S2-FGJV-ENV-PLN-0025

SURFACE WATER MANAGEMENT PLAN

Approval Record			
Document preparation, review and approval		Name in print	Signature
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5	05.06.2020	Update from DPIE comments. For Approval

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ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
AEP	Annual exceedance probability
ANZECC/ARMCANZ (2000)	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
AC	Acid consuming
AFL	Agreement for Lease
ANC	Acid neutralising capacity
ARD	Acid rock drainage
ARI	Average recurrence interval
BCD	Biodiversity and Conservation Division (formerly OEH)
Blue Book	*Managing Urban Stormwater: Soils and Construction*. Landcom, (4th Edition) March 2004
BMP	Biodiversity Management Plan
BOD	Biological oxygen demand
BoM	Bureau of Meteorology
CoA	Conditions of Approval
COPC	Contaminants of potential concern
CSSI	Critical State significant infrastructure
DEC	Department of Environment and Conservation (now part of Department of Planning, Industry and Environment)
DECC	Department of Environment and Climate Change (now part of Department of Planning, Industry and Environment)
DMP	Dredging Management Plan
DoI Water	NSW Department of Industry – Water
DPIE	NSW Department of Planning, Industry and Environment (formerly DPE)
DoI	NSW Department of Industry
DPI Fisheries	NSW Department of Primary Industries – Fisheries
EC	Electrical conductivity
ESCP	Erosion and Sediment Control Plan
EIS	*Environmental Impact Statement Exploratory Works for Snowy 2.0*
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
EWAR	Exploratory Works Access Road
Future Generation	Future Generation Joint Venture
Future Generation-PMS	Future Generation Project Management System

Acronym	Definition
Hydro-electric	Generation of electricity using flowing water (typically from a reservoir held behind a dam or barrage) to drive a turbine which powers a generator.
KNP	Kosciuszko National Park - A National Park protected under the *National Parks and Wildlife Act 1974* (NSW) and managed by NSW National Parks and Wildlife Service. It covers an area of 673,543 hectares and forms part of Australia's only Alpine area.
Lobs Hole	A former settlement location within Kosciuszko National Park, and primary location of Exploratory Works.
Lobs Hole Spelling	In this document the contemporary spelling *Lobs Hole* is used except for when a specific older name is referred to, such as for example, *Lobbs Hole Copper Mine*, when the original spelling is used.
MNES	Matters of National Environmental Significance (MNES)
NPWS	National Parks and Wildlife Service
NPW Act 1974	*National Parks and Wildlife Act 1974*
PEP	Project Execution Plan
POEO	*Protection of the Environment Operations Act 1997*
PoM	Plan of Management
Project, the	Snowy 2.0 - Exploratory Works
QMP	Quality Management Plan
REMMs	Revised environmental management measures
Snowy Hydro	Snowy Hydro Limited
STP	Sewage (wastewater) treatment plant
Submissions Report or RTS	*Response to Submissions Exploratory Works for Snowy 2.0*
SWA	Surface Water Assessment
SWMP	Surface Water Management Plan
TBM	Tunnel Boring Machine
WAL	Works Access Licence
WHL	World Heritage List
WMS	Work Method Statement
WQO	Water Quality Objective
WTP	Water Treatment Plant

1. INTRODUCTION

Salini Impregilo, Clough and Lane have formed the Future Generation Joint Venture (Future Generation) to provide the Civil Works Package for Snowy Hydro Limited (SHL) on the Snowy 2.0 Project (the Project).

The Project is a pumped hydro project that will increase the generation capacity of the Snowy Mountains Scheme by up to 2,000mW and at full capacity will provide approximately 350,000MW/h of energy storage. The project includes all activities associated with the civil works requirements for the Snowy 2.0 Pumped Hydro-electric Scheme.

Intake and outlet structures will be built at both Tantangara and Talbingo Reservoirs, which are in the Kosciusko National Park (KNP) in southern NSW. Approximately 27km of concrete-lined tunnels will be constructed to link the two reservoirs and a further 20km of tunnels will be required to support the facility. The power station complex will be located almost one kilometre underground.

The project will deliver one of the largest pumped hydro schemes in the world and underscores the importance of the Snowy Scheme's role in the National Electricity Market.

Future Generation was conceived to deliver an integrated engineering, procurement and construction management service for the project. The joint venture is backed by the combined experience of Salini Impregilo, Clough and Lane, through their experience in the infrastructure, mineral and oil and gas sectors throughout Australia and the world.

1.1. Purpose

This Surface Water Management Plan (SWMP or Plan) forms part of the Water Management Plan and Environmental Management Strategy (EMS) for Snowy 2.0 – Exploratory Works – Stage 2 (Exploratory Works – Stage 2). The Exploratory Works is the first phase of Snowy 2.0, a pumped hydro-electric storage and generation project which will increase the hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme. The Main Works or second phase, will be subject to a separate Environmental Impact Statement (EIS) in 2019.

This Plan has been prepared to address the requirements of:

- the Infrastructure Approval (SSI 9208) issued for Snowy 2.0 Exploratory Works on the 7 February 2019 and modified on 2 December 2019;
- the Environmental Impact Statement Exploratory Works for Snowy Hydro 2.0;
- the revised environmental management measures within the Response to Submissions Exploratory Works for Snowy 2.0;
- the Modification 1 Assessment Report – Exploratory Works for Snowy 2.0 (Modification 1);
- the REMMs within the Response to Submissions - Exploratory Works Modification 1 (Submissions Report for Modification 1);
- the Modification 2 Assessment Report - Exploratory Works for Snowy 2.0 (Modification 2); and
- the REMMs within the Response to Submissions - Exploratory Works Modification 2 (Submissions Report for Modification 2).

The Exploratory Work scope for Snowy 2.0 includes:

- an exploratory tunnel to the site of the underground power station for Snowy 2.0;
- horizontal and test drilling;

- a portal construction pad;
- an accommodation camp;
- road works and upgrades providing access and haulage routes;
- barge access infrastructure and dredge works*;
- excavated rock management, including subaqueous placement within Talbingo Reservoir*;
- services infrastructure; and
- post-construction revegetation and rehabilitation.

Note: these activities will not proceed unless the relevant management plans are approved by Department of Planning, Industry and Environment (DPIE).

Exploratory Works will be delivered in three distinct stages and these stages will be completed by two different contractors. Leed Engineering (Leed) is the contractor who will be carrying out the Snowy 2.0 Stage 1 work on behalf of Snowy Hydro. Future Generation is the contractor who will be delivering the Snowy 2.0 Stage 2 works on behalf of Snowy Hydro.

Works to be completed by Leed Engineering (Leed) on behalf of SHL:

- **Stage 1a – Pre-construction Minor Works** - Stage 1a has been approved and commenced in the first quarter of 2019. The scope of pre-construction minor works includes dilapidation studies, survey work, borehole installation, site office establishment, minor access roads, installation of monitoring equipment, installation of erosion and sediment controls, and minor clearing. Works commenced in the quarter two (Q2) of 2019.
- **Stage 1b - Exploratory Works Access Roads (EWAR)** – Stage 1b has been approved and commenced in the second quarter of 2019. The scope includes roadworks and upgrades to enable access and haulage routes during Exploratory Works. This includes upgrades to 26 km of existing roads and creating about 2 km of new roads, two new bridge crossings and two temporary waterway crossings.

Works to be completed by Future Generation on behalf of SHL:

- **Stage 2 – Exploratory Works** – Approval was issued and works commenced in quarter three (Q3) of 2019. The scope for Stage 2 Exploratory Works includes:
  - pre-construction minor activities including dilapidation studies, survey, investigations, access etc; and
  - construction works including exploratory tunnel, portal construction pad, accommodation camp, dredging*, barge access infrastructure, excavated rock management and additional geotechnical investigation. This includes subaqueous emplacement within Talbingo Reservoir*.

Note: these activities will not proceed unless the relevant management plans are approved by DPIE.

Further detail on construction activities and staging is presented in Section 1.7 and Figure 1-1.

This Plan identifies the Project's environmental management measures in relation to surface water management for the Exploratory Works – Stage 2.

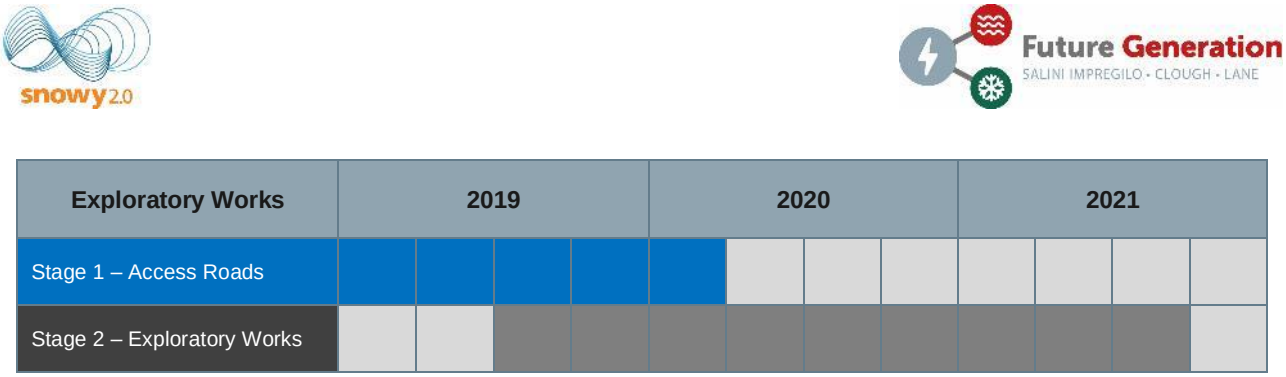


Figure 1-1: Timing of exploratory works stages

Stage 2 management plans have been revised from the corresponding Stage 1 management plan, as demonstrated in the document revision section of each Stage 2 plan. The intent of this arrangement is to ensure a consistent approach to managing environmental risk and regulatory requirements for the Exploratory Works project. In the event that both Exploratory Works Stages are undertaken concurrently, and / or in overlapping locations, the Stage 1 management plan will apply to the Stage 1 works, and the Stage 2 management plans will apply to the Stage 2 works. This arrangement would not affect management standards as all relevant measures from each management plan would continue to apply. As the proponent, Snowy Hydro will oversee both stages of the Exploratory Works project.

The timing of the preparation, consultation, submission and approval of this Plan, along with other management plans required by the Conditions of Approval (CoA), is shown within Table 4.4 and Figure 4.4 of the EMS.

Ongoing revisions to this Plan will occur in accordance with Section 1.6 of the EMS, and as required by condition 4 of schedule 4 of the Infrastructure Approval. Circumstances requiring a review, and if necessary revision, of this Plan include submission of incident reports or audit reports, approval of modifications to the CoA and directions of the Planning Secretary under condition 4 of schedule 2.

Some distinct work activities which have the potential to impact on other water elements such as surface and dredging, require greater detail and therefore warrant separate plans. The distinction between these plans are shown within Table 1-1.

Table 1-1: Relationship to other plans

Activities	Relevant plan	Timing of the plan[1]	
		Stage 1	Stage 2
General environmental compliance including inspection, monitoring and auditing.	Environmental Management Strategy	P	R
Road construction – general management of surface water runoff	This plan	P	R
Erosion and sediment control	This plan	P	R
Process and wastewater management	This plan	P	R
Excavated material	Excavated Material Management Plan	P	R
Dredge spoil disposal	Dredging Management Plan	P	R[2]
Groundwater	Groundwater Management Plan	P	R
Work within waterways etc	Aquatic Habitat Management Plan	P	R

[1] *P – prepare, R – revise*

[2] *Approval has been sought to submit the revised Dredging Management Plan prior to the commencement of dredging.*

Specific on-site management measures identified in this Plan will be incorporated into site

documents which are to be prepared by Future Generation. These documents will be prepared for construction activities and will detail the management measures which are to be implemented on the ground. Construction personnel will be required to undertake works in accordance with the mitigation measures identified in the site-specific documents.

1.2. Background

Snowy Hydro Limited (Snowy Hydro) is the proponent of the Snowy 2.0 project which is a pumped hydro-electric storage and generation project to help address increasing demands for renewable energy supplies. Snowy 2.0 involves linking Talbingo and Tantangara reservoirs within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme) and building an underground power station between the two reservoirs.

Snowy Hydro proposes to carry out Exploratory Works prior to the main construction works for the Snowy 2.0 project, to inform the detailed design and to reduce project risk. Exploratory Works are required to obtain detailed geological data for the proposed location of the underground power station. An exploratory tunnel is to be constructed to gain this critical information. The Exploratory Works will predominantly be in the Lobs Hole area of Kosciuszko National Park. If the Exploratory Works are not undertaken, risks to the design and construct elements of the power station cavern are significantly increased.

The *Environmental Impact Statement Exploratory Works for Snowy 2.0* (EIS) was prepared to assess the impact of these works on the environment, including an assessment of surface water impacts and flooding within Chapter 5.4 and Appendix M. The EIS identified the potential for direct and indirect impacts on water quality from surface water runoff from disturbed and operating areas of the site and from dredging, subaqueous excavated rock placement and discharges of process water and waste (effluent) water.

The EIS concluded that, with the implementation of appropriate impact mitigation measures, there would be no significant impacts to waterways within the project area, to high risk areas or sensitive receiving environments downstream of the project.

1.2.1. Modification 1

Snowy Hydro has modified infrastructure consent SSI 9208 pursuant to section 5.25 of the EP&A Act to reflect requirements identified as part of the detailed design undertaken by the construction contractor. The purpose of the proposed modification is to:

- provide additional geotechnical information for the detailed design of the Snowy 2.0 power station and power waterway;
- provide a reliable long-term source of construction power for the duration of Exploratory Works and will reduce the reliance on diesel generation and associated on-site storage and emissions;
- improve the efficiency of the Exploratory Works construction power;
- optimise the detailed design of construction areas and access roads; and
- improve worker safety during construction.

The Modification 1 Assessment Report and associated technical studies were submitted to Department of Planning, Industry and Environment (DPIE), in June 2019 and was publicly exhibited between 26 June and 9 July 2019. A total of nine submissions were received, and following consideration, approval was granted by the Minister for Planning and Public Spaces on 2 December 2019.

Though Modification 1 included several changes, only the geotechnical investigations are relevant to the Stage 2 works and Future Generation's activities for the Exploratory Works project. This plan

has therefore been revised for the most part to address the surface water requirements and management measures from Modification 1 which are relevant to the geotechnical activities.

1.2.2. Modification 2

In accordance with section 5.25 of the EP&A Act, the Infrastructure Approval issued for Exploratory Works was modified to:

- revise the tunnelling method from drill and blast to predominantly tunnel boring machine (TBM);
- provide for road upgrades required to enable the transport and delivery of TBM equipment and materials required for tunnelling;
- include vegetation trimming, and selective tree lopping/removal on Lobs Hole Ravine Road (south) to provide adequate clearance for transport of the TBMs;
- improve access and egress to Lobs Hole via Lobs Hole Ravine Road (north);
- relocate the Middle Bay Barge ramp;
- increase the capacity of the Lobs Hole accommodation camp from 152 personnel to up to 250;
- provide for additional diesel storage capacity for the TBM until the Lobs Hole substation construction power is available;
- provide for the additional diesel generators required to provide power supply to the TBM prior to Lobs Hole substation commissioning; and
- revise the transport strategy to reduce the use of barging for delivery of materials to site.

The Modification 2 Assessment Report was submitted to Department of Planning, Industry and Environment (DPIE) in October 2019, and was publicly exhibited between 5 November 2019 and 21 November 2019. A total of twenty-five submissions were received, and following consideration, approval was granted by the Minister for Planning and Public Spaces on 27 March 2020.

This SWMP has been revised to address the changes which have occurred as a result of Modification 2.

1.3. Environmental Management System

The overall environmental management system for the Project is described in the Future Generation EMS. This SWMP forms part of Snowy Hydro Limited's environmental management framework for the Project as described in Section 4 of the EMS.

This Plan aims to transfer the relevant requirements of the Infrastructure Approval into a management plan which can be practically applied on the Project site.

1.4. Relationship to Project Management Systems and Other Project Plans

It is a requirement of Volume 4 Employer's Requirements – Project Execution to develop and implement a number of project plans for the project. These plans are defined as deliverables.

The Environmental Management Strategy (EMS) will form part of the Project Management System (Future Generation-PMS) and will include any requirements specified in the contract documents, where appropriate. All Future Generation-PMS procedures will support, interface or directly relate to the development and execution of the plan.

The Project Execution Plan (PEP) is the overarching document that outlines the minimum requirements for project management on the project. The PEP is not a standalone document and has been prepared with consideration to other project plan requirements. The PEP will also detail

the interfaces between other project plans and provide information on the responsibility and management of the interfaces and project works.

All project plans are reviewed by the Quality Manager and/or Systems Manager to ensure consistency with the Quality Management Plan (QMP) and Future Generation-PMS.

1.5. Purpose and Objectives

The purpose of this Plan is to describe how construction impacts on surface water will be minimised and managed during construction.

The key objective of the SWMP is to ensure that impacts on surface water quality are minimised and within the scope permitted by the Conditions of Approval (CoA) during Stage 2 of the Project. To achieve this, Snowy Hydro and Future Generation will target to:

- ensure appropriate measures are implemented during construction to avoid or minimise potential impacts to surface water quality within the rivers and creeks across the Project;
- ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 2.1 of this Plan;
- establish a surface water monitoring program to assess the effectiveness of the surface water management controls and impacts on the receiving environment; and
- ensure that work activities are managed so as to minimise flood impacts and risks.

1.5.1. Plan Preparation

In accordance with the requirements of Schedule 3 Condition 34 of the Infrastructure Approval this plan has been prepared by Roisin Batch of WolfPeak, John Wright of TREES and Hilary Chapman of Seran whose appointment, on behalf of Future Generation, has been approved by the Secretary of Department of Planning and Environment on 31 May 2019.

1.6. Consultation

In accordance with Schedule 3, Condition 34 of the Infrastructure Approval dated 7th February 2019, this WMP is to be prepared as part of the Water Management Plan in consultation with the NSW Environment Protection Authority (EPA), National Parks and Wildlife Service (NPWS), Department of Industry – Water (DoI Water) and Department of Primary Industries – Fisheries (DPI Fisheries). The Water Management Plan must be prepared to the satisfaction of the Planning Secretary.

