)	72	1,086	7.3	54	2.49	0.29
Relevant performance criteria**	***43 - 75***	***1,103***	***6.2 - 7.6***	***50***	***1.72***	***0.14***
Nepean River						
N67 (upstream 1)	110	492	8.1	13	1.91	0.05
N66A (upstream 2)	99	450	7.7	14	nd	nd
N66B (downstream)	100	448	7.7	13	nd	nd
N66 (further downstream)	102	449	7.8	11	1.75	0.04
N64 (d/s Warragamba)	108	420	7.6	12	1.57	0.03
Warragamba River						
N642 (upstream)	109	317	7.5	12	0.69	0.01
N642A (downstream)	108	226	7.7	13	0.90	0.01
N641 (further downstream)	113	296	7.9	15	0.80	0.02
ANZECC default trigger value***	***85 - 110***	***125 - 2,200***	***6.5 – 8.0***	***6 - 50***	***0.35***	***0.025***

Cell colouring: Red indicates value outside the guideline value range; Green indicates all measured values within the guideline value range; Grey indicates no data (nd)
*Represents laboratory reporting limit
** Draft Wianamatta-South Creek Waterway Health Objectives (DPIE, 2020)***Guideline values for lowland rivers in south-east Australia with slightly disturbed ecosystems (ANZG, 2018)

Source: EIS Appendix K Table 5-10

7.1.7 Public health

John Holland has considered the potential health risks associated with reusing water on site. Reuse strategies identified in Table 7-4 aim to mitigate these risks. Given that no recycled/treated water is proposed to be used, the public health risks are considered negligible, and advice in this regard is not considered necessary from relevant agencies. If at any point the Project plans to utilise stormwater captured from established systems, recycled, or treated sewage public and Project personnel health will be reconsidered and evaluated.

7.1.8 Concrete and material batching

All concrete and asphalt will arrive on site pre-mixed and the use of non-potable water for batching plant production will be encouraged. Concrete and asphalt suppliers to the Project will be encouraged to use recycled water wherever possible and will report monthly on non-potable usage. Given these are offsite facilities, this is not addressed further by this Strategy.

7.1.9 Recycled water network

No network/pipeline exists within a feasible pumping distance for the Project to utilise. The use of any such network is prohibited by cost and distance.

7.1.10 Hydrostatic Testing & Wet Commissioning

Timing & Staging: Hydrostatic testing to identify potential asset leakage is required for all liquid retaining structures (excluding stormwater channels and culverts), steel tanks, pumps, and pipelines prior to the commencement of pre-commissioning as per the Sydney Water civil specification. Generally testing occurs prior to backfill and permanent surface works around the structure or asset.

Water Demand: To provide indication of the forecasted demand, one bioreactor cell requires greater than ten (10) megalitres (ML) for testing (of which there are three) and the treated water pipeline an additional ten (10) ML. These two assets are only one of many requiring significant quantities of water for testing purposes (detailed quantities provided in Appendix A). To fill and test all water retaining assets in a practical period consistent with construction staging and program a water source is required that is in excess of a hundred (100) ML and can supply both the AWRC and pipelines across the geographical area of the project, responding to both the logistical restrictions and water demand requirements. The utilisation of water cart delivered captured and harvested water to fil the treater pipeline would take 1000 water cart deliveries with a 10,000-litre capacity to complete.

Water Quality: The civil specification details that water levels for testing must be maintained for a stabilizing period of 7 days to allow for absorption and autogenous healing of the concrete. For healing to occur any water used must be free of impurities such as suspended solids (less than 2 NTU) unspecified chemicals and pollutants. The quality of water must meet Sydney Water's relevant work instruction and procedures for testing and commissioning (D0001668 & D0001909).

Discharge: Water used for testing and commissioning in accordance with the Sydney Water civil specification requires upon completion of asset testing, the structure be emptied, and the water disposed of. For pressured pipelines (treated and brine), the pipeline must be tested hydrostatically in sections to prove the structural soundness and watertightness of the pipelines. Pressured pipes due to the specification requirement must be tested in sections not exceeding 1 km in length. Sydney Water's work instruction (D0001668) states that water must not be left in the asset for extended periods of time, before or after testing, to prevent pH levels of held water from increasing to parameters outside specified discharge detailed within Sydney Water's discharge policy (D0001667) and the Project's environmental approvals for water discharge.

Upon the completion and acceptance/certification of hydrostatic testing, the commissioning phase can commence with pre-commissioning (Figure 7-3). The second phase of commissioning, wet commissioning, will require re-circulation of water throughout the entire system as part of the Site Acceptance Test (SAT). SAT is a formal test, that must be conducted prior to the introduction of process fluids(sewage). Water utilised for SAT testing is subject to the same limitations as that of hydrostatic testing and the same Sydney Water work procedures apply.

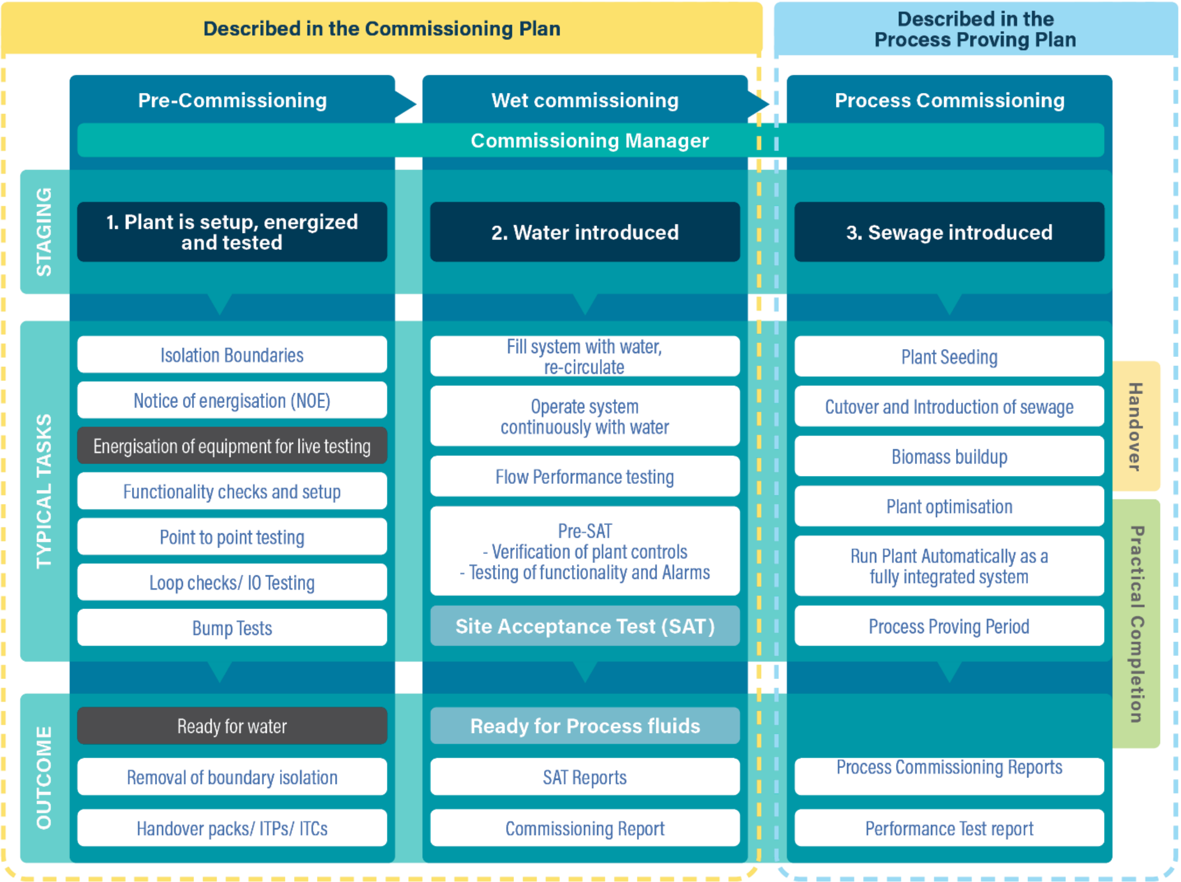

Figure 7-3 Commissioning phases, extracted from the Project Commissioning Plan (USCP-MPL-G-0026)