On 27 May 2019, the Plan was issued to EPA, NPWS, DoI Water and DoI Fisheries for review and comment. Comments from the consultation process have been incorporated into this Plan where appropriate. Comments are summarised in Table 1-2.

A face-to-face briefing was also undertaken with EPA, NPWS, DoI Water and DPI Fisheries to discuss the plan in June 2019.

A separate document titled Agency Consultation Evidence Report has been prepared detailing the consultation process and Future Generation's responses. This report has been submitted to DPIE,

Table 1-2: Stage 2 consultation with stakeholder agencies summary

Date	Consultation	Outcomes
Stage 2 Consultation – First round		
27 May 2019	Management Plan submitted to EPA, NPWS, DoI Water and DoI Fisheries	-

Date	Consultation	Outcomes
5 June 2019	Agency briefing meeting held with EPA, NPWS, DoI Fisheries, DoI Water & SHL	-
7 June 2019	Department of Primary Industries - Fisheries	Comments received on management plan. Management plan updated to reflect comments.
11 June 2019	National Parks and Wildlife Services	Comments received on management plan. Management plan updated to reflect comments.
12 June 2019	Department of Industry – Water	Comments received on management plan. Management plan updated to reflect comments.
9 July 2019	EPA	Comments received on management plan. Management plan updated to reflect comments.

Revision 1 of the SWMP (prepared in response to Modification 1 of the Infrastructure Approval), was issued to the following agencies for consultation:

- NPWS on 10 October 2019; and
- EPA on 24 October 2019.

NPWS recommended that the plan be issued to EPA and EPA advised that they had no comments.

Revision 2 of this Plan (prepared in response to Modification 2 of the Infrastructure Approval), was issued to the following agencies for consultation:

- NPWS and EPA.

Agency comments were incorporated into this plan.

Revision 3 of this plan (prepared in response to Modification 2 consolidation approval conditions) was issued to NPWS and EPA for consultation on 6 April 2020. No comments were provided by either NPWS or EPA.

1.7. Construction Activities

This Plan relates to Stage 2 works. Stage 2 will include the following:

- pre-construction minor works (not construction activities) including:
  - building/road dilapidation studies;
  - survey works;
  - installing groundwater bores in the Ravine beds on site for water supply;
  - establishing a temporary site office;
  - minor access roads to facilitate the pre-construction minor works;
  - installation of environmental impact mitigation measures, including the installation of monitoring equipment, erosion and sediment controls, and fencing;
  - minor clearing or translocation of native vegetation within the approved disturbance footprint for the pre-construction minor works;
- the exploratory tunnel which is approximately 3.1 km long and will lead to the site of the underground power station. Excavation of the tunnel will occur through a method of both drill and blast and TBM;
- road upgrades for transport and delivery of the TBM and TBM equipment;

- a turnaround area on Link Road for transportation of the TBM equipment and materials to the construction areas at Lobs Hole and to facilitate set down and turn-back of oversize and overmass (OSOM) deliveries;
- horizontal and other test drilling, investigations and analysis in situ at the proposed cavern location and associated areas, and around the portal construction pad, access roads and excavated rock management areas all within the disturbance footprint;
- borehole drilling and geophysical surveys for further geotechnical investigation of the Snowy 2.0 power station and power waterway at Marica, Talbingo and Tantangara;
- ongoing groundwater monitoring using existing boreholes and access tracks within KNP;
- ongoing maintenance and rehabilitation of existing access tracks required for groundwater monitoring and geotechnical investigations within KNP;
- additional geotechnical drilling is proposed to enable investigation and detailed design of critical bridge works (Nungar Creek bridge) on Tantangara Road;
- additional laydown areas at Talbingo north for the transfer of plant and materials are proposed within Modification 1 to improve constructability;
- a portal construction pad for the exploratory tunnel. This will provide the entrance structure to the tunnel and an area for infrastructure and equipment needed to support tunnelling activities;
- an accommodation camp for the Exploratory Works construction workforce;
- barge access infrastructure, including one new barge ramp at Middle Bay near Lobs Hole at the southern part of Talbingo Reservoir;
- excavated rock management, including subaqueous placement within Talbingo Reservoir*. Up to 750,000 m3 of excavated rock will need to be tested for its geochemical properties (i.e. whether the rock is reactive or non-reactive) before being managed by a combination of the following options:
    - re-use – suitable material can be used as construction materials for roads or similar. Some materials will be provided to NPWS for use in road maintenance and upgrades in other areas of KNP;
    - on land placement - material will be temporarily placed in one of two on land emplacement areas. No material is to remain at any emplacement area and must be either sub aqueously placed at Talbingo Reservoir* or removed to a suitable place outside of KNP within three years of completion of the exploratory works (should Snowy 2.0 Main Works not proceed).
    - subaqueous placement within Talbingo Reservoir* – suitable material will be placed at a suitable location within Talbingo Reservoir, subject to a number of water quality controls and monitoring;
- services infrastructure such as diesel-generated power, water and communication; and
- post-construction revegetation and rehabilitation, management and monitoring.

Note: these activities will not proceed unless the relevant management plans are approved by DPIE.

1.7.1. Works approved through Modification 1

The Exploratory Works - Modification 1 works scope is included in Table 1-3. For clarity this has been divided between Stage 1 and Stage 2 works.

The revised project boundary (disturbance footprint) for the project, as approved through Modification 1 of the Infrastructure Approval, has been included in Appendix E of the Water

Management Plan.

Table 1-3: Exploratory Works - Modification 1 works scope (Stage 1 and Stage 2)

Modification 1 - Stage 1	
Activity	**Description**
Lobs Hole Substation	Additional disturbance area required for the construction power connection to an existing transmission line (Line 2) at Lobs Hole for power supply to the Exploratory Works accommodation camp and construction areas. This will provide a reliable and long-term source of construction power and will reduce the reliance on diesel generation and associated on-site storage requirements and emissions. Works in this area will include establishing a substation, connection infrastructure, access roads and ancillary construction areas. Works in this area will include establishing a substation, connection infrastructure, access roads and ancillary construction areas. This will include: • construction of a 330/33 kV substation within Kosciuszko National Park and adjacent to Line 2, which forms a 330-kV connection between Upper Tumut Switching Station and Yass Substation; • geotechnical investigation works to inform the detailed design of the construction power substation; • replacement of one transmission support structure (Structure 54) within the existing transmission easement. This will involve removal of the existing structure and establishment of one new steel lattice tower, approximately 50 m in height; • short overhead 330 kV transmission line connections (approximately 100 m in length) between the substation and the new Structure 54; • 33 kV feeder connection between the substation and the Exploratory Works construction power network. This will be either overhead lines or underground cables; • establishment and upgrade of access tracks and roads to the new substation and transmission line structures; • installation of a fibre optic communication link into the new substation from the approved communication network; and • ancillary activities, including brake and winch sites, crane pads, site compounds and equipment laydown areas. (Illustrated in Appendix E of the Water Management Plan, Figure 1i).
Camps Bridge and Wallaces Creek	Additional disturbance area around Camp Bridge and Wallaces Creek Bridge required for improved constructability of the crossings. Works within these areas will include vegetation clearing, levelling earthwork, erection of falsework, sediment controls, laydown, parking and movement of equipment. (Illustrated in Appendix E of the Water Management Plan, Figures 1h and 1i).
Lobs Hill Ravine Road and Construction Boundary Changes	Minor changes to the project boundary identified through detailed design including: revised road upgrade for Lobs Hole/Ravine Road to improve access, drainage and safety; minor additions to construction areas for design optimisation. removal of dangerous trees on Lobs Hole Ravine Road. This will involve either complete or partial removal of up to 91 trees that have been identified to pose a safety risk to road users on Lobs Hole Ravine Road and Mine Trail Road; (Illustrated in Appendix E of the Water Management Plan, Figures 1b to 1f and Figure 1i).
Operating Hours	Modify operating hours for the use of Upper Lobs Hole Ravine Road from 7 am to 6pm to sunrise to sunset.

Miscellaneous	Continued use of existing communications towers within KNP that were previously approved by the NPWS under a separate review of environmental factors (REF R – Wallaces Creek Geotechnical drilling) environmental impact assessment carried out under the NSW National Parks and Wildlife Act 1974 (NPW Act) and its regulation for the geotechnical investigation program; and Increase in peak traffic volumes. Additional vehicles will be required to access the site to facilitate construction of Exploratory Works, however no change in impacts to the road network are expected. (The location of the communications towers are illustrated in Appendix E of the Water Management Plan, Figures 1a, 1f and 1l).
Modification 1 - Stage 2	
Activity	**Description**
Borehole drilling and geophysical surveys	This includes: • borehole drilling and geophysical surveys for further geotechnical investigation of the Snowy 2.0 power station and power waterway at Marica, Talbingo and Tantangara; • clearing of up to 2.79 hectares (ha) of additional vegetation for access tracks and drilling pads. About 1.33 ha within Smokey Mouse potential habitat; • trimming of overhanging dangerous branches on adjacent trees (these trees will not require removal); • mulching of trees and vegetation; • establishment of an additional 1 km of access tracks (4 m wide), including minor earthworks; • placement of geofabric (as required) and import of stabilised material; • establishment of eight drilling pads and boreholes at top of the cavern area, with an area of 900 m2 per pad, including minor earthworks, placement of geofabric (as required) and import of stabilised material (as required); • undertaking geophysical surveys near Talbingo and Tantangara reservoirs; • establishment of two drilling pads and boreholes at both Tantangara and Talbingo with an area of 900 m2 per pad, including approximately 400 m of additional access tracks and minor earthworks (as required); • establishment of in-reservoir boreholes including one in Talbingo Reservoir and two in Tantangara Reservoir; • drilling of additional nested vertical boreholes at each of the drilling pads up to a depth of 1,100 m; • conversion of the investigation boreholes into monitoring bores; • undertaking geophysical surveys; • rehabilitation of the drilling pads and access tracks following completion of works; • ongoing maintenance of existing access tracks required for geotechnical investigations within KNP. (Illustrated in Appendix E of the Water Management Plan, Figures 1j, 1k, 1l, 1m and 1n).
Talbingo Laydown	Outside of KNP, SHL is proposing to add four laydown locations to facilitate the construction of the communications cable linking Lobs Hole with the Tumut 3 Power Station. These are proposed on existing hardstand areas along the northern foreshore of Talbingo Reservoir within Snowy Hydro owned land. Additional widening of Spillway Road for accessibility is required. (Illustrated in Appendix E of the Water Management Plan, Figure 1o).
Tantangara Access	Two additional geotechnical boreholes are required to facilitate the detailed design of cuttings, bridge foundations, retaining wall foundations, and drainage structures near Nungar Creek. (Illustrated in Appendix E of the Water Management Plan, Figure 1m).
Operating Hours	Modify operating hours for the use of Upper Lobs Hole Ravine Road from 7 am to 6pm to sunrise to sunset.

1.7.2. Works approved through Modification 2

The Exploratory Works - Modification 2 scope for Stage 2 works is included in Table 1-4.

The revised project boundary (disturbance footprint) for the project, as approved through Modification 2 of the Infrastructure Approval, has been included in Appendix E of the Water Management Plan.

Table 1-4: Exploratory Works - Modification 2 works scope (Stage 2)

Modification 2 - Stage 2 works	
Activity	**Description**
Tunnelling	The tunnelling methodology has been revised and include the following: • TBM method will used to excavate the exploratory tunnel. The TBMs will be fully equipped to perform the excavation, ventilation, lining, and removal of excavated material; • the TBMs will be engineered to facilitate dismantling operations. This will avoid the need to excavate a preliminary dismantling chamber and allow the TBMs to be retrieved from the tunnel, thereby reducing the amount of excavated rock material; • the TBM will be equipped with devices to perform the following surveys: – geophysical seismic reflection surveys; – geoelectrical surveys; and – systematic probe core retrieval ahead of the advancing tunnel face; • the probing results will also be used to determine the presence of potentially acid forming (PAF) and naturally occurring asbestos (NOA) material; • the TBMs will be equipped with drilling machines to drill drainage holes with pipes to relieve groundwater pressures. If required, pre-excavation grouting will also be used to seal-off groundwater inflow and to improve the stability of the excavation face; • post-excavation grouting from the segmental lining may also be used to further consolidate the surrounding rock and/or prevent water ingress if required. (Illustrated in Appendix E of the Water Management Plan)
Design	Detailed design and geotechnical investigations have been optimised. The project optimisation is expected to reduce the exploratory tunnel length by approximately 600 m and reduce the volume of excavated material by approximately 65,000 m^3. (Illustrated in Appendix E of the Water Management Plan)
Road upgrades (undertaken by Future Generation and SHL)	Minor road upgrade works will be undertaken to enable transport of TBM equipment and materials required for tunnelling. The road upgrades have been designed to avoid additionally impacting any areas of geodiversity significance including the boulder streams, karst and fossil features on Lobs Hole Ravine Road. (Illustrated in Appendix E of the Water Management Plan)
Vegetation Clearing (undertaken by Future Generation and SHL)	The additional clearing will include approximately 2.78 ha of vegetation to establish road upgrades on Lobs Hole Ravine Road (south), Lobs Hole Ravine Road (north) and Link Road. (Illustrated in Appendix E of the Water Management Plan)
Transport Strategy	Modification 2 proposes to revise the transport strategy so that materials and equipment required for Exploratory Works will be delivered using Lobs Hole Ravine Road (south) as the primary access road.
Link Road Turnaround Area (undertaken by SHL)	A turnaround area will be established on Link Road for safe transportation of the TBM equipment and materials to the construction areas at Lobs Hole. The turnaround area will facilitate set down and turn-back of oversize and overmass deliveries. (Illustrated in Appendix E of the Water Management Plan)

Modification 2 - Stage 2 works	
Activity	**Description**
Lobs Hole Ravine Road (south) (undertaken by SHL)	Minor upgrade works will be undertaken on sections Lobs Hole Ravine Road (south) to enable the transport of the TBM equipment. (Illustrated in Appendix E of the Water Management Plan)
Lobs Hole Ravine Road (north)	Roadworks will be conducted at Lobs Hole Ravine Road (North) to provide improved access and egress to Lobs Hole. Road works will include road upgrade and widening in several sections suitable for passing bays as well as regular maintenance of the existing roadway. (Illustrated in Appendix E of the Water Management Plan)
Middle Bay Barge Ramp	The location of the Middle Bay barge ramp was revised as part of further refinement to the construction methodology. An alternative location for the Middle Bay barge ramp was identified to the west of the approved barge ramp location. A key benefit of the new barge ramp location is that it minimises the requirement for dredging as part of the barge ramp construction. (Illustrated in Appendix E of the Water Management Plan)
Accommodation Camp	Lobs Hole accommodation camp will increase capacity to provide beds for up to 250 personnel. The additional accommodation will be created through an additional storey to the Lobs Hole accommodation camp using modular and stackable accommodation units that will allow the expansion to be entirely within the existing disturbance footprint.
Power Supply	Additional power supply capacity is required to enable TBM tunnelling for Exploratory Works. The Lobs Hole substation proposed under Modification 1 is scheduled to be online from approximately October 2020 and will provide the power supply required for operation of the TBM. It is currently planned to commence tunnelling with the TBM from August 2020. In the period prior to the Lobs Hole substation commissioning the additional power supply required for TBM tunnelling will be provided by additional diesel generator sets. Diesel generator sets with a total capacity of 20 MVa as well as an additional three 65 kL diesel storage tanks will be installed at the portal construction pad. (Illustrated in Appendix E of the Water Management Plan)

2. ENVIRONMENTAL REQUIREMENTS

2.1. Legislation

Legislation relevant to surface water management includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act);
- *Environmental Planning and Assessment Regulation 2000*;
- *Protection of the Environment Operations Act 1997*;
- *Protection of the Environment (General) Regulation 2009* (as amended);
- *Water Management Act 2000*;
- *Water Management Amendment Act 2014*;
- *Water Management (General) Regulation 2011*;
- *Fisheries Management Act 1994*;
- *Snowy Hydro Corporatisation Act 1997*.

Relevant provisions of the above legislation are explained in the register of legal and other requirements.

2.2. Conditions of Approval

Table 2-1 details all conditions from the Infrastructure Conditions of Approval (SSI 9208) relevant to management of impacts on surface water.

Table 2-1: Conditions of Approval relevant to surface water management

Condition	Requirement	Where addressed
Sch 3, Cond 32	Unless an environment protection licence authorises otherwise, the Proponent must comply with Section 120 of the POEO Act. Note: *Section 120 of the POEO Act makes it an offence to pollute any waters.*	Section 2.5.1 Section 5, Table 5-1
Sch 3, Cond 33	The Proponent must: (a) minimise the use of clean water on site; (b) maximise the diversion of clean water runoff around disturbance areas on site; (c) minimise the flow rates from any clean water runoff diversions to adjoining watercourses; (d) minimise any soil erosion associated with the development; (e) ensure all chemicals and hydrocarbon products are stored on site in bunded areas in accordance with the relevant Australian Standards.	Section 5
Sch 3, Cond 34	Prior to carrying out any construction, unless the Planning Secretary agrees otherwise, the Proponent must prepare a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must: (c) include a Surface Water Management Plan with:	This plan
	• detailed baseline data on surface water flows and quality in the watercourses that could potentially be affected by the development;	Section 3.2 Section 6 Appendix A
	• a program to augment the baseline data during the development;	Section 6
	• a description of the measures that would be implemented to minimise the impacts of:	Section 5, Table 5-1
	– any subaqueous emplacement;	
	– the dredging within Talbingo Reservoir;	
	– the barge infrastructure;	
	– the water intake;	
	– the water treatment pipes and outlets;	
	– any in-stream works;	
	– stockpiles;	
	– eastern emplacement area;	
	– western emplacement area;	
	– construction portal;	
	– accommodation camp;	
	– Lobs Hole substation;	
	– road upgrades, and in particular the road works in the vicinity of the Yarrangobilly River;	
	– chemical and hydrocarbon storage.	Section 5 and Appendix B
	• surface water assessment criteria, including trigger levels for investigating	Section 6

Condition	Requirement	Where addressed
	any potentially adverse surface water impacts of the development;	
	• a description of the measures that would be implemented to minimise the surface water impacts of the development;	Section 5
	• a program to monitor and report on the surface water impacts of the development including water monitoring locations, analytes and sampling frequency for each monitoring location;	Section 6
	• a program to monitor and report on the surface water impacts of the development	Section 6
	• a plan to respond to any exceedances of the surface water trigger levels and/or assessment criteria and mitigate and/or offset any adverse surface water impacts of the development;	Section 6
Sch 3, Cond 39	The Proponent must: (a) ensure the temporary bridges over Wallace Creek and the Yarrangobilly River incorporate, to the greatest extent practicable, the requirements: • *Guidelines for Controlled activities on Waterfront Land* (NRAR, 2018); and • *Policy and Guidelines for Fish Habitat Conservation* (DPI 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003); (b) remove temporary bridges as soon as practicable after the construction of the permanent bridges, and rehabilitate the land to the satisfaction of the NPWS; (c) consider scheduling to minimise in stream works between October to January, the migratory period of the Macquarie Perch (*Macquaria australasica*).	Stage 1 Surface Water Management Plan and Appendices
Sch 3, Cond 40	The Proponent must: (a) ensure that permanent bridges over Wallaces Creek and the Yarrangobilly River are designed and constructed to comply with the relevant requirements of the: • *Guidelines for Controlled activities on Waterfront Land* (NRAR, 2018); and • *Policy and Guidelines for Fish Habitat Conservation* (DPI 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003); (b) ensure that the permanent bridges over Wallace Creek and the Yarrangobilly River are designed and constructed to comply with the relevant requirements of the relevant Austroads Standards (such as elevating them above the 1% AEP flood level); (c) minimise in stream works between October to January, the migratory period of the Macquarie Perch (*Macquaria australasica*).	Stage 1 Surface Water Management Plan and Appendices

2.3. Revised Environmental Management Measures

Environmental safeguards and management measures are included in the EIS in Section 6.3. During preparation of the Submissions Report, revised environmental management measures (REMMs) were developed and included in Section 8 of the Submissions Report and the Surface Water Assessment (SWA).