7.1.11 Onsite Treatment of drilling fluid and reuse of drilling mud for engineered fill/earthworks

Project drilling contractors undertaking horizontal directional drilling, under boring and pipe jacking will use a bentonite-based fluid Bentonite is a naturally occurring clay mineral, with excellent swelling properties that when mixed with water forms a viscous or gel like solution. The utilisation of Bentonite in the context of HDD (Horizontal Directional Drilling) and other drilling techniques serves several crucial purposes within the drilling fluid composition. It serves to effectively loosen the soil, facilitate the continuous removal of bore spoil, stabilize the bore hole itself, assist in smooth cutting of the material, provide cooling for the drilling tools, and uphold the integrity of the product pipe. The primary and paramount role it assumes is the stabilisation of the bore hole. This is particularly vital due to the consistent gravitational pressure acting on the horizontal bore, necessitating the fluid's safeguarding against collapse and the proper discharge of excavated material. Moreover, it maintains its flowability and material transport capabilities while in motion, all the while retaining its stabilising force. This distinctive consistency of the clay mineral renders Bentonite an indispensable component within HDD drilling fluids.

Reusing and reprocessing drill fluid can be undertaken by separating the solid matter (spoil) that has been extracted by the fluid in the execution of the drilling by means of a recycling or treatment unit and injecting the extracted drilling fluid back into a mixing unit to minimise the need continuous addition of bentonite and potable water. Spatial constraints of sites can prevent reusing and processing as space to install both the mixing and recycling unit is needed along with large scale generators in certain circumstances to power the units.

To treat drilling fluid at the completion of drilling works post processing unit extraction of spoil a water treatment plant is required to separate bentonite from water. Significant space is required to construct temporary holding structures or install tanks capable of holding extracted solution or evaporating the residual drilling fluid to generate drilling mud. Drilling mud and the testing and chemical properties it must meet for allowance to apply to land are defined by the NSW EPA in the resource recovery order for treated drilling mud (2014).

7.1.12 Best practice and industry advice

John Holland has an extensive breadth of experience in sustainability and water reuse initiatives in civil infrastructure projects, the extent of this combined industry knowledge and experience is reflected in the detailed initiatives identified, explored, and evaluated through qualitative and quantitative assessment/modelling in Section 6, Section 7.1, Section 7.2, Table 7-4 and Appendix A of this CWRS.

This strategy has considered water use practices and advice from similar major infrastructure projects in NSW. The project has consulted and advised with the following projects in the development of the strategy:

- Sydney Gateway
- M7 Widening & M7-12 Interchange Project
- Botany Rail Duplication
- Sydney Metro - Eastern Tunnelling Package
- Sydney Metro - City and Southwest
- Western Sydney Airport
- WestConnex M4-M5 Link Rozelle Interchange
- Sydney Metro – Western Sydney Airport, Surface and Civil Alignment Works

John Holland has engaged with and sought relevant industry, agency, and regulator advice as necessary for groundwater and surface water runoff capture and reuse. With respect to the project CWRS, the following agencies have been engaged with:

- NSW Environment Protection Authority (EPA)
- NSW Department of Planning & Environment, Environment & Heritage Group (EHG)
- NSW Department of Planning & Environment, DPE Water
- NSW Department of Primary Industries, Fisheries (DPI Fisheries)
- WaterNSW
- Relevant Councils, including:
  - Wollondilly Shire Council
  - Penrith City Council
  - Liverpool City Council
  - Fairfield City Council
  - Canterbury-Bankstown City Council
- Certified Professional in Erosion and Sediment Control (CPESC)

As construction progresses, John Holland will continue to work collaboratively with Sydney Water, suppliers, and subcontractors to investigate any future potential water reuse options on the project and will seek advice on those options from relevant agencies as needed.