The environmental management measures relevant to this Plan are listed in Table 2-2 below. If additional measures are cross-referenced from another section of the EIS or Submissions Report, these measures are also included. A full list of REMMs relevant to water management is detailed in Appendix D of the WMP. Any references to the SWMP in the WMP Appendix D are shown in Table 2-2 of this Plan including where the requirements are addressed within this Plan.

Table 2-2: Revised environmental management measures relevant to surface water and soils

Impact	Reference	REMM Requirement		Where Addressed
Impact to aquatic ecology from erosion and sedimentation	ECO_14	1	The water quality controls described in in WAT01 to WAT05 and WM1.1 to WM 8.8 will be implemented.	WAT_01 to WAT_05 in Section 5 WM_1.1 to WM_7.6, WM_8.6 & WM_8.7 in Section 5 WM_8.1 to WM_8.5 and WM_8.8 in Excavated Materials Management Plan WAT_01 & WAT_02 in Section 5, WAT_03 & WAT_04 in WMP - Appendix C Dredging Management Plan WAT_05 in the Subaqueous Emplacement Management Plan
Impacts to aquatic habitat and biota during dredging and subaqueous placement	ECO_15	2	Measures relevant to aquatic ecology will be implemented as described below including: monitoring of water quality indicators including turbidity, pH and dissolved oxygen within and downstream of the construction area and, if a decline in water quality is detected as a result of the works, investigate potential causes and develop and implement an appropriate response;	Section 6, WMP – Appendix C Dredging Management Plan, Aquatic Habitat Management Plan and the Subaqueous Emplacement Management Plan
		13	Measures relevant to aquatic ecology will be implemented as described below including: minimising suspension of sediment and turbidity by implementing WAT14 and WAT15.	WAT14 and WAT15 refers to WAT04 and WAT05. Section 5, WMP - Appendix C Dredging Management Plan, Aquatic Habitat Management Plan and the Subaqueous Emplacement Management Plan
Impacts to soil resources	SOIL_01	1	Soil management procedures (including stripping, stockpiling and application) will be implemented as part of the CEMP.	Section 5 and in the Excavated Material Management Plan
		2a	The objectives of soil management will be to: • preserve as much of the topsoil and subsoil as possible;	Section 5 and in the Excavated Material Management Plan
		2b	The objectives of soil management will be to: • minimise the risk of contamination;	Section 5 and in the Excavated Material Management Plan

Impact	Reference	REMM Requirement		Where Addressed
		2c	The objectives of soil management will be to: • minimise the risk of any topsoil degradation or compaction during construction and following reinstatement;	Section 5 and in the Excavated Material Management Plan
		2e	The objectives of soil management will be to: • minimise topsoil mixing with unsuitable soil and spoil materials during stripping and stockpiling; and	Section 5 and in the Excavated Material Management Plan
		2f	The objectives of soil management will be to: • ensure reinstatement of soil horizons in the correct order and required depths to allow for rehabilitation.	Section 5 and in the Excavated Material Management Plan
		3	Topsoil and subsoil will be stripped, stockpiled and handled during construction to avoid degradation.	Section 5 and in the Excavated Material Management Plan
		4a	Management measures that will be implemented include: • the topsoil stripping procedure and stockpiling procedure will be developed and implemented to maximise the salvage of materials and minimise soil degradation;	Section 5 and in the Excavated Material Management Plan
		4b	Management measures that will be implemented include: • structural decline of soil will be minimised by using suitable machinery, timing stripping where practicable, using correct stockpile development techniques and minimising handling of topsoil materials;	Section 5 and in the Excavated Material Management Plan
		4c	Management measures that will be implemented include: • topsoil and subsoil will be stockpiled, with stockpiles designed and located to minimise contamination, development of anaerobic conditions, and to avoid erosion and dust generation;	Section 5 and in the Excavated Material Management Plan
		4d	Management measures that will be implemented include: • nutrient decline will be minimised by managing stockpile methods and heights;	Section 5 and in the Excavated Material Management Plan
		4e	Management measures that will be implemented include: • stockpiles will be regularly inspected for weeds; and	Section 5 and in the Excavated Material Management Plan
		4f	Management measures that will be implemented include: • to minimise the risk of loss from wind and water erosion to stockpiled topsoil, a vegetative cover will be established or the stockpile covered.	Section 5 and in the Excavated Material Management Plan

Impact	Reference	REMM Requirement		Where Addressed
Erosion and sediment transport	SOIL_02	1	Erosion and sedimentation controls will be implemented as part of the Water Management Plan to minimise erosion potential in accordance with the guideline Managing Urban Stormwater, Volumes 1 and 2, or equivalent.	Section 2.4, Section 3, Section 5
Leaching/ running into groundwater/ creeks	WAT_01	1	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including: • minimizing direct access to the river by construction vehicles and mechanical plant;	Section 5 and Appendix B Spill Management Procedure
		2	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including: • regular inspection of construction vehicles and mechanical plant for leakage of fuel and /or oils;	Section 5 and Appendix B Spill Management Procedure
		3	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including: • establishing a bunded area for storage of fuel and oils;	Section 5 and Appendix B Spill Management Procedure
		4	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including: • refuelling and maintenance of vehicles and mechanical plant at least 50 m from watercourses;	Section 5 and Appendix B Spill Management Procedure
		5	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including: • avoiding as far as possible re-fuelling, washing and maintenance of land based vehicles and plant within 50 m of watercourses;	Section 5 and Appendix B Spill Management Procedure
		6	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • reporting spillages to the appropriate officer and immediately deploying spill containment and / or absorption kits as required to restrict its spread;	Section 5 and Appendix B Spill Management Procedure
		7	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • vehicles, vessels and plant would be properly maintained and regularly inspected for fluid leaks;	Section 5 and Appendix B Spill Management Procedure

Impact	Reference	REMM Requirement		Where Addressed
		8	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • emergency spill kits will be kept onsite, at refuelling areas and on all vessels at all times during the Exploratory Works. The spill kit will be appropriately sized for the volume of substances on the vessel. All staff would be made aware of the location of the spill kit and trained in its use;	Section 5 and Appendix B Spill Management Procedure
		9	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • if any hydrocarbon spills were to occur during soil stripping, the impact will be isolated and clean-up procedures implemented;	Section 5 and Appendix B Spill Management Procedure
		10	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • areas to be used for long-term storage and handling of hydrocarbons and chemicals will be enclosed with concrete bunds;	Section 5 and Appendix B Spill Management Procedure
		11	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • chemicals will be handled and stored as per manufacturer's instructions; and	Section 5 and Appendix B Spill Management Procedure
		12	Management measures will be implemented to minimise potential environmental impacts to water and soil from hydrocarbon and chemical spills and leaks including • below ground, refuelling will be undertaken in dry, enclosed, bunded areas;	Section 5 and Appendix B Spill Management Procedure
Surface and groundwater	WAT_02	1	A Surface and Groundwater Monitoring Program will be developed and implemented to monitor the effectiveness of water quality controls.	Section 6 and WMP – Appendix B Groundwater Management Plan
		2	The program will include: • establish monitoring locations to provide suitable baseline and detection monitoring of surface and groundwater parameters;	Section 6
Spills of hydrocarbons	WAT_11	1	Procedures to address spills and leaks will be developed and implemented as part of the CEMP.	Section 5 and Appendix B Spill Management Procedure
Controls for construction disturbance areas Controls for all	WM_1.1	1	The following controls will be applied to the design of the clean water management system: • where practical, all clean water will be diverted around or through water management areas. Runoff from clean water areas that cannot be diverted must be accounted for in the design of water management systems;	Section 5

Impact	Reference	REMM Requirement		Where Addressed
construction areas	WM_1.2	1	The following controls will be applied to the design of the clean water management system: • All permanent clean water drainage will be designed and constructed to convey the 1% AEP peak flow and will have adequate scour protection. Temporary clean water drainage will be designed to convey the 50% AEP peak flow.;	Section 5
	WM_1.3	1	The following controls will be applied to the design of the clean water management system: • where practical, diversions will seek to avoid materially increasing flow rates in adjoining watercourses; and.	Section 5
	WM_1.4	1	The following controls will be applied to the design of the clean water management system: • Where practical, the permanent diversion of drainage lines or watercourses using contour drains will be avoided.	Section 5
	WM_2.1	1	An Erosion and Sediment Control Plan (ESCP) will be prepared for each construction area.	Section 5
		2	Each ESCP will: • consider local soil characteristics, clean water management and the proposed construction methods;	Section 5
		3	Each ESCP will: • apply all practical source control and rehabilitation methods; and	Section 5
		4	Each ESCP will: • be progressively amended as required during construction.	Section 5
		5	Each ESCP will: • A suitably qualified erosion and sediment control expert will be commissioned to develop and execute each ESCP. The expert will be responsible for overseeing the development of the ESCP and inspecting and auditing controls during implementation. Regular expert input will ensure that erosion and sediment control practices will be established and operated to a high standard and progressively improved.	Section 5
	WM_2.2	1	The clean water management controls WM_1.1 to 1.4 apply to all ESCPs.	Section 5
	WM_2.3	1	Stockpiles will be located where they are not exposed to concentrated or flood flow. Flood flow is defined as the 20% AEP flood extent. Monitoring for dispersion and erosion of soil stockpiles will be undertaken, particularly on moderately dispersive soils. Addition of ameliorants, such as gypsum and organic matter for dispersive soils will be undertaken as needed.	Section 5
	WM_2.4	1	Soils will be lightly scarified on the contour to encourage rainfall infiltration and minimise run-off. As soon as practicable after respreading, a cover crop will be established to limit erosion and soil loss. This will also provide good mulch for native plant establishment.	Section 5

Impact	Reference	REMM Requirement		Where Addressed
	WM_2.5	1	Sediment traps or filters will be maintained at all discharge locations. The filters will only use non-toxic or materials which will not cause material harm to the environment, including biodegradable or natural materials where practicable. Sediment traps, filters and other appropriate sediment control devices will be installed to target the removal of coarse sediments.	Section 5
Additional controls for construction areas that are constrained by terrain or the proposed disturbance boundary	WM_2.6	1	Runoff from construction areas that are constrained by terrain or the proposed disturbance boundary and are larger than 2,500 m^2 will be captured in a sump and pumped to a water treatment plant. The water treatment plant will use water treatment chemicals to enhance sedimentation and phosphorus and dissolved metal removal rates using an automated chemical dosing system. Only water treatment chemicals that have a low risk of increasing the toxicity of treated stormwater will be used. The design dewatering and treatment rate will be the 1 in 3 month average return interval (ARI) peak flow.	Section 5
Additional controls for construction areas that are not constrained by terrain	WM_2.7	1	Where appropriate, sedimentation basins will be constructed in accordance with the methods recommended in Managing Urban Stormwater: Soils and Construction: Volume 1 (Landcom 2004) and Volume 2D (DECC 2008). Water treatment chemicals will be applied to sedimentation basins with catchment areas greater than 2,500m^2 to enhance sedimentation and phosphorus and dissolved metal removal rates. Only water treatment chemicals that have a low risk of increasing the toxicity of treated stormwater will be used. Water treatment chemicals will be applied using an automated chemical dosing and mixing system. The design treatment rate will be the 1 year ARI peak flow.	Section 5
	WM_2.8	1	When practical, water captured in sedimentation basins will be used for dust suppression.	Section 5 and WMP Section 4
Water management controls for access roads Controls for all access roads	WM_3.1	1	Sections of Lobs Hole Road that will no longer be required following the construction of the new access roads will be removed and rehabilitated. This will reduce associated sediment loads;	Section 5
	WM_3.2	1	• all cut and fill batters will be stabilised as soon as practicable;	Section 5
	WM_3.3	1	• The clean water management controls WM_1.1 to 1.4 will apply to the design of all access roads.	Section 5
	WM_3.4	1	• access road surfaces will be maintained with appropriate aggregate material to reduce the risk of erosion;	Section 5
	WM_3.5	1	• where practicable and safe to do so access roads will be single cross fall and will grade to tables drain located against the toe of the cut batters. The drains will be stabilised by rock armouring as required;	Section 5
	WM_3.6	1	• where appropriate, the sedimentation basins established to manage runoff during construction of the access roads will be maintained during the Exploratory Works to provide ongoing treatment of runoff from access roads;	Section 5

Impact	Reference	REMM Requirement		Where Addressed
Additional controls for access roads that are not constrained by terrain or the proposed disturbance footprint.	WM_3.7	1	The sedimentation basins established to manage runoff during construction of the access roads will be modified to be constructed wetland style basins. Constructed wetland style basins will maintain permanent water. An extended detention zone will be established above the permanent water. The extended detention zone will drain slowly through a low flow outlet control. Where practical, runoff from road embankments that have been stabilised by vegetation will be diverted into the clean water drainage system to minimise the contributing catchment area to the constructed wetlands. This will increase the effective size of the basin (in terms of depth of rainfall captured) and will result in a treatment volume that is greater than the 5 day 85th percentile volume that is proposed for sedimentation basins for construction areas.	Stage 1 SWMP Section 5.0 for establishment and modification of the basins. Stage 2 SWMP Section 5 for the maintenance of the basins constructed for Stage 1 works and any additional basins capturing runoff from access roads that Stage 2 construct.
Water management controls for the accommodation camp	WM_4.1	1	A stormwater management plan will be prepared as part of the detailed design of the project. The plan will consider geotechnical constraints including shallow soils.	This plan
	WM_4.2	1	Clean water from upslope areas will be diverted around the accommodation camp.	Section 5
	WM_4.3	1	A piped drainage system will be established to capture stormwater and convey it to the proposed water quality improvement ponds. The drainage system will have a 20% AEP capacity. Overland flow paths will be provided as required.	Section 5
	WM_4.4	1	All pervious areas including batters will be vegetated with endemic native vegetation where practicable.	Section 5
	WM_4.5	1	Runoff from roof areas will be collected in rainwater tanks where practicable. Captured water will be used for non-potable uses, reducing runoff volumes.	Section 5
	WM_4.6	1	Source controls including permeable pavers and rain gardens will be used where practicable.	Section 5
	WM_4.7	1	All runoff from the accommodation camp will be treated in water quality improvement basin(s). The basin(s) will be designed as constructed wetlands where practicable and will provide a water quality improvement function and attenuate peak runoff rates from the accommodation camp.	Section 5
	WM_4.8	1	Collectively, the stormwater controls will be sized and configured to achieve the water quality specifications provided in SWA Table 6.12.	Section 5
	WM_4.9	1	The water quality improvement pond batters will be established using retaining structures or other suitable measures to avoid disturbance of the Watercourse 3 channel.	Section 5
Water management controls for the	WM_5.1	1	A stormwater management plan will be prepared as part of the detailed design of the project. The plan will be integrated with the process water system.	This Plan

Impact	Reference	REMM Requirement		Where Addressed
portal construction pad	WM_5.2	1	Where practical, all activities that will occur on the portal construction pad with potential to contaminate stormwater runoff will be isolated from the stormwater system through the use of covering (i.e. by a building or roof) and bunding. Water produced within the covered and bunded areas will be either: • managed by the process water system; or • disposed as liquid waste to an appropriate facility.	Section 5
	WM_5.3	1	Clean water from upslope areas will be diverted through or around the portal construction pad in a designated clean water drainage system.	Section 5
	WM_5.4	1	A piped drainage system will be established to capture stormwater and convey it to the water management basin. The drainage system will have a 1% AEP capacity. Overland flow paths will be provided as required.	Section 5
	WM_5.5	1	All aggregate storage and stockpile areas will be bunded to prevent stormwater ingress. Runoff from these areas will be treated in sediment wedge pits or other sediment controls to remove all coarse material. Sediment wedge pits will overflow into the piped drainage system.	Section 5
	WM_5.6	1	All runoff from the portal construction pad and adjoining access road will be conveyed to a water management basin with adequate capacity for at least a 5 day 95th percentile rainfall event and include additional volume to accommodate required water quality treatments (i.e. a total volume of at least 3,750 m^3). The basin will provide a water quality improvement function. Water captured in the basin will be extracted to supply the process water system. Water treatment chemicals will be applied to the water management basin to enhance sedimentation and phosphorous and dissolved metal removal rates. Only water treatment chemicals that have a low risk of increasing the toxicity of treated stormwater will be used. Water treatment chemicals will be applied using an automated chemical dosing and mixing system. The system will be designed to meet the water quality specifications provided in SWA Table 6.16. The design treatment rate will be the 1 year ARI peak flow.	Section 5
	WM_5.7	1	The water management basin will be designed to provide a freeboard between its overflow pipe and spillway. The freeboard volume will be calculated to contain probable leaks, spills and firewater runoff volumes. The overflow pipe will have a manual shutoff valve that will enable site management to shut off the overflow pipe to enable the basin to contain any leak, spill or fire water runoff.	Section 5
Water management controls for the process water system	WM_6.1	1	A process water management system will be established to manage any potentially contaminated water that may be produced by the construction activities.	Section 5
	WM_6.2	1	The process water management system will be separated from the stormwater system to avoid uncontrolled overflows associated with stormwater ingress.	Section 5

Impact	Reference	REMM Requirement		Where Addressed
	WM_6.3	1	The process water system will incorporate a water treatment plant that will treat water to a suitable quality for its proposed use in construction activities. If required to meet water quality criteria, additional treatment will be provided for any water that is discharged to Talbingo Reservoir via the controlled discharge pipeline. This treatment system will meet the water quality specifications provided in Table 4.5 of this RTS.	Section 5
	WM_6.4	1	The process water management system will have the ability to extract water from the portal construction pad's water management basin. This will be done to top-up supply.	Section 5
	WM_6.5	1	A reticulation system will be established to enable the process water system to: • extract water from Talbingo Reservoir (as required); and • discharge treated process water into Talbingo Reservoir (as required).	Section 5
Water management controls for the waste water management system	WM_7.1	1	Waste water from the accommodation camp will be reticulated to a waste water treatment plant via a sewer system. The sewer system will be designed to restrict stormwater ingress into the waste water system.	Section 5
	WM_7.2	1	Water efficient fittings will be used to minimise waste water loads.	Section 5
	WM_7.3	1	Low phosphorus products are to be used for washing activities controlled by site management (i.e. laundry services and mess hall) and encouraged (via education) for general use.	Section 5
	WM_7.4	1	The waste water storage system will include emergency storage of untreated waste water. The storage volume will be calculated at detailed design based on analysis of response times from regional waste management contractors to provide emergency trucking and offsite disposal options.	Section 5
	WM_7.5	1	A waste water treatment plant will meet the water quality specifications provided in Table 4.4 of this RTS.	Section 5
	WM_7.6	1	Treated waste water will be disposed to Talbingo Reservoir via the controlled discharge pipeline.	Section 5
Water quality impacts from rock emplacement areas	WM_8.2	1	During establishment, the water management controls for construction areas (WM_2.1 to 2.8) will be applied.	Section 5
	WM_8.6	1	Runoff from Lick Hole Gully will be diverted around or through the eastern emplacement area. The diversion works will comprise a dam upstream of the diversion inlet and either a gravity or pump assisted diversion system. The diversion works will have a 1% AEP capacity. The dam upstream of the diversion inlet will be designed as a detention basin and will not permanently hold water. A high-flow diversion drain will be established to convey runoff from Lick Hole Gully around the emplacement area in a controlled manner, avoiding uncontrolled overflows through the emplacement area This diversion drain will only be engaged if a flood greater than a 1% AEP event occurs.	Section 5

Impact	Reference	REMM Requirement		Where Addressed
	WM_8.7	1	Seepage from the eastern emplacement area will be collected in a water management dam. Collected water will either be irrigated to the emplacement (to promote evaporation) or treated in the process water treatment plant. Discharge of seepage water to the Yarrangobilly River will be avoided.	Section 5
Flood risks	FM_1.1	1	Camp and Wallaces bridges will be designed in accordance with AustRoads bridge design standards which require the: • bridge deck soffit to be located above the 1% AEP flood level;	Stage 1 SWMP Table 5.1
	FM_1.1	2	Camp and Wallaces bridges will be designed in accordance with AustRoads bridge design standards which require the: • bridge structure to be designed to withstand a 0.05% AEP event; and	Stage 1 SWMP Table 5.1
	FM_1.1	3	Camp and Wallaces bridges will be designed in accordance with AustRoads bridge design standards which require the: • abutments to be protected by appropriately designed scour protection.	Stage 1 SWMP Table 5.1
	FM_1.2	1	The western emplacement will be designed to minimise the risk of emplacement material being entrained in flood waters during a 0.2% AEP event. This may require a flood protection berm or rock armouring along the northern toe of the emplacement.	Section 5
	FM_1.3	1	A flood emergency response plan will be prepared as part of the Project's emergency response plans.	Emergency Response Management Plan
	M1.13		Protocols will be developed for the proposed modification elements for use and storage of plant, equipment and materials in flood prone areas commensurate with the frequency of inundation.	Emergency Response Management Plan (in relation to the Modification 1 elements)
Clean water	M1.8		Where practicable, all clean water will be diverted around or through sites using cross-path drains or other similar measures to limit impact to existing flow regimes.	Section 5
Regrading	M1.9		Drill sites that have been modified to allow for vehicle access will be regraded to natural lay of the land as part of the site rehabilitation.	Section 5 Rehabilitation Management Plan
Refuelling	M1.10		A refuelling protocol will be developed for in-reservoir borehole drilling and will be included in the Construction Environment Management Plan (CEMP).	Appendix D
Erosion and sedimentation	M1.11		Erosion and Sediment Control Plans will be prepared for all proposed construction sites and drilling pads. These plans will consider local soil characteristics, clean water management and site-specific measures to suit the proposed construction methods.	Section 5

Impact	Reference	REMM Requirement		Where Addressed
Spills	M1.12		Geotechnical investigation drilling will be undertaken in accordance with the surface water management plan. The following mitigation measures are included in the existing surface water management plan: • All fuel and hazardous substances used in drilling will be stored in designated areas of the drill pad. Hazardous chemicals will be stored in accordance with relevant standards, including AS 1940:2004. • Designated fuel storage areas will be bunded to mitigate risk of contamination to surface water and soils should spills occur. Refuelling will also be carried out in the designated, bunded area. • Equipment should be appropriately maintained to ensure there are no leaks. • Spill kits will be available on site to contain contamination should any spills outside these bunded areas occur. If used, waste from the spill kits will be disposed of appropriately. • The safety data sheets of all hazardous chemicals required for drilling activities will be made available on site. All waste produced during drilling will be stored on site in above ground containers, and when required will be taken off-site by vehicles. All waste will be disposed of off-site to an EPA licensed facility.	Section 5 and Appendix B Spill Management Procedure
Barge ramp establishment at Middle Bay	MOD2 – 001		The following measures will be implemented for barge ramp establishment works at Middle Bay: • all barge ramp construction and dredging works would be closely monitored and carried out according to the Dredge Management Plan, Surface Water Management Plan and Aquatic Habitat Management Plan; • appropriate methods and pre-dredge testing would be implemented to that material is appropriately handled to minimise impacts to aquatic species and habitat; and • removal and subsequent disposal of aquatic macrophytes would be undertaken according to the Dredge Management Plan and / or Waste Management Plan.	Dredging Management Plan Surface Water Management Plan Aquatic Habitat Management Plan

2.4. Guidelines and Standards

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

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ 2000);
- *Australian Rainfall and Runoff* (Commonwealth of Australia, 2016);
- *Managing Urban Stormwater: Soils and Construction*. Landcom, (4th Edition) March 2004 (reprinted 2006) (the Blue Book). Volume 1 and Volume 2;
- *Managing Urban Stormwater: Soils and Construction - Volume 2C Unsealed roads* (DECCW 2008);
- *Managing Urban Stormwater: Soils and Construction - Volume 2D Main road construction* (DECCW 2008);
- *Managing Urban Stormwater: Soils and Construction - Volume 2E Mines and quarries* (DECCW 2008);
- *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla,* 16 pp; Fairfull, S. and Witheridge, G. (2003)
- Department of Primary Industries *Guidelines for Controlled Activities on Waterfront Land* (2012);
- NSW Office of Water Guidelines for working within riparian corridors;
- *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* – March 2004;
- *Environmental Best Management Practice Guideline for Concreting Contractors*, DEC, 2004;
- *NSW Floodplain Development Manual* (2005);
- *Guidelines for Treatment of Stormwater Runoff from the Road Infrastructure* (AP- R232) (Austroads, 2003);
- Australian Standard: AS1940 - 2017, *The Storage and Handling of Flammable and Combustible Liquids* (Standards Australia, 2017);
- Australian and New Zealand Standard: ASNZS 4452 – 1997, *The storage and handling of toxic substances* (Joint Standard Australia/Standard New Zealand Committee, 1997);
- NSW Environment Protection Authority's *Requirements for publishing pollution monitoring data* (EPA 2013).

2.5. Licences and Permits

2.5.1. Environment Protection Licence

Environment Protection Licence (EPL) (No 21266) has been issued for the Project for the scheduled activity of land based extractive activities. The EPL details conditions which must be complied with when undertaking the extractive activities works.

The EPL includes requirements for surface water monitoring for Snowy 2.0 Exploratory Works. At times, the surface water monitoring requirements of the EPL may differ to that detailed within this plan, particularly in the event of variations to the EPL. Differences may include changes to the monitoring locations; changes to the frequency of monitoring; or changes to the parameters which are required to be monitored.

Should differences arise, the monitoring requirements of the EPL will take precedence. This will occur until such time that the revised SWMP is updated and approved. Responsibility for monitoring will be either that of SHL or Future Generation as detailed within Section 6.2.3.

Future Generation are required to establish an Agreement for Lease (AFL) with NPWS, with an accompanying Works Access Licence in order to carry out the relevant Stage 2 Exploratory Works in accordance with the Exploratory Works EIS, CSSI 9208 and the approved Management Plans.

2.5.2. Water Access Licence

The extraction of water from Talbingo Reservoir will not require a water use approval as the project is designated Critical State Significant Infrastructure (CSSI). Section 5.23 of the *Environmental Planning and Assessment Act 1979* provides that the following approvals are not required - a water use approval under section 89; a water management work approval under section 90; or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

Section 60A of the *Water Management Act 2000* requires that a water access licence be obtained to extract water from a water source. The *Water Management (General) Regulation 2018* does however provide exemptions for the requirement to obtain water access licences. A Water Access Licence will be obtained by Snowy Hydro, in consultation with DoI Water, for extracting surface water from Talbingo Reservoir for activities other than dust suppression; pump testing a bore; or monitoring which are exempt activities under the *Water Management Regulation 2018*. Refer to Section 2.4 of the Water Management Plan for further details.

3. EXISTING ENVIRONMENT

Details of the existing environment including topography and soil types are detailed in the Water Management Plan.

3.1. Existing Waterways

The Yarrangobilly River and Talbingo Reservoir are the defining features of Lobs Hole. The river initially flows in a southerly direction before turning to the west, towards Talbingo Reservoir. The Yarrangobilly River and its tributaries (including Wallaces and Stable creeks) are shown in Figure 3-1. Watercourses in the project area are all ‘gaining’ streams with groundwater providing baseflows.

The Yarrangobilly River is a major regional watercourse that flows into Talbingo Reservoir, downstream of Lobs Hole. The river’s catchment has an area of 271 km2 that is wholly within the KNP. The catchment is characterised by a range of subalpine grasslands and woodlands and montane dry sclerophyll forests. Elevations range from 550 m AHD at Lobs Hole to more than 1,400 m AHD in the head water catchments. There are no dams or flow diversions in the Yarrangobilly River catchment upstream of the Talbingo Reservoir.

Stream flows in the Yarrangobilly River are perennial. However, the majority of the stream flows occur in late winter and early spring, which is a typical regime for rivers in the Australian Alps. In summer and autumn, stream flows are maintained by groundwater fed baseflows.

Wallaces Creek is a major tributary to the Yarrangobilly River and forms the southernmost portion of the catchment. Wallaces Creek has a similar flow regime and water quality characteristics to the Yarrangobilly River. Stable Creek is a watercourse that joins Wallaces Creek approximately 600 m upstream of the confluence of Wallaces Creek and the Yarrangobilly River. Other local named and unnamed watercourses in the area are all intermittent or ephemeral streams.

The proposed access track improvement work and geotechnical investigations are located at Marica on a ridgeline away from major rivers or watercourses. Figure 3-2 shows the location and stream order of mapped watercourses in the vicinity of the proposed activities at Marica. There are several headwaters of first order watercourses to the immediate west of the main work area (refer Inset 1), which make up the upper reaches of a non-perennial unnamed tributary of the Yarrangobilly River. The remaining boreholes are located close to a mapped non-perennial first order watercourse which drains to the south towards Stable Creek, which flows to the Yarrangobilly River via Wallaces Creek.

Tantangara Reservoir also makes up part of the existing Snowy Hydro Scheme, and it also provides considerable storage for the scheme. Tantangara Reservoir sits at a significantly higher elevation than Talbingo and the main Exploratory Works areas. The main inflows to the reservoir are provided by the Murrumbidgee River to the west, Nungar Creek to the south-west, Mosquito Creek from the north and Kellys Plain Creek from the south. Of most relevance to Modification 1 is Kellys Plain Creek, which has a relatively large upstream catchment area and passes through the existing project access tracks (refer to Figure 3-3). The proximity of Nungar Creek to the geotechnical works is indicated in Figure 3-4.

The Talbingo Reservoir is operated as part of the Snowy Hydro scheme. The gross volume of the reservoir is equivalent to 75% of the average annual flow through the reservoir and significant inflows are maintained during the summer months due to diversions from the greater Snowy Scheme. As a result, the water quality is expected to be less sensitive to seasonal changes in stream flow regimes than river systems such as the Yarrangobilly River.

3.2. Baseline Surface Water Quality Summary

Analysis of results from the surface water quality monitoring undertaken during the EIS (Appendix A of this Plan) determined the following existing waterway conditions:

- Yarrangobilly River and Wallaces Creek during base flow conditions are:
  - neutral to slightly alkaline, with pH measurements ranging between 7.5 and 8.4;
  - high carbonate alkalinity and hardness and alkalinity;
  - low salinity;
  - low levels of suspended solids and turbidity with the is potential for higher levels of suspended solids during non-base flow conditions;
  - low levels of nutrients (phosphorus, nitrogen and carbon) with potential for higher levels of nutrients during non-base flow conditions;
  - low levels of dissolved metals;
- Talbingo Reservoir during base flow conditions is:
  - neutral pH;
  - low carbonate (hardness and alkalinity);
  - low salinity;
  - low levels of suspended solids;
  - low nutrient levels;
  - low dissolved metal concentrations other than copper and zinc.

3.3. Aquatic Ecology

Yarrangobilly River and Wallaces Creek are watercourses with substantial ecological value. The streams contain boulders, cobbles, pebbles and gravel with little evidence of siltation.

Nearby tributaries of Wallaces Creek (Lick Hole Creek and Sheep Station Creek) are ephemeral and provide aquatic habitat of lower value. These watercourses would provide very limited habitat for fish but would provide more valuable refuge for aquatic macroinvertebrates and potentially burrowing crayfish.

An assessment of the likelihood of occurrence of all threatened aquatic species identified five with potential to occur:

- Murray crayfish has a high chance of occurring in Yarrangobilly River and Wallaces Creek;
- Trout cod – stocking records in Talbingo Reservoir suggest it has a moderate chance of occurring;
- Macquarie perch – stocking records in Talbingo Reservoir suggest it has a moderate chance of occurring both here and in the Yarrangobilly River; and
- Murray cod and Silver perch – these species have been stocked in Blowering Dam and there is a possibility, albeit low, that they have also been introduced to Talbingo Reservoir.

Threatened Macquarie perch and Trout cod were not identified during field surveys or in environmental deoxyribonucleic acid (DNA) samples from Talbingo Reservoir. It is not known whether any self-sustaining populations of these species are present.

During surveys of Yarrangobilly River and Wallaces Creek, Murray crayfish were observed. There also appears to be suitable habitat for Macquarie perch within Yarrangobilly River.

The measures detailed in Section 5 of this Plan are intended to reduce the potential impact and therefore maintain existing habitat and population of these species.

3.4. Threatened Terrestrial Fauna

The Boorolong Frog was recorded along the Yarrangobilly River, from the full supply level of Talbingo Reservoir to the upper reaches of the Yarrangobilly River, as well as along Wallaces Creek. The Yarrangobilly River provides optimal breeding habitat for this species, with a series of cobble banks and bedrock structures, with slow flowing water. These areas are connected by larger, slow-flowing pools. The Boorolong Frog is listed as Endangered under the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Management measures additional to meeting the water quality targets in this Plan will be addressed in the Biodiversity Management Plan, Section 5 and Section 6 of this Plan.