7.2 Evaluation of reuse options per application

The subsequent assessment provides a comprehensive overview of the Project's identification and assessment of non-potable water sources for potential reuse, along with the status of implementation. The evaluation is delineated into two specific Project areas: AWRC (Advanced Water Recycling Centre) and Pipelines, as applicable. This division is based on the distinct variations in site layout and geographic positioning, which influence the spectrum of accessible water sources and opportunities within the ambit of the Project.

The evaluation below will consider and identify opportunities as valid and feasible that:

- Are significant water end uses across the construction phase, significance being defined by 5% or > than the total water demand.
- Deliver positive reduction in water demand and water reuse.
- Risks and opportunities in reference to section 7.1 considerations for each option for each water source.
- Are considered logistically and technically possible, posing an acceptable risk for the Project; and
- Have identified benefits that outweigh the whole of life costs through a viable financial payback period consistent with the Project construction period.

Table 7-4 Evaluation of potential reuse options

(Note, red light = unviable reuse opportunity, yellow light = reuse opportunity still under assessment, green light = viable reuse opportunity)*

Non-potable Water Source	Potential End Use	Evaluation of reuse option	Assessment timeframe/ implementation	Assessment Outcome	
Capture, detention and reuse of site surface water (*Consideration Ref: 7.1.4*)	Dust suppression, ablutions, compaction, washing, concrete curing and ERSED establishment and maintenance.	**Viable**	*Implementation:* During construction period.	**AWRC Site:** During the construction phase of the AWRC site, stormwater management basins will be utilised as sedimentation basins to capture and contain runoff and facilitate sediment removal. The areas associated with the proposed future on-site detention (OSD) basins, provides a suitable area away from waterways and flooding to be utilised for these basins. The capacity to function as sediment basins was confirmed in accordance with the Blue Book (Soils and Construction Guide Volume [1], 4th Edition for managing urban stormwater by the NSW government (Landcom, 2004)). Water supply during the construction phase, including water for bulk earthworks for the purpose of dust suppression and compaction will be provided from a combination of harvested stormwater runoff from within the construction sediment basins and potable water. It is proposed that across the construction site(s), additional temporary basins would be constructed, and existing on-site dams would be repurposed, where possible, to catch and store any runoff for reuse in the bulk earthworks. Mains water supply would be connected to the AWRC site before construction to top up harvested stormwater as required. The re-use of local runoff is expected to reduce potable demand. In addition to the above mentioned sediment basins the flood detention basin to be constructed as part of the operational design, will provide additional volume for sediment controls during construction, should the project	

Non-potable Water Source	Potential End Use	Evaluation of reuse option	Assessment timeframe/ implementation	Assessment Outcome	
				choose to implement high efficiency sediment basins (HES). These flood detention basin volumes provide the required 196 m^3/ha of storage to achieve the site sediment management approach if operated as HES. Either management approach, whereby the flood detention storages are used as traditional construction sediment basins or HES, will be able to be utilised for stormwater harvesting and reuse to replace potable water demand for end uses such as dust suppression following stormwater and runoff events from the construction areas. John Holland is currently engaging with the NSW EPA regarding construction-phase stormwater discharges and how this will be represented in the project's EPL and the role that the Water Pollution Impact Assessment (required under CoA E124) will have in determining the requirements for discharges off-site. When determined, these requirements will be incorporated into this SWGCSP. **Pipelines sites (Unviable)**: The pipelines facilities will primarily serve as a location to store pipes prior to installation and for construction personnel ablutions. The pipelines facilities at this time don't require basins in accordance with Blue Book (Soils and Construction Guide Volume 1, 4th Edition for managing urban stormwater by the NSW government (Landcom, 2004)). The Project ultimately wants to limit the environmental footprint of the facilities and restrict ground disturbance as much as possible, as such capturing, detaining and utilising site water by means of basins or storage tanks isn't viable.	
Stormwater – Rooftop capture (*Consideration Ref: 7.1.4*)	Dust suppression, ablutions, compaction, washing, concrete curing and ERSED establishment and maintenance.	**Viable**	*Implementation:* During construction period.	**AWRC & Pipelines sites:** Rainwater will be captured on all Project sites in which spatial and logistical setup allow roof capture constraints permit. The installation of rainwater capture through roof canopy drainage/tanks and associated infrastructure are to be installed where the return on investment (ROI) threshold is achieved. John Holland has calculated that an average roof area of greater than 1450m^2 installed and in place for a period of 2.5-years or more during the construction period is required to achieve Project ROI based on regional rainfall projections in Table 7-1.1. All current Project compound layouts (Appendix C) have been assessed for viability to achieve ROI. Due to the spatial restrictions of the majority of Pipelines compound areas needing to be utilised for pipe storage there is little to no roof space provided at the Project ancillary facilities. The AWRC Site is the only viable facility for capture and reuse with a roof space of greater than 1450m^2. The Project cost benefit analysis is provided in Appendix B for information. Please refer to Table 7-2.2 for a site compound specific assessment.	