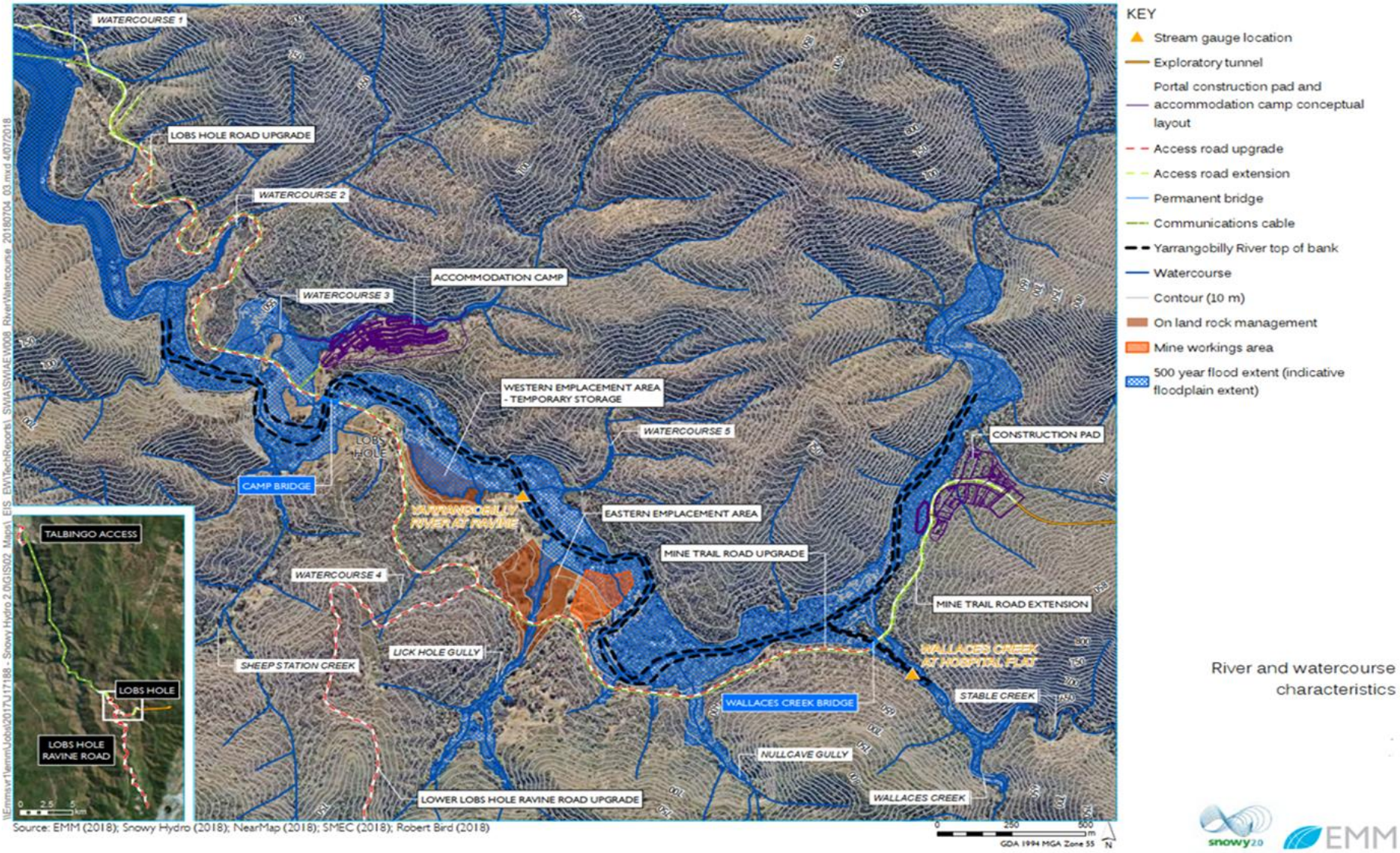


Figure 3-1: Existing surface water environment

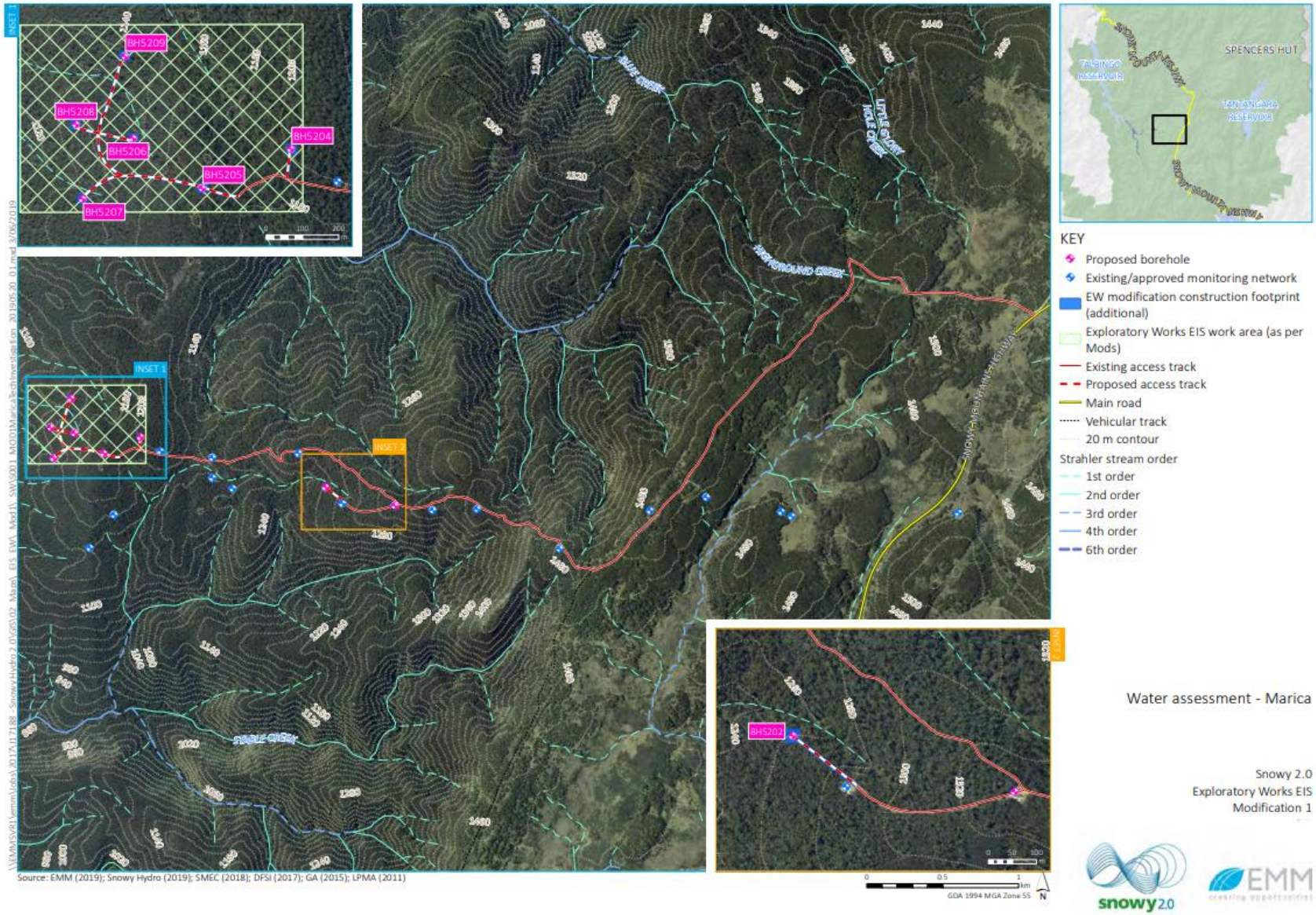


Figure 3-2: Watercourses - Marica Area (EMM, Modification 1)

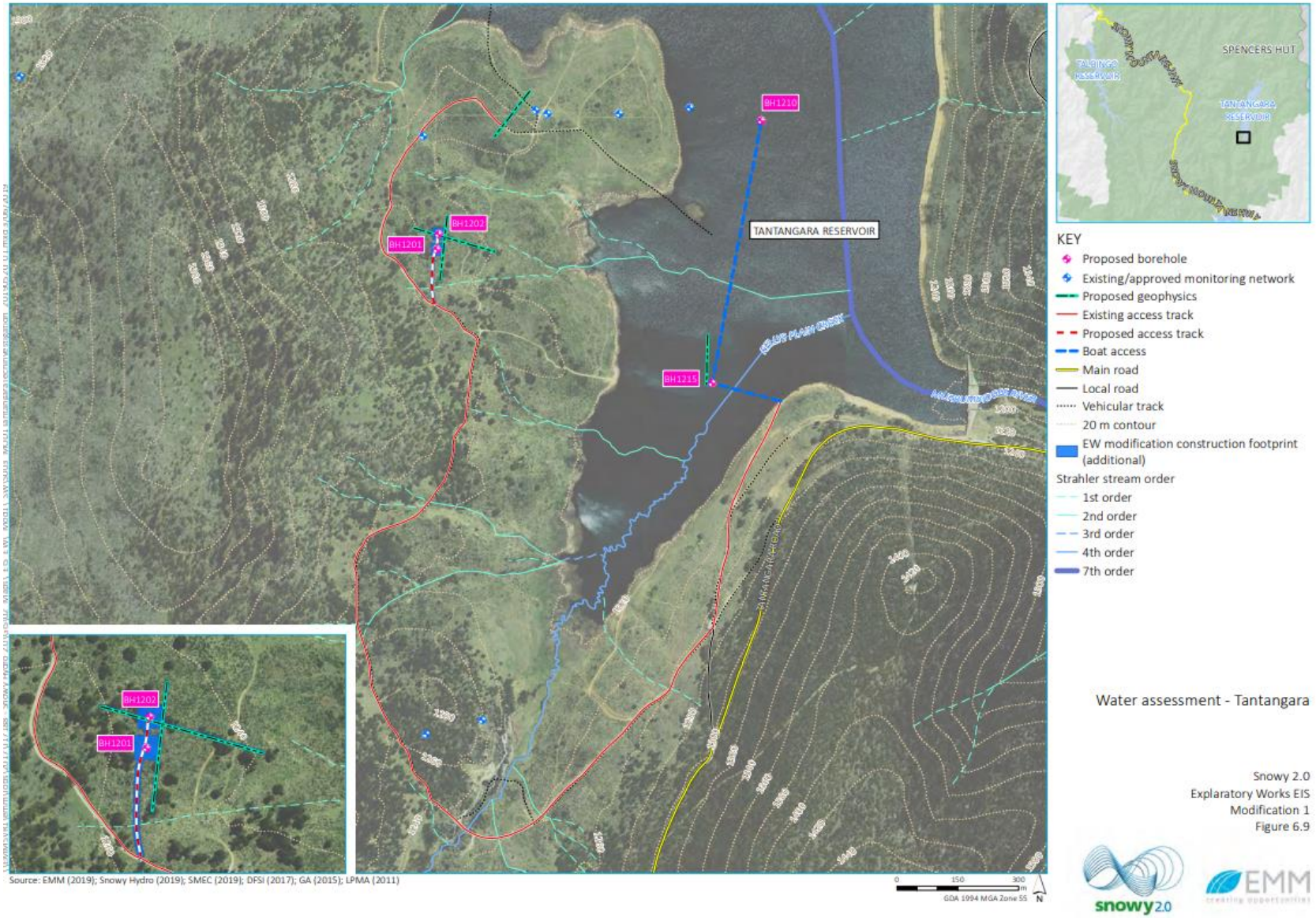


Figure 3-3: Watercourses – Tantangara (EMM, Modification 1)

Figure 3-4: Nungar Creek geotechnical investigation (EMM, Modification 1)

3.5. Rainfall

Rainfall characteristics within the Yarrangobilly River catchment were determined in the EIS using information from Bureau of Meteorology (BoM) rainfall gauges and rainfall maps that are also produced by BoM. The following rainfall gauges are located within proximity to the Yarrangobilly River catchment:

- Talbingo (72131);
- Cabramurra SMHEA AWS (72161); and
- Yarrangobilly Caves (72141).

Table 3-1 presents key information and statistical data from the three gauges.

Table 3-1: Rainfall statistics[1]

Rainfall[2] statistics (annualised)		Talbingo (72131)	Cabramurra SMHEA AWS (72161)	Yarrangobilly Caves (72141)
Rainfall record		1997 - present	1996 - present	1906 – 1919 1978 - present
Distance from Lobs Hole	(km)	25 km to the north west	15 km to the south	15 km to the north-east
Elevation (m AHD)	(m AHD)	395	1482	980
Average rainfall	(mm/year)	952	1178	1169
Lowest rainfall	(mm/year)	361	567	552
5th percentile rainfall	(mm/year)	663	877	818
10th percentile rainfall	(mm/year)	771	992	905
Median rainfall	(mm/year)	946	1202	1158
90th percentile rainfall	(mm/year)	1220	1386	1511

Notes: *1. Data sourced from BoM website (climate data online)*

2. Some precipitation will occur as snow fall but has been referred to as rainfall to maintain consistency with other sections in the EIS.

The median rainfall within Yarrangobilly catchment ranges from 1400 mm/year in the head water catchments to 950 mm/year at Lobs Hole as detailed in the SWA. The variation in median rainfall generally reflects the variation in topography.

Figure 3-5 plots 10th, 50th and 90th percentile monthly rainfall depths that have been calculated by BoM from the Talbingo (72131) gauge. This information indicates that the highest and most consistent rainfall occurs in winter and early spring. Rainfall in summer is more variable with significant differences between 10th and 90th percentile monthly rainfall depths.

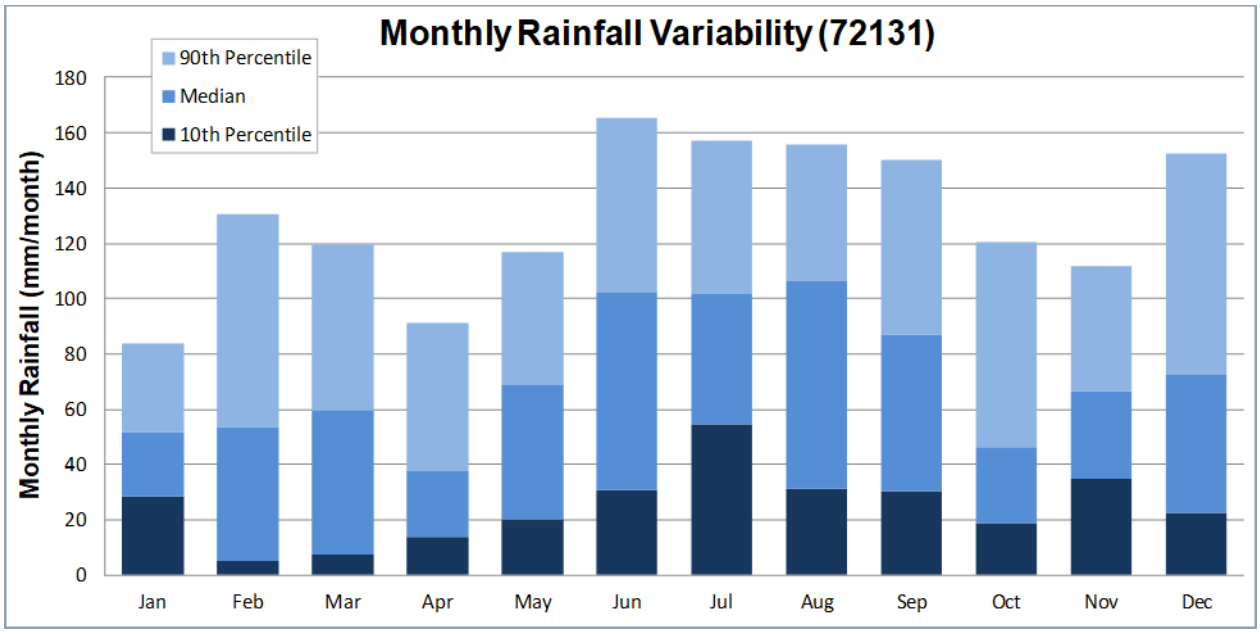


Figure 3-5: Monthly rainfall statistics - Talbingo

Design rainfall information is used to calculate aspects of the stormwater management system. The following design rainfall information has been established for the Lobs Hole area:

Figure 3-6 provides design rainfall depths for a range of Annual Exceedance Probability (AEP) events of varying duration. This information was sourced from the ARR2016 data portal; and

Figure 3-7 presents rainfall depths for 2, 5, 10 and 20 day rainfall events. This information was calculated from the Talbingo (72131) rainfall record and is used for establishing sedimentation basin volumes.

	Annual Exceedance Probability (AEP) – Rainfall depths (mm)						
	63.2%	50%	20%	10%	5%	2%	1%
15 min	10	11	14	17	20	24	27
30 min	13	14	19	22	26	31	35
1 hour	17	18	24	28	32	38	43
2 hour	21	24	30	35	40	47	52
3 hour	25	27	35	40	46	53	59
6 hour	32	36	46	52	59	69	76
12 hour	42	46	60	69	78	91	101
24 hour	54	59	77	89	101	118	131
48 hour	65	73	95	109	123	144	160
72 hour	72	80	104	120	134	156	173

Notes: Data sourced from Australian Rainfall Runoff Data Portal.

Figure 3-6: Design rainfall depths from Australian rainfall and runoff

	Rainfall Duration			
	2 day	5 day	10 day	20 day
80th Percentile event	7.5 mm	24.2 mm	47.4 mm	86.9 mm
85th Percentile event	11.4 mm	30.6 mm	56.0 mm	99.0 mm
90th Percentile event	18.4 mm	41.6 mm	68.1 mm	116.0 mm
95th Percentile event	30.0 mm	56.8 mm	85.0 mm	138.0 mm

Notes: Rainfall depths have been calculated from the Talbingo (72131) gauge record

Figure 3-7: Design rainfall depths for frequent events

3.6. Flooding

The area is subject to flooding from the Yarrangobilly River which flows through the site in a westerly direction. Minor tributaries which enter the River from both the north and south are also subject to flooding. A flood assessment was undertaken as part of the EIS by GRC Hydro Pty Ltd.

The flood model results were used to establish flood characteristics within Lobs Hole for the 20%, 5%, 1%, 0.2%, 0.05% annual exceedance probability (AEP) and probable maximum flood (PMF) events. It was found that the Exploratory Works avoid flood prone land where possible. The flood model was applied to assess changes to the existing flooding regime associated with the infrastructure. This process concluded that the predicted changes to flood regimes will not impact infrastructure or items of heritage significance. Management measures that will be implemented to minimise the flood risk are detailed in Section 0. A Flood Emergency Response Plan has been prepared as part of the Emergency Response Plan and is included in Appendix B18 to the EMS.

3.7. Site Water Balance

Water usage and details of the Site Water Balanced as per Section 4 of the Water Management Plan. Water will be sourced from groundwater bores initially, then extracted from Talbingo Reservoir once the raw water, water treatment plant is commissioned. Water from sediment basins will be used where available. Licensing arrangements are discussed in Section 2.5.

4. ENVIRONMENTAL ASPECTS, IMPACTS AND RISKS

An environmental aspect is an element of an organisation's activities, products, or services that has or may have an impact on the environment (ISO 14001 Environmental management systems). The relationship of aspects and impacts is one of cause and effect.

Key aspects of the Project that could result in surface water impacts are identified in Table 4-1 (Column 1). The extent of these impacts will depend on the nature, extent and magnitude of construction activities and their interaction with the natural environment (Column 2). This is further exacerbated by environmental factors (Column 3).

Table 4-1: Projects aspects and impacts relevant to surface water

Environmental Aspects (Construction activities likely to cause impact to surface water)	Environmental Impacts	Environmental Factors (Conditions)
Vegetation clearing Topsoil stripping Bulk earthworks Site access including waterway crossings Culvert and drainage works Stockpiling Water use and extraction Dewatering Subaqueous placement Dredging activities Ancillary facility operation and storage of fuels and chemicals Instream work platforms and crossings Drilling and piling	Sediment-laden runoff entering into Yarrangobilly River, Wallaces Creek and other local waterways. Contamination of stormwater runoff due to construction activities (including accidental spills). Changes to flow regime from new infrastructure. Uncontrolled discharge of process water into the stormwater system. Water quality impacts associated with the discharge of process and treated wastewater (sewage) to Talbingo Reservoir. Water quality impacts including sediment impacts associated with dredging and subaqueous placement works.	**Soil type** – more erodible soil types have an increased soil erosion potential; **Soil moisture** – increased soil moisture decreases soil mobilisation; **Rainfall** – heavy rainfall increases soil entrainment **Extent of vegetation cover** – vegetation assists in stabilising soils and reduces the ability for erosion The presence of acid forming and acid neutralising materials Existing soil and water contamination **Sensitivity of aquatic environments** – Dispersion of contaminants is increased when working within aquatic environments

With the implementation of practical controls to avoid or mitigate impacts the residual impacts were described as follows:

- turbidity, and suspended solids and nutrients concentrations in discharged stormwater are expected to exceed default trigger levels for physical and chemical stressors on occasions and it is possible that metal concentrations may also exceed the relevant default trigger levels;
- stormwater discharges will rapidly mix with river flows, so no concentration impacts are predicted;
- load increases due to stormwater discharges are conservatively estimated to be less than 2.6% of existing loads for all pollutants;
- no change to stream flow regimes is predicted; and
- no ecological impacts are predicted.

5. ENVIRONMENTAL MANAGEMENT MEASURES

5.1. Management Measures

The following management measures will be implemented to avoid, minimise and manage impacts to surface water aligned with the EIS, CoAs and REMMs:

- provide targeted training and education;
- minimise the extent and duration of disturbance;
- monitor weather conditions and modify work programs accordingly

- control stormwater flows onto, through and from the site;
- minimise soil erosion;
- maximise sediment retention on the site;
- inspect regularly and maintain controls in working order;
- monitor the site and respond appropriately;
- prepare and maintain documents;
- report outcomes and impacts.

Table 5-1 lists the management control measures that will be implemented during the Project to minimise construction impacts to surface water. As a minimum the Blue Book (Landcom 2004) principles of erosion and sediment control, including volumes 1 and 2, will be adopted for the Project.

5.1.1. Erosion and sedimentation control strategy and methods

As defined in the Blue Book (Landcom 2004) erosion control includes the protection of soil from dislocation by water, wind or other agents. Sediment control is the management of material deposition of varying size, both mineral and organic, away from its site of origin by the action of water, wind, gravity or ice. Generally, in construction, erosion and sediment controls are controls which manage and limit the impact of sedimentation from soil erosion on the environment as a result of construction ground disturbance activities. Construction of surface infrastructure will require the removal of vegetation and disturbance of soils which in-turn triggers the risk of erosion and sedimentation.

Erosion and sediment controls including clean-water diversions and progressive rehabilitation to re-establish stabilised groundcover are the key methods proposed to limit the generation of sediment and manage sediment laden runoff from construction areas.

The use of combined erosion and sediment controls will be implemented to achieve the Project's water quality targets (Section 6.1 of the Plan). The following sections detail key controls that will be implemented on the Project.

5.1.1.1. Erosion and sediment control planning

Potential erosion and sedimentation impact for Stage 2 works will be predicted and in-turn managed through the development of Erosion and Sediment Control Plans (ESCP). A Concept ESCP (CESCP) will be developed for Stage 2 as an overarching principles document. A Project ESCP (PESCP) will be developed per specific location. PESCPs will be applicable for the following works:

- vegetation clearing and initial site establishment;
- construction and operation of unsealed access roads;
- construction and operation of the accommodation camp;
- construction and operation of the portal pad;
- construction and operation of the stockpiles and works at the emplacement area;
- construction of the services pipeline, dewatering pipes and discharge outlets;
- construction and operation of barging facilities;
- construction and operation of ancillary facilities including chemical storage and workshops;
- construction and operation of drill pads (Modification 1).

These plans will be designed by a suitably qualified person in consultation with construction personnel and the Project Soil Conservationist to guide staff on the appropriate controls for specific work stages. The ESCPs will be updated as required based on the progression of new areas of ground disturbance and changing site conditions.

The Environment team, through site inspections and consultation with construction personnel, will manage updates of the ESCPs.

5.1.1.2. Clean-water diversions

Clean-water diversions reduce the potential for sediment laden runoff from construction area by diverting surface water from non-construction disturbed areas (clean water catchments) around disturbed construction areas (dirty water catchments). This control measure will be implemented for the following Stage 2 works:

- vegetation clearing and initial site establishment;
- construction and operation of unsealed access roads;
- construction and operation of the accommodation camp;
- construction and operation of the portal pad;
- construction and operation of the stockpiles and works at the emplacement area;
- construction and operation of drill pads (Modification 1).

Specific detail of clean-water diversions will be detailed in the progressive ESCPs for Stage 2 works.

5.1.1.3. Ground stabilisation

Progressive ground stabilisation will be executed as soon as practical from the commencement of ground disturbance activities. This includes application of polymers, geotextiles and vegetation rehabilitation. Rehabilitation with native flora species where practicable will be implemented to reduce the ground disturbance footprint and subsequently limit the potential for erosion from construction areas. All rehabilitation will be undertaken in accordance with the approved Rehabilitation Management Plan.

Rehabilitation measures will be implemented to reinstate the ground including stockpiling topsoil and subsoil in a manner and location that minimises contamination and managing the stockpiles to minimise the development of anaerobic conditions, nutrient decline, weed prevalence and dust generation.

5.1.1.4. Water capture and filtration options

A number of options are available to treat surface runoff from construction areas. Passive treatment options such as capture/ filtration controls and active treatment such as dosing units, can be implemented to suitably manage dirty surface water runoff to meet the Project's water quality objectives. The EIS acknowledges that the existing topography is steep terrain which limits the practicality of some surface water treatment methods which, in less graduated terrain, would otherwise be reasonable.

Implementing sediment basins that are designed to capture rainfall to meet 85% 5-day rainfall event Blue Book (Landcom 2004) criterion is an accepted industry standard for managing surface water in construction. Further detail provided in Section 3.5 of this Plan.

The Blue Book (Landcom 2004) has provisions for treatment of surface water runoff from catchments sizes that do not trigger the need for sediment basins. This determination is based on soil type, erosivity and disturbance area size. Controls such as silt fences, mulch berms, catch drains, rumble grids and establishing groundcover, such as application of geotextiles are all acceptable controls which, when designed appropriately by a suitably qualified person and

documented in an ESCP, can practically meet the Project's water quality objectives. Furthermore, suitable location selection of sediment sources and the controls can also be implemented to meet the Project's water quality objectives. This includes locating stockpiles away from waterways.

5.1.2. Water treatment

Water treatment plants (WTP) are proposed to be installed and utilised at the accommodation camp for potable water consumption and at the exploratory tunnel portal for tunnel process water treatment.

The accommodation camp WTP is intended to provide potable water to the accommodation camp and portal construction pad facilities and will be treated to a standard that complies with the Australian Drinking Water Guidelines. The accommodation camp water supply will be pumped via the water pipeline from Talbingo Reservoir.

A package waste water (sewage) treatment plant (STP) is proposed at the accommodation camp for Exploratory Works waste water. Following treatment waste water will be discharged to Talbingo reservoir via the water services pipeline connecting the accommodation camp to Talbingo Reservoir.

The exploratory tunnel WTP will be connected to a drainage system comprised of sumps and pipelines from the tunnel to the WTP at the portal surface. This process water will be treated to the water quality discharge criteria in the Project's EPL and be re-used on site as non-potable dust suppression and plant wash down. Excess treated water that cannot be utilised on site will be discharged via pipeline into the Talbingo Reservoir. This water will be tested and approved for discharge by the Environment team prior to the water leaving the Project boundary. At the time of submission, the water discharge criteria for the Project EPL had not yet been determined.

The proposed water treatment approach is not expected to increase the overall toxicity of discharge due to the selection of low risk chemicals. Higher risk chemicals such as aluminium based chemicals and cationic flocculants will be avoided. It is understood that the use of the proposed treatment chemicals may result in a minor increase in salinity (10 to 30 µS/cm). This will be an unavoidable effect of using water treatment chemicals and has been considered in the surface water trigger values in Section 6 of this Plan. The change to salinity levels will be minimised where possible by optimising dosing rates.

5.1.3. Surface water treatment controls summary

Based on the above information the Project will implement the following surface water treatment options for Stage 2 Exploratory Works:

- sediment basins will be designed to in accordance with best practice;
- erosion and sediment controls will be installed and maintained to manage impacts to receiving environments including areas that do not trigger the need for sediment basins in compliance with the Blue Book (Landcom 2004) such as roads;
- locating stockpiles away from waterways and severe flood areas where possible;
- the WTPs and STP will be installed and utilised in accordance with the details described above.

These measures will be planned, designed and detailed in progressive ESCPs as described above. Review and modifications of these options possible on the basis of evolving design and construction elements. Any proposed changes will be discussed with the relevant stakeholders. Additional measures that will be implemented on the Project to minimise the impact of Stage 2 construction activities on surface water quality are detailed in Table 5-1 of this Plan.

5.1.4. Chemical control and spill management

Chemicals will be stored and managed in a manner that is consistent with the CoAs and REMMs. Details of these requirements and the manner with which they will be complied is detailed in Appendix B of this Plan as the Spill Management Procedure.

Chemical transport, handling and storage controls are detailed in the Chemical, Hazardous and Fibrous Material Management Plan. Designated chemical storage areas will be established on the Project including appropriate bunding consistent with Storing and handling of liquids: Environmental protection participant's manual (DECC NSW2007).

Response to incidents will be managed in accordance with Section 7 of the EMS.

5.2. Mitigation Measures

The following mitigation measures are applicable to Stage 2. Stage 1 mitigation measures/requirements have also been included for completeness.

Note that mitigation measures that relate to subaqueous emplacement, dredging within Talbingo Reservoir and the barge infrastructure are detailed in the Dredging Management Plan and the Subaqueous Management Plan. Subaqueous emplacement, dredging and barge infrastructure works will be undertaken consistent with the mitigation measures in Table 5-1 of this Plan.

Table 5-1: Surface water management measures

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
	General				
WM01	Training will be provided to all project personnel, including relevant sub-contractors on surface water and soil management practices, ESCPs and the requirements from this plan through inductions, toolboxes and targeted training.	All	Pre-construction and construction	Contractor	Schedule 3 Condition 34
WM02	Training will be provided on low-toxicity chemical options including for laundering and cleaning purposes.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_7.3
WM03	A Project Soil Conservationist will be engaged during the project and will be consulted throughout construction to provide advice on erosion and sediment control design, installation and maintenance.	All	Construction	Contractor	Good practice Schedule 3 Condition 34, REMM WM_2.1
WM04	The use of clean water shall be minimised through the efficient use of water generated and treated during construction.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.2, REMM WM_ 3.3, Schedule 3 Condition 33
WM05	Unless authorised otherwise by an environment protection licence the requirements of Section 120 of the POEO Act will be complied with.	All	Construction	Contractor	Schedule 3 Condition 32
WM06	The stockpiling and use of mulch shall minimise generation of tannins where practicable.	All	Construction	Contractor	Good practice
WM07	Works will be programmed to minimise the extent and duration of disturbance to vegetation where practicable. This will include minimising the time between clearing and initial earthworks and commencement of subsequent ground stabilisation activities.	All	Construction	Contractor	Good practice
WM08	Where practicable, vegetation clearing and construction works will be restricted during periods of rainfall where there is a risk of sediment runoff and pollution of downstream watercourses.	All	Construction	Contractor	EIS App N Table 11.5
WM09	Weekly inspection and maintenance of (as required) erosion and sediment controls and chemical storage will be undertaken by relevant construction personnel.	All	Construction	Contractor	Good Practice

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM10	Soil management will be undertaken according to the following principles: • preserve as much of the topsoil and subsoil as possible to be developed and implemented to maximise salvage through the application of the Topsoils stripping and Stockpiling Procedure; • minimise the risk of contamination; • minimise the risk of any topsoil degradation or compaction during construction, stockpiling and following reinstatement; • ameliorate subsoil where required for use in rehabilitation works; • minimise topsoil mixing with unsuitable soil and spoil materials during stripping and stockpiling; and • ensure reinstatement of soil horizons in the correct order and required depths to allow for rehabilitation.	All	Construction	Contractor	Schedule 3 Condition 34, REMM SOIL_01 1-4a
WM11	Rainwater runoff from roof areas will be collected in rainwater tanks where practicable. Captured water will be used for non-potable uses.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_4.5
WM12	Source controls including permeable pavers and rain gardens will be used where practicable.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_4.6
WM13	Water efficient fittings will be used to minimise waste water loads associated with the accommodation camp, crib huts, toilets and site offices.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_7.2
WM14	Low phosphorus products are to be used for washing activities controlled by site management (i.e. laundry services and mess hall) and encouraged (via education) for general use.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_7.3
Procedures, plans and monitoring					
WM15	Emergency flood response will be managed in accordance with the Emergency Response Management Plan.	All	Pre-construction and construction	Contractor	Schedule 3 Condition 34, REMM FM_1.3, REMM M1.13.
WM16	Emergency response to spills of oils and fuel etc will be managed in accordance with the Emergency Spill Response Procedure included in Appendix B of this plan.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01, REMM WAT_11, REMM M1.12.
WM17	Third-party laboratory testing must be suitably accredited for laboratory samples and equipment calibration.	All	Construction	Contractor	Good Practice
WM18	Erosion and Sediment Control Plans or part of where applicable will be developed and implemented prior to the commencement of ground disturbance.	All	Construction	Contractor	Good Practice

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM19	The following principles will be considered when designing Erosion and Sediment Control Plans for the purpose of designing, constructing, maintaining and operating the controls: • assess the soil and water implications of development at the site; • planning stage, including those relating investigating the soils where their disturbance is likely to expose and/or exacerbate local constraints; • plan for erosion and sediment control concurrently with engineering design and before earthworks begin, ensuring proper assessment of site constraints and integration of the various components; • minimise the area of soil disturbed and exposed to erosion; • conserve topsoil for later site rehabilitation/revegetation; • control water flow from the top of, and through the development area; • rehabilitate disturbed lands quickly; and • maintain soil and water management measures appropriately during the construction stage.	All	Construction	Contractor	Good Practice
WM20	A topsoil stripping and stockpiling procedure will be developed and implemented to: • maximise the salvage of materials and minimise soil degradation; • minimise the structural decline of soil by using suitable machinery, timing stripping where practicable, using correct stockpile development techniques and minimising handling of topsoil materials; • design and locate stockpiles to minimise contamination, development of anaerobic conditions, and to avoid erosion and dust generation • minimise nutrient decline by managing stockpile methods and heights; • regularly inspection stockpiles for weeds • manage loss from wind and water erosion by establishing a vegetative cover for topsoil stockpiles	All	Construction	Contractor	Schedule 3 Condition 34, REMM SOIL_01
WM21	Surface water and soil management measures from this plan will be included in relevant site environmental documents including for example, Erosion and Sediment Control Plan (ESCP), Work Method Statements (WMS) and/or Site Environmental Plans (SEPs).	All	Pre-construction and construction	Contractor	Schedule 3 Condition 34, REMM WM_2.1

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
Clean water diversions					
WM22	Where practical, all clean water will be diverted around or through water management areas. Runoff from clean water areas that cannot be diverted will be accounted for in the design of the water management systems. In accordance with REMM WM_1.1. All diversions will be constructed to prevent the water from re-entering the works and in a manner, which does not cause erosion, an increase in flow rate to intercepting waterway, pollution or nuisance of landholders. This will apply to all Erosion and Sediment Control Plans (ESCPs) and the design of all access roads.	All	Pre-construction and construction	Designer and Contractor	Schedule 3 Condition 34, REMM WM_1.1, Schedule 3 Condition 33, REMM M1.8
WM23	All permanent clean water drainage will be designed and constructed to convey the 1% AEP peak flow and will have adequate scour protection. Temporary clean water drainage will be designed to convey the 50% AEP peak flow and have installed checks to minimise the potential to materially increase water flow in the receiving waterway. This will apply to all Erosion and Sediment Control Plans (ESCPs) and the design of all access roads.	All	Pre-construction	Designer and Contractor	Schedule 3 Condition 34, REMM WM_1.2
WM24	Where practical, diversions will seek to avoid materially increasing flow rates in adjoining watercourses. This will apply to all Erosion and Sediment Control Plans (ESCPs) and the design of all access roads. In accordance with REMM WM_1.3.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_1.3, Schedule 3 Condition 33
WM25	Where practical, the permanent diversion of drainage lines or watercourses using contour drains cut across steep slopes will be avoided, applied to relevant Erosion and Sediment Control Plans (ESCPs). In accordance with REMM WM_1.4.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_1.4
WM26	Clean water from upslope of the portal construction pad will be diverted through or around the pad in a separated, designated clean water drainage system. This system will be designed to limit the potential to materially increase the water flow in the receiving waterway.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_4.2, REMM WM_5.3
WM27	A piped drainage system will be established for the portal construction pad to capture stormwater and convey it to the water management basin. The drainage system will have a 1% AEP capacity. Overland flow paths will be provided as required.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_5.4
WM28	All aggregate storage and stockpile areas will be bunded to prevent stormwater ingress. Runoff from these areas will be treated with appropriate sediment controls to remove all coarse material. Sediment wedge pits used will overflow into the piped drainage system.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_5.5
Process and intercepted water management					
WM29	A reticulation system will be established to enable the process water system to: • extract water from Talbingo Reservoir (as required); and • discharge treated process water into Talbingo Reservoir (as required).	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_6.5

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM30	A process water management system will be established to manage and treat water produced by and used for tunnelling. This system will be: • established to manage any potentially contaminated water that may be produced; • separated from the stormwater system to avoid uncontrolled overflows associated with stormwater ingress to rainfall events no less than the 85th percentile 5-day rainfall event. Established to treat water to a suitable quality for its intended use and discharge into Talbingo Reservoir Have constructible provision to extract water from the portal construction pad's sediment basin to top up supply where required	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_6.1, REMM WM_6.2, REMM WM_6.3, REMM WM_6.4, REMM WM_6.5 Good Practice
WM31	Any surplus process water will meet the prescribed criteria for discharge.	All	Construction	Contractor	Good Practice
WM32	Any additional water required will be sourced from Talbingo Reservoirs.	All	Construction	Contractor	Good Practice
WM33	All waste and process water will meet the prescribed criteria for discharge into the Yarrangobilly River arm of Talbingo Reservoir.	All	Construction	Contractor	Good Practice
WM34	All emplacement seepage will be captured and managed (treated or irrigated back to emplacement) to avoid discharge to watercourses and reservoirs. Discharge of seepage water to the Yarrangobilly River will be avoided, where reasonable and feasible.	All	Construction	Contractor	REMM WM_8.7, Good Practice
WM35	Oil skimming/ collection facilities will be used with construction water treatment.	All	Construction	Contractor	Good Practice
WM36	Waste water from the accommodation camp will be reticulated to a waste water treatment plant via a sewer system.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_7.1
WM37	The accommodation camp sewer system will be designed to restrict stormwater ingress into the waste water system.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_7.1
WM38	Waste water will be treated to the RTS Table 4.4 value and only then disposed to Talbingo Reservoir. The waste water (sewage) system will include emergency storage of untreated waste water. The storage volume will be calculated at detailed design based on analysis of response times from regional waste management contractors to provide emergency trucking and offsite disposal options.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_7.4, REMM WM_7.5, REMM WM_7.6