Non-potable Water Source	Potential End Use	Evaluation of reuse option	Assessment timeframe/ implementation	Assessment Outcome	
Extraction of water from local waterways & neighbouring dams (*Consideration Ref: 7.1.5*)	Dust suppression	Feasibility assessment ongoing	*Feasability Assessment Timing: Q3 2023 – Q1 2024.* *Implementation:* Under assessment	**AWRC & Pipelines – Local Waterways:** The Project is currently in the process of acquiring the necessary approvals to extract and use surface water during construction from a local waterway. A Water Access Licence (WAL) has been obtained by Sydney Water for the purpose of the USC Project, including the security of relevant shares as detailed in WAL 44469.The project is currently liaising with representatives from DPE Water to obtain a Miscellaneous Work (MW) number for USC CSSI project and this will be used to link the project to a new WAL. **AWRC & Pipelines – Neighbouring Landowner Stormwater Detention Dams:** The Project is currently assessing the viability and feasibility of requesting and brokering agreement to purchase water from local landowners for use in construction activities. There are several logistical limitations the Project must consider regarding mobilising the water to site; pumping distances, temporary power to maintain pressure and ongoing access to maintain the pumping system that are yet to be resolved. Additionally, the Project would only pursue this opportunity if the outcome would be a positive reduction in water demand and reuse for the region, the Project won't request access and extraction of dammed water for the purposes of agricultural businesses that needs readily available water access in times of prolonged dry weather for crops and livestock.	
Stormwater – capture and reuse of existing underground stormwater systems (*Consideration Ref: 7.1. & 7.1.2*)	Ablution blocks and dust suppression.	Unsuitable	*Implementation:* Not feasible for Project implementation.	**AWRC Site:** The AWRC site has no formal existing stormwater system as it is a greenfield site. As such, the connection and extraction of a stormwater source is unviable for Project reuse. **Pipeline Sites:** Treated Pipeline All treated pipeline sites are situated in an equivalent setting to that of the AWRC site, there is no existing stormwater system in place to capture water from. Brine Pipeline The Project sites situated on the brine pipeline will be in areas with existing systems. Stormwater that is unaffected by project works will be diverted to existing stormwater drainage systems as per the Project's erosion and sediment control plans. John Holland doesn't intend to seek permission to intercept this existing water reuse with relevant local authorities. The compounds lack the required area to treat and store stormwater to a level acceptable for use and worker exposure. Due to the unknown pollutants and contaminants that could enter or runoff the sealed surfaces into the stormwater network the water sources present an unacceptable risk of contaminated water for reuse without processed wastewater treatment. The source furthermore offers	