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
Construction disturbance areas and access roads					
WM39	The concept ESCP (CESCP) will be developed by the Contractor prior to construction and be used as a basis for the development of Project ESCPs (PESCPs) during construction. The PESCPs will be prepared and implemented in accordance with Soils and Construction – Managing Urban Stormwater (The Blue Book) (Landcom 2004) for each construction area in advance of disturbance. The plans will consider local soil characteristics, clean water management and practical source and rehabilitation measures that reflect the proposed construction methods. The PESCPs will be progressively reviewed and amended as required. Erosion and sedimentation controls will be implemented to minimise erosion potential, in particular in areas of dispersive soils, in accordance with the guideline Managing Urban Stormwater, Volume 1 and Volume 2, or equivalent. Collectively, the stormwater controls will be sized and configured to achieve the water quality specifications provided in SWA Table 6.12.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.1, REMM SOIL_02, REMM WM_4.8, Schedule 3 Condition 33
WM40	Where practicable, vegetation clearing will occur immediately before construction works so as to minimise the period of exposure.	All	Construction	Contractor	Schedule 3 Condition 34, EIS App N Table 11.5
WM41	A stormwater management system will manage runoff from impervious areas. All pervious areas including batters will be temporarily stabilised and permanently vegetated with endemic native vegetation.	All	Construction	Contractor	Good Practice
WM42	Windrows or similar alternatives will be used along contours to reduce slope length and surface flow velocities.	All	Construction	Contractor	EIS App N Table 11.5
WM43	Stockpiles will be located where they are not exposed to concentrated or flood flow. Flood flow is defined as the 20% AEP flood extent. Inspections of erosion and gullying for dispersive soils stockpiles will be undertaken regularly and ameliorants applied where issues are identified.	All	Construction	Designer Contractor	Schedule 3 Condition 34, REMM WM_2.3
WM44	Areas for stockpiling must be designated within the site works boundary before excavation commences and outside of ecologically sensitives areas, located away from drainage lines, watercourses and vegetation. Existing surfaces will be protected prior to placement of material stockpiling and reasonable effort will be made to contain cross-contamination between stockpiles.	All	Construction	Contractor	Good Practice
WM45	Soils will be lightly scarified on the contour to encourage rainfall infiltration and minimise run-off. As soon as practicable after respreading, a cover crop will be established to limit erosion and soil loss.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.4
WM46	Sediment traps or filters will be maintained at all discharge locations. The filters will only use non-toxic or materials which will not cause material harm to the environment, including biodegradable or natural materials where practicable. Sediment traps, filters and other appropriate sediment control devices will be installed to target the removal of coarse sediments.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.5

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM47	Access road surfaces will be maintained with appropriate aggregate material or sealed to reduce the risk of erosion.	All	Pre-construction and construction	Designer and Contractor	Schedule 3 Condition 34, REMM WM_3.4
WM48	Where practicable and safe to do so access roads will be single cross fall and will grade to a table drain located against the toe of the cut batters. The drains will be stabilised by rock armouring or other suitable methods as required.	All	Pre-construction and construction	Designer and Contractor	Schedule 3 Condition 34, REMM WM_3.5
WM49	All slopes that have been cut and/or filled as part of the construction works shall be appropriately stabilised in accordance with erosion and sediment control and other relevant sub plans. Stabilisation including rehabilitation will be undertaken progressively where practicable.	All	Construction	Contractor	Good Practice
WM50	Organic material prior to and during clearing and grubbing works will be collected and preserved for later utilisation where possible including woodchip, woody debris and topsoil. Topsoil will be kept free of foreign materials where topsoil is. Topsoil is defined as the surface or top layer of soil, including fine roots, the herbaceous vegetation and overlying grass and is characterised by the presence of organic matter.	All	Construction	Contractor	Good Practice
WM51	Swales and sediment basins within the accommodation camp shall be considered to be planted or grassed to assist in water quality treatment.	All	Construction	Contractor	Good Practice
WM52	All sediment basins and swales left permanently in place should be considered to be planted with ephemeral species before handover, in consultation with NPWS.	All	Construction	Contractor	Good Practice
WM53	Mulch stockpiles will be managed in a manner that limits the potential for fire and the spread of fire from a mulch stockpile.	All	Construction	Contractor	Good Practice
WM54	Topsoil stockpiled in areas designated on site to a depth not exceeding 2.5 m and be protected from erosion where practicable.	All	Construction	Contractor	Good Practice
WM55	Erosion and Sediment Control Plans (ESCP) will be prepared for each disturbed, construction area and will: • consider local soil characteristics, clean water management and the proposed construction methods; • apply all practical source control and rehabilitation methods; and • be progressively amended as required during construction.	All	Construction	Contractor	Good Practice
WM56	ESCPs will be developed by suitably qualified erosion and sediment control professional who is responsible for overseeing the development of the ESCP and inspecting and auditing controls during implementation. Regular expert input will ensure that erosion and sediment control practices will be established and operated to a high standard and progressively improved.	All	Construction	Contractor	Good Practice

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
Sediment basins and water treatment – Construction disturbance areas and access roads					
WM57	Areas that are constrained by terrain - for construction areas > 2500m2: • Water will be captured in a sump and pumped to a water treatment plant where it cannot be gravity fed to the basin. • Water treatment chemicals will be applied that aim to enhance sedimentation and reduce phosphorus and dissolved metals. An automated chemical dosing system can be applied to achieve this. • Chemicals will be used that have a low risk of increasing the toxicity of treated stormwater. • The design dewatering and treatment rate will be the 1 in 3 month average recurrence interval (ARI) event.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.6
WM58	Areas that are not constrained by terrain - for construction areas > 2500m2: • Where appropriate, sedimentation basins will be constructed in accordance with the methods recommended in Managing Urban Stormwater: Soils and Construction: Volume 1 (Landcom 2004) and Volume 2D (DECC 2008). However, the basins will be adjusted to accommodate the water treatment system requirements described below, where adopted. • Water treatment chemicals will be applied to the basins using automated means or other suitable means based on the basin design. Other reasonable and practical controls applied that aim to achieve the required water quality will be implemented to aim to reduce the use of chemicals. • Chemicals will be used that have a low risk of increasing the toxicity of treated stormwater. • The water treatment systems will be designed to treat all runoff during a 1 year ARI event.	All	Construction	Designer and Contractor	Schedule 3 Condition 34, REMM WM_2.7
WM59	When practical, water captured in sedimentation basins will be used for dust suppression.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.8
WM60	Where appropriate, the sedimentation basins established to manage runoff during construction of the access roads will be maintained during the Exploratory Works to provide ongoing treatment of runoff from access roads. These will be modified to be constructed wetland style basins where practicable for locations not constrained by terrain conditions. Constructed wetland style basins will maintain permanent water. An extended detention zone will be established above the permanent water. The extended detention zone will drain slowly through a low flow outlet control.	All	Construction - tunnelling	Contractor	Schedule 3 Condition 34, REMM WM_3.6 Schedule 3 Condition 34, REMM WM_3.7

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM61	Accommodation camp runoff will be treated in water quality improvement basin(s) the design and construction of which will aim to include a water quality improvement function and attenuate peak runoff rates where practicable. The water quality improvement pond batters will be established using retaining structures or other suitable measures to avoid disturbance of the Watercourse 3 channel.	Stage 2	Design Construction	Designers Contractor	Schedule 3 Condition 34, REMM WM_4.7, REMM WM_4.9
WM62	Where practical, runoff from road embankments that have been stabilised by vegetation will be diverted into the clean water drainage system to minimise the contributing catchment area to the constructed wetlands.	All	Construction - tunnelling	Contractor	Schedule 3 Condition 34, REMM WM_3.7
WM63	Sediment basins will be designed and construction in accordance with the methods recommended in Managing Urban Stormwater: Soils and Construction: Volume 1 (Landcom 2004) and Volume 2D (DECC 2008). Sediment basins will have adequate capacity for at least a 5 day 85th percentile rainfall event.	All	Design Construction	Designers Contractor	Good Practice
WM64	The portal pad water management basin will be designed to provide a freeboard between its overflow pipe and spillway. The freeboard volume will be calculated to contain probable leaks, spills and firewater runoff volumes. The overflow pipe will have a manual shutoff valve that will enable site management to shut off the overflow pipe to enable the basin to contain any leak, spill or fire water runoff. An oil skimming device shall be provided for the removal of oil from the surfaces of basins.	All	Design Construction	Designers Contractor	Schedule 3 Condition 34, REMM WM_5.7, Best Practice
WM65	All water channels and basins shall be designed to assist with water quality treatment and capture of sedimentation including consideration of implementing the use of vegetation planting to assist in capture.	All	Design Construction	Designers Contractor	Good Practice
WM66	The sedimentation ponds (sedimentation basins) shall be kept empty for the longest practicable periods. Water in the ponds shall be treated and discharged within 24 hours of the water level in the ponds (sedimentation basins) reaching the 50% volume storage capacity where practicable after the cessation of rain.	All	Construction	Contractor	Best Practice
WM67	The Contractor shall remove sediment from the sedimentation ponds (sedimentation basins) after the sedimentation exceeds 15% of the total design storage capacity. The removed sediment shall be disposed of at appropriately licensed facilities agreed by the Employer.	All	Construction	Contractor	Best Practice
WM68	Drill sites that have been modified to allow for vehicle access will be regraded to natural lay of the land as part of the site rehabilitation.	Stage 2	Construction	Contractor	REMM M1.9

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
Disturbance within creeks, rivers and riparian areas					
WM69	The construction footprint and extent to which soil and vegetation within the riparian zone are disturbed will be minimised where practicable. A 50m exclusion buffer will be applied either side of Yarrangobilly River for construction activities except where avoidance is not possible, for example construction of waterway crossing.	All	Construction	Contractor	EIS App G Table 5.1
WM70	Direct access to the rivers and creeks by construction vehicles and mechanical plant will be minimised and permitted only within the limits of clearing and designated areas of disturbance.	All	Construction	Contractor	EIS App G Table 5.1
WM71	Erosion control matting or other practical methods will be used in the riparian zone to minimise sediment entering the river channel and provision of protection against scouring and erosion of the river bed.	All	Construction	Contractor	EIS App G Table 5.4
WM72	The construction footprint and use of temporary structures with creeks and riparian zones will be minimised where practicable.	All	Construction	Contractor	EIS App G Table 5.4
WM73	Construction material will not be stockpiled within 50m of watercourses.	All	Construction	Contractor	EIS App G Table 5.4
WM74	Any temporary structure will be removed and the river channel rehabilitated to the satisfaction of NPWS following construction of permanent bridges.	Stage 1	Construction	Contractor	EIS App G Table 5.4, Schedule 3 Condition 39
WM75	Temporary watercourse crossings at Yarrangobilly River and Wallaces Creek where feasible and reasonable, will be consistent with the Guidelines for Controlled Activities Watercourse Crossings (NRAR, 2018), Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge, 2003), Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, February 2004), and Policy and Guidelines for Fish Habitat Conservation and Management (DPI Fisheries, 2013). Management measures will include: • temporary in-stream structures will avoid spanning the full width of the waterway channel to ensure base flow conditions are maintained down the waterway where practicable; • maintaining some unmodified channel so that a weir effect or flow through rock interstices only is not created where practicable; • temporary in-stream structures will be inserted during low-flow periods where practicable; • ensure any build-up of debris potentially obstructing fish passage will be removed; • considering scheduling to minimise in stream works between October to January, the migratory period of the Macquarie Perch (Macquaria australasica).	Stage 1	Construction	Contractor	EIS App G Table 5.4, Schedule 3 Condition 34, REMM ECO_11, REMM ECO_12, REMM ECO_13, Schedule 3 Condition 39

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM76	The permanent bridges at Yarrangobilly River and at Wallaces Creek will be designed and constructed to comply with the Policy and Guidelines for Fish Habitat Conservation - Update 2013 (DPI 2013) and Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge 2003) and Guidelines for Controlled activities on Waterfront Land (NRAR, 2018).	Stage 1	Pre-construction and construction	Designer and contractor	Schedule 3 Condition 34, REMM ECO_11, Schedule 3 Condition 40
WM77	Construction of the permanent crossing at Yarrangobilly River and Wallace's Creek will minimise in stream works during the migration time of Macquarie Perch (October to January) where possible.	Stage 1	Construction	Contractor	Schedule 3 Condition 8, REMM ECO_13, Schedule 3 Condition 40
Contamination of surface waters and soils by hydrocarbons and other hazardous materials					
WM78	Construction, vessels, vehicles and mechanical plant will be regularly maintained and checked for leakage of fuel and /or oils.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01
WM79	Bunded areas for the storage of fuel and oils, refuelling and maintenance of vehicles and mechanical plant will be established at least 50 m from watercourses.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01, REMM M1.12
WM80	Refuelling for the in-reservoir borehole drilling will be undertaken in accordance with Appendix D – In-reservoir Geotechnical Works Refuelling Protocol.	Stage 2	Construction	Contractor	REMM M1.10
WM81	Vehicles and machines will be properly maintained to minimise risk of fuel and oil leaks.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01
WM82	Refuelling, washing and maintenance of vehicles and plant will be avoided as far as practicable within 50 m of watercourses.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01
WM83	Emergency spill kits will be kept onsite and on all vessels at all times during the Exploratory Works. The spill kit must be appropriately sized for the volume of substances on the vessel. All staff would be made aware of the location of the spill kit and trained in its use.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01, REMM M1.12
WM84	Fuels and chemicals will be stored in bunded areas to prevent chemical spills or leakages in accordance with the relevant Australian Standards including: ASNZS 4452:1997 The storage and handling of toxic substances, AS1940 – 2017 The storage and handling of flammable and combustible liquids, and Areas to be used for long-term storage and handling (i.e. those at a site compound or dedicated fuel storage area) of hydrocarbons and chemicals will be enclosed with concrete bunds or other suitably sealed bunding.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01, Schedule 3 Condition 33, REMM M1.12
WM85	Designated impervious bunded facilities will be provided for washout of concrete trucks and cleaning and/or maintenance of other vehicles, plant or equipment. These facilities will be located at least 50 metres away from natural and built drainage lines.	All	Construction	Contractor	Good practice

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM86	Spill response will be managed in accordance with the Spill Emergency Response Procedure included in this Plan. The Spill Emergency Response Procedure will be implemented.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_11
WM87	Where practical, all activities that will occur on the portal construction pad during tunnelling with potential to contaminate stormwater runoff will be isolated from the stormwater system through the use of covering (i.e. by a building or roof) and bunding. Water produced within the covered and bunded areas will be either: managed by the process water system; or disposed as liquid waste to an appropriate facility.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_5.2
WM88	The Portal Pad water management basin used during tunnelling will be designed to provide a freeboard between its overflow pipe and spillway. The freeboard volume will be calculated to contain probable leaks, spills and firewater runoff volumes. The overflow pipe will have a manual shutoff valve that will enable site management to shut off the overflow pipe to enable the basin to contain any leak, spill or fire water runoff. Further detail regarding stormwater management at the Portal Pad will be included in the Stormwater Management Plan (Accommodation Camp and Portal Pad). The stormwater management system will be designed to contain any leak, spill or fire water runoff from the portal construction pad.	Stage 2	Pre-construction and Construction	Contractor	Schedule 3 Condition 34, REMM WM_5.7, Good Practice
WM89	Activities that have significant potential to contaminate stormwater runoff will be isolated from the stormwater system by covering (i.e. by a building or roof) and/or bunding.	Stage 2	Construction	Contractor	Good Practice
WM90	All runoff from the portal construction pad and adjoining access road will be conveyed to a water management basin with adequate capacity for at least a 5 day 95th percentile rainfall event and include additional volume to accommodate required water quality treatments (i.e. a total volume of at least 3,750 m3). The basin will provide a water quality improvement function in that it will not worsen the existing water quality. Water captured in the basin will be extracted to supply the process water system where practicable. Water treatment chemicals will be applied to the water management basin to enhance sedimentation and reduce phosphorous and dissolved metal removal rates in that it will not worsen the existing water quality. Only water treatment chemicals that have a low risk of increasing the toxicity of treated stormwater will be used. Water treatment chemicals will be applied using an automated chemical dosing and mixing system.	Stage 2	Construction	Contractor	Schedule 3 Condition 34, REMM WM_5.6
WM91	Any hydrocarbon spills that occur on soil requires the impacted soil to be removed and stored separately as part of the Spill Response Procedure.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_01