Non-potable Water Source	Potential End Use	Evaluation of reuse option	Assessment timeframe/ implementation	Assessment Outcome	
				an inconsistent supply due to reliance on rainfall. Due to these two major limiting factors the water source presents an unviable water source to the Project that poses a risk to worker exposure and is cost prohibitive for project return on investment.	
Extraction and reuse of groundwater (*Consideration Ref: 7.1.2 & 7.1.3*)	Compaction, irrigation & dust suppression.	Unsuitable	*Implementation:* Not feasible for Project implementation.	In addition to the groundwater investigations undertaken as part of the development of the EIS, additional site investigations for the purpose of furthering the design of both the AWRC and the treated water and brine pipelines has been undertaken by the project following contract award. The following observations have been made regarding groundwater levels relative to the design of the AWRC site and proposed depths of both the treated water and brine pipelines: **AWRC Site:** 3 additional geotechnical boreholes were established at the AWRC site, at key locations relative to significant structures on site, including the bioreactor and inlet structure. In consideration of the results from these boreholes and historical information obtained during the development of the EIS and subsequent preliminary groundwater monitoring events undertaken by Sydney Water (USC AWRC Pre-construction Groundwater Monitoring Event Report, Aurecon Arup, April 2022), groundwater at the AWRC site ranges from 0.5 – 1.0m below ground level (mbgl) at monitoring wells in close proximity to South and Kemps Creek; and high variability in monitoring well readings from the south to the north of the site, ranging between 1.3 - 2.4mbgl, respectively. **Pipeline Sites:** Brine Pipeline: 41 additional geotechnical boreholes were established along the proposed alignment, including at key waterway crossings, roadways and intersections, railway corridors and existing critical utilities. Groundwater was encountered in 17 of the boreholes with the average depth of groundwater being 2.85m mbgl. The average excavation depth for the BP is 1.8m, indicating that interaction with groundwater during pipe installation will likely be minimal. Treated Water (TW) Pipeline: 28 additional geotechnical boreholes were established along the proposed alignment, including at key waterway crossings, roadways and intersections. Groundwater was encountered in 21 of the boreholes with the average depth of groundwater being 3.74mbgl. The average excavation depth for the TW is 2.5m, indicating that interaction with groundwater during pipe installation will likely be minimal.	

Non-potable Water Source	Potential End Use	Evaluation of reuse option	Assessment timeframe/ implementation	Assessment Outcome	
				Both alluvial and porous/fractured rock aquifers intersected by the project are within a “less productive groundwater source” category as defined by the NSW Aquifer Interference Policy criteria based on the relatively low number of registered supply bores, expected low yields and poor water quality (high salinity). <u>Conclusion</u> The results of the detailed investigation by Sydney Water & John Holland have detailed a low yield water source of high salinity. The amount possible for extraction thus make the feasibility from a practical application and whole of life cost perspective unviable, furthermore the high salinity of the groundwater prohibits its use for the end uses identified due to the detailed limitations listed in section 7.1.3. Application of such a poor-quality water source would only worsen the ground conditions and create the potential for off-site discharge to the creeks bounding the Project.	
Recycled water network connection and extraction (*Consideration Ref: 7.1.9*)	Concrete activities, ERSED establishment and maintenance (spray grass, soil binder etc.) non-destructive digging, surface/cleaning washing, grit blasting, washing vehicles and plant, street sweeping and hydrostatic testing and wet commissioning.	**Unviable**	*Implementation:* Not feasible for Project implementation.	**AWRC & Pipelines sites:** No network/pipeline exists within a feasible pumping distance to the Projects main compound at the AWRC for the Project to utilise. The use of any such network is prohibited by cost and distance associated with installation of necessary infrastructure or delivery by water carts.	
Hydrostatic Testing & Wet Commissioning storage & reuse (*Consideration Ref: 7.1.10*)	Compaction, irrigation, dust suppression & testing reuse.	Feasibility assessment ongoing	*Feasibility Assessment Timing: Q3 2023 – Q2 2024.* *Implementation:* Under assessment.	**AWRC Site:** The Project is currently required to test, treat in-situ and discharge the water of each water retaining structure and asset of the recycle centre in sequence. The following applications have been considered and eliminated or remain under investigation: • Irrigation (***Unviable***) – Noting the limitations of reduced infiltration and increased soil dispersion identified in section 7.1.3 consistent the saline sodic soil profile of the AWRC site, application of water to land poses a significant Project risk. The volume of water requiring discharge post-test completion is greater than 1 megalitre (ML) in the majority of structure and asset testing. The discharge to land for irrigation purposes of >1 ML has a high likelihood of resulting in site inundation, due to the presence of saline sodic soils high	