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
	Flooding				
WM92	Camp and Wallaces bridges will be designed in accordance with AustRoads bridge design standards which require the: • bridge deck soffit to be located above the 1% AEP flood level; • bridge structure to be designed to withstand a 0.05% AEP event; and • abutments to be protected by appropriately designed scour protection.	Stage 1	Pre-construction	Contractor	Schedule 3 Condition 34, REMM FM_1.1
WM93	The accommodation camp drainage system will have a 20% Annual Exceedance Probability (AEP) capacity. Overland flow paths will be provided as required. The treatment train will begin with piped drainage to a vegetated channel which will lead into an inlet pond to remove coarse sediments. Endemic native vegetation will be used where practicable.	Stage 2	Design Construction	Contractor	Schedule 3 Condition 34, REMM WM_4.3, REMM WM_4.4
WM94	Stockpiles will be located where they are not exposed to concentrated of flood flow. Flood flow is defined as the 20% Annual Exceedance Probability (AEP) flood event.	All	Design Construction	Contractor	Schedule 3 Condition 34, REMM WM_2.3
WM95	The Western Emplacement will be designed to minimise the risk of emplacement material being entrained in flood waters during a 0.2% Annual Exceedance Probability (AEP) event. This may require a flood protection berm or rock armouring along the northern toe of the emplacement.	Stage 2	Design Construction	Contractor	Schedule 3 Condition 34, REMM FM_1.2
WM96	Runoff from Lick Hole Gully will be diverted around or through the eastern emplacement area. The diversion works will comprise a dam upstream of the diversion inlet and either a gravity or pump assisted diversion system. The diversion works will have a 1% AEP capacity. The dam upstream of the diversion inlet will be designed as a detention basin and will not permanently hold water. A high-flow diversion drain will be established to convey runoff from Lick Hole Gully around the emplacement area in a controlled manner, avoiding uncontrolled overflows through the emplacement area. This diversion drain will only be engaged if a flood greater than a 1%AEP event occurs.	Stage 2	Design Construction	Contractor	REMM WM_8.6
WM97	Protocols will be developed for the proposed modification elements for use and storage of plant, equipment and materials in flood prone areas commensurate with the frequency of inundation.	Stage 2	Construction	Contractor	REMM M1.13

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
	Geotechnical works				
WM98	The following mitigation measures will be implemented for geotechnical investigation works: • all fuel and hazardous substances used in drilling will be stored in designated areas of the drill pad. Hazardous chemicals will be stored in accordance with relevant standards, including AS 1940:2004. • designated fuel storage areas will be bunded to mitigate risk of contamination to surface water and soils should spills occur. Refuelling will also be carried out in the designated, bunded area. • equipment should be appropriately maintained to ensure there are no leaks. • spill kits will be available on site to contain contamination should any spills outside these bunded areas occur. If used, waste from the spill kits will be disposed of appropriately. • the safety data sheets of all hazardous chemicals required for drilling activities will be made available on site. • All waste produced during drilling will be stored on site in above ground containers, and when required will be taken off-site by vehicles. All waste will be disposed of off-site to an EPA licensed facility.	Stage 2	Construction	Contractor	REMM M1.12
WM99	Geotechnical works undertaken both in-reservoir and on land will be carried out in accordance with the process detailed in Appendix D.	Stage 2	Construction	Contractor	DPIE request
WM100	Any refuelling of drill rigs located on the reservoir will occur in accordance with the 'Geotechnical works – Process for in-reservoir and on land drilling' included within Appendix D of this plan.	Stage 2	Construction	Contractor	REMM M1.10
WM101	Barge ramp establishment works will be closely monitored. Monitoring of the works will be undertaken through: • surface water quality monitoring which will be undertaken in accordance with the Surface Water Monitoring Program (refer section 6 of this Plan); and • monitoring during dredging operations as detailed within Section 6 of the Dredging Management Plan.	Stage 2	Construction	Contractor	MOD2 - 001
	Rehabilitation				
WM102	All cut and fill batters for access roads will be stabilised to minimise the risk of erosion as soon as practicable.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_3.2
WM103	Sections of Lobs Hole Road that will no longer be required following the construction of the new access roads will be removed and rehabilitated. This will reduce associated sediment loads.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WM_3.1
WM104	Excavated slopes flatter than 1:4 and over 1 hectare will be rehabilitated or stabilised within 14 days of construction of the slopes.	All	Construction	Contractor	Best Practice

ID	Mitigation measures/Requirements	Applicable stage	When to implement	Responsibility	Reference
WM105	Excavated slopes steeper than or equal to 1:4 and over 1 hectare will be rehabilitated or stabilised within 7 days of construction of the slopes.	All	Construction	Contractor	Best Practice
WM106	Drill sites that have been modified to allow for vehicle access will be regraded to natural lay of the land as part of the site rehabilitation.	All	Construction	Contractor	M1.9
Monitoring					
WM107	Visual inspection will be undertaken of stockpiles to identify evidence of erosion or weed growth. Appropriate ameliorants will be implemented to minimise the risk of soil degradation, erosion or offsite impacts.	All	Construction	Contractor	Schedule 3 Condition 34, REMM SOIL_01
WM108	Rainfall forecasts will be monitored daily and the works planned and the site works managed to minimise the potential impact of heavy rainfall and flood events. Prior to heavy rain events erosion and sediment controls will be reviewed and improved where necessary to minimise impacts.	All	Construction	Contractor	Good practice
WM109	Erosion and sediment controls including clean water diversions will be inspected at least weekly (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather may be increased where necessary.	All	Construction	Contractor	EMS Revised SWA
WM110	A Surface Water Monitoring Program has been developed and is included in this plan. This plan will be implemented. The Surface Water Monitoring Program establishes monitoring requirements to assess the quality of the receiving waters.	All	Construction	Contractor	Schedule 3 Condition 34, REMM WAT_02
WM111	A Trigger Action Response Plan has been developed as part of the Surface Water Monitoring Program and provides detail of the response actions that will be implemented in the event of an exceedance. This plan will be implemented.	All	Pre-construction and construction	Snowy Hydro/Contractor	Schedule 3 Condition 34
WM112	Drainage from hazardous material storage, handling, usage areas and workshop areas shall be collected by internal perimeter drains and collected in appropriately dimensioned sumps. Collected runoff shall be treated to remove oil and fuel and other contaminants.	All	Construction	Contractor	Good Practice

6. COMPLIANCE MANAGEMENT

6.1. Compliance Criteria

6.1.1. Water quality objectives

The water quality objectives (WQOs) reference the default trigger values that are published in the ANZECC/ARMCANZ 2000 guidelines (ANZECC). The WQOs are shown in Figure 6-1. They will be applied to receiving water quality compliance and to discharges from licensed discharge points in accordance with the Project EPL 21266 for Stage 2 construction. The following approach to selecting default trigger values was adopted in the development of this program:

- Yarrangobilly River is of high conservation and ecological value:
    - physical and chemical stressor trigger values – no change beyond natural variability. Provisional Site Specific Trigger Values (SSTVs) will be calculated and updated monthly using available data. The calculation of provisional SSTVs will consider seasonal trends in water quality and variations in water quality during wet weather conditions. The provisional SSTVs will be presented with the default values until there is sufficient data available to calculate SSTVs for a full range of flow conditions, including summer baseflow, winter baseflow and wet weather conditions; and
    - toxicant trigger values for the protection of 99% of aquatic species.
- Talbingo Reservoir:
    - physical and chemical stressor trigger values for fresh water lakes and reservoirs – slightly to moderately disturbed; and
    - toxicant trigger values for the protection of 99% of aquatic species.

It should be noted that these approaches that Future Generation will aim towards by implementing the mitigation measures in Section 5 of this Plan and any other reasonable and feasible measures required.

Category	analyte	Unit	WQO value	
			Yarrangobilly River	Talbingo Reservoir
Physico-chemical Properties	pH		The mean of the stressor will be updated monthly for control sites and compared to disturbed site sample data	6.5 – 8.0[1]
	Electrical conductivity (EC)	µS/cm		20 – 30[1]
	Turbidity	NTU		1- 20[1]
	Dissolved oxygen (DO)	%		90 – 110[1]
Nutrients	Total ammonia (NH_4^+)	mg/l		0.010[1]
	Oxidised Nitrogen (NOx)	mg/l		0.010[1]
	Total Nitrogen (TN)	mg/l		0.35[1]
	Filterable Reactive phosphorus (FRP)	mg/l		0.005[1]
	Total Phosphorus (TP)	mg/l		0.01[1]
Inorganics (dissolved)	Cyanide	mg/l	0.004	0.007
Metals (dissolved)[2]	Aluminium (Al)	mg/l	0.027	0.055
	Arsenic (As)[4]	mg/l	0.0008	0.013
	Boron (B)	mg/l	0.090	0.370
	Cobalt (Co)[3]	mg/l	0.0014	0.0014
	Total Chromium (Cr)[5]	mg/l	0.0001	0.001
	Copper (Cu)	mg/l	0.0010	0.0014
	Manganese (Mn)	mg/l	1.2	1.9
	Nickel (Ni)	mg/l	0.008	0.011
	Lead (Pb)	mg/l	0.001	0.0034
	Selenium (Se)	mg/l	0.005	0.005
	Silver (Ag)	mg/l	0.00002	0.00005
	Vanadium (V)[3]	mg/l	0.006	0.006
	Zinc (Zn)	mg/l	0.0024	0.008
	Mercury (Hg)	mg/l	0.00006	0.00006
	Iron (Fe)[3]	mg/l	0.3	0.3
Pathogenic organisms	E-coli	cfu/100ml	n/a	150
	Enterococci	cfu/100ml	n/a	35
	Protozoans	orgs/100ml	n/a	nil

Note

1. *The trigger value for field parameters and nutrients refer to the trigger values for physical and chemical stressors in south-east Australia (freshwater lakes and reservoirs) that are reported in Tables 3.3.22 and 3.3.3 of the ANZECC/ARMCANZ (2000)*
2. *The trigger values for metals refer to the trigger values of 99% protection for the Yarrangobilly River and 95% protection for Talbingo reservoirthat are reported in tables 3.4.1 of ANZECC/ARMCANZ (2000).*
3. *WQO value refers to a low reliability trigger value*
4. *For As (V)*
5. *For Cr (VI)*

Figure 6-1: Receiving water quality objectives

6.1.2. Discharge water quality characteristics

Discharge limits shown in Table 6-1 will apply to licensed EPL 21266 discharge points, currently the Process water treatment plant and the sewage water treatment plant. Target criteria from erosion and sediment water capture systems, indicated in Table 6-2, will be benchmarked to discharge limits or target criteria from sediment water capture systems, sediment basins and non-licenced dosing plants associated with sediment basins.

The effectiveness of the erosion and sediment controls in achieving the target criteria will be assessed during Stage 2 construction by bench-marking target criteria results against the discharge limits that were presented in the Surface Water Assessment (EMM, 2018) and recorded during Stage 1 works. This bench-marking will occur internally and any findings will be submitted to the relevant stakeholder agencies.

Non-licensed discharge points will have discharges that occur under a Water movement permit where the discharge is a result of a rainfall event that does not exceed the overflow rainfall event limit. These non-licensed discharge points include mobile dosing units and sediment basins. For these discharge controls in a non-overflow rain event, the discharge will meet the discharge criteria shown in Figure 6-2.

		Maximum concentration at point of discharge		
Parameter	**Units**	**Construction areas <2,500 m²** (erosion and sediment controls, no chemical water treatment)	**Construction areas >2,500 m²** (erosion and sediment controls, with chemical water treatment)	**Operational basins[1] for access roads and accommodation camp**
Physio-chemical				
Electrical conductivity (EC)	µS/cm	No value provided	No value provided	No value provided
pH	-	6.5 – 8.0	6.5 – 8.0	6.5 – 8.0
Turbidity	NTU	150	25	50
Suspended sediment	mg/l	40	20	25
Oil and Grease	mg/l	Not visible	Not visible	Not visible
Nutrients				
Total ammonia - N	mg/l	No value provided	No value provided	No value provided
Oxidised nitrogen (NOx)	mg/l	0.5	0.5	0.4
Total nitrogen (TN)	mg/l	1.5	1.5	1.0
Reactive phosphorus (FRP)	mg/l	0.12	0.05	0.05
Total phosphorus (TP)	mg/l	0.20	0.05	0.1
Metals (dissolved)				
Dissolved metals	mg/l	Concentrations of some metals may exceed relevant trigger values		

Note: 1. These characteristics apply once construction sediment basins have been converted to wetland style basins

Figure 6-2: Predicted discharge water quality characteristics of erosion and sediment controls

Licensed discharge points in accordance with the Project EPL 21266 are currently the process water treatment plants and sewage treatment plants. The discharge limits of these treatment systems have been assessed against the Water Quality Objectives in Figure 6-1. These characteristics align where suitable with the Water Quality Objectives, ANZECC/ARMCANZ (2000) Table 3.4.1 default freshwater trigger values for 99% protection of species for Talbingo Reservoir, applicable to the licensed discharge points.

Table 6-1: Treatment plants discharge characteristics

Sampling type	Parameter	Unit	Sewage Treatment Plant Treated Discharge	Process Water Treatment Plant Treated Discharge
			Maximum range	Maximum range
Discharge Standard	**Physio-chemical**			
	Electrical conductivity (EC)	µS/cm	20–30	20–30
	pH	-	6.5–8.0	6.5–8.0
	Turbidity	NTU	<25	<25
	Oil & grease	mg/L	None visible	None visible
Discharge Monthly	**Nutrients**			
	Total ammonia – N	mg/L	As per Figure 6-1	As per Figure 6-1
	Oxidised nitrogen (NO_x)	mg/L	As per Figure 6-1	As per Figure 6-1
	Total nitrogen (TN)	mg/L	As per Figure 6-1	As per Figure 6-1
	Filterable reactive phosphorus	mg/L	As per Figure 6-1	As per Figure 6-1
	Total phosphorus (TP)	mg/L	As per Figure 6-1	As per Figure 6-1
	Pathogenic organisms			
	E-coli	cfu/100 mL	As per Figure 6-1	-
	Enterococci	cfu/100 mL	As per Figure 6-1	-
	Protozoans	orgs/100 mL	As per Figure 6-1	-
	Metals (dissolved)			
	Arsenic	µg/L	-	As per Figure 6-1
	Cadmium	µg/L	-	As per Figure 6-1
	Chromium (VI)	µg/L	-	As per Figure 6-1
	Copper	µg/L	-	As per Figure 6-1
	Iron	µg/L	-	As per Figure 6-1
	Lead	µg/L	-	As per Figure 6-1
	Manganese	µg/L	-	As per Figure 6-1
	Mercury	µg/L	-	As per Figure 6-1
	Nickel	µg/L	-	As per Figure 6-1
	Zinc	µg/L	-	As per Figure 6-1

6.2. Surface Water Management

6.2.1. Inspections

Inspections of waterways surrounding the Project boundary will be undertaken consistent with the frequencies required for the surface water monitoring program. Weekly environmental inspections and rainfall inspections of the works areas including erosion and sediment controls and active

discharge points will be undertaken in accordance with Section 8 of the EMS.

6.2.2. Surface Water Monitoring Program

This Surface Water Monitoring Program has been prepared in accordance with condition 34(c) and will be implemented during Stage 2 Exploratory Works. The purpose of the monitoring program is to minimise the Project's impact on surface water quality by:

- monitoring downstream water quality impacts attributable to the Project;
- responding to any non-natural fluctuations where required; and
- regularly inspecting Project elements that have the potential to impact on surface water quality and maintaining these elements where required.
- The objectives of the surface water monitoring program are to:
- continue to monitor water quality conditions during construction upstream of disturbance areas as an extension of baseline and pre-construction monitoring;
- monitor water quality at the point of discharge or immediately downstream during and after rain events and those that cause overflow discharges from sediment basins; and
- monitor receiving waters downstream of disturbance areas and within the Talbingo Reservoir to identify and quantify any water quality impacts including potential impacts from dredging.

Detailed information for Stage 2 monitoring locations, methods and frequencies is provided in Table 6-4.

6.2.3. Responsibilities

Sampling and testing will be coordinated by either Snowy Hydro or the Contractor as defined below:

- stream gauge monitoring – Snowy Hydro / Future Generation;
- comprehensive monitoring as described in Section 6 – Snowy Hydro / Future Generation;
- basic monitoring as described in Section 6 – Snowy Hydro / Future Generation.

Sample data collected by Snowy Hydro will be provided to Future Generation for analysis, investigation and reporting as described in Section 6. At all times during construction the Contractor will be responsible for initiation of the TARP's and implementation of corrective measures. Additional requirements and responsibilities in relation to inspections are documented in Section 5 of the EMS.

6.2.4. Monitoring parameters

Water monitoring for discharges and the Surface Water Monitoring Program will be undertaken in the manner defined within Table 6-2. Table 6-2 details the type of sampling that will be undertaken as well as the monitoring event type and the analytical sampling suites. Sampling locations subject to potential impacts from dredging will also comply with monitoring parameters detailed in the Dredging Management Plan (as required in the event of dredging).

Sample collection is to comply with the NSW EPA's Approved Methods for the Sampling and Interpretation of Results of Water Pollutants in NSW. Table 6-3 describes proposed sampling analytes and analysis methods. Each monitoring event will record the date, time, weather conditions, location, visual appearance of water, recent rainfall and the sampling field readings based on monitoring type. It is noted that receiving waterway water monitoring will be located more than 10m from any discharge location to ensure monitoring is undertaken outside of any mixing

zone.

Table 6-2: Monitoring type, frequency and trigger classification

Monitoring classifications	
Sampling type	
Discharge Standard	Monitoring of water quality will be undertaken: • prior to every active, treated discharge of sediment basins post a rainfall event below the overflow rainfall event criteria (Basic sampling) (to meet the discharge criteria), and • at the receiving mixing zone location downstream of the mobile treatment units and any wetland style basins (basic sampling (to meet the WQOs)), and • at the process/waste water treatment plants (to meet the WQOs). Monitoring will be undertaken with a portable water quality meter and/or in-situ water quality probes.
Discharge Monthly	Laboratory sampling of water quality will be undertaken prior to treated discharge of process/waste water treatment plants. Initially at a frequency of prior to each discharge during commissioning and at a monthly frequency after 3 operational discharges have occurred. Discharge Monthly includes the parameters in 'Discharge Standard'.
Basic (in-situ)	Inspection and in-field measurements with a calibrated, portable water quality meter. Data is available same day. Applicable for all sediment basins and mobile treatment discharges each discharge.
Comprehensive (laboratory)	Basic monitoring as well as collection and analysis of laboratory samples. Data is generally available within 2 weeks from date of sampling.
Monitoring event type	
Continuous	Monitoring equipment installed long-term within a waterway with data collected at available intervals from the commencement of construction
Monthly	Monitoring undertaken each month from the commencement of construction. Can occur during baseflow and / or during wet weather.
Wet weather monitoring/ Comprehensive wet weather	Monitoring that will be undertaken during wet weather events where feasible (may constitute monthly monitoring). Wet weather events are defined as any rainfall event that results in any discharge of surface water from the project's water management dams or sediment basins. This will typically require 30 to 50 mm of rainfall event.
Post wet weather	Monitoring undertaken in accordance with the Trigger Action Response Plans. Monitoring undertaken approximately two (2) days after the end of a wet weather rainfall event over one (1), five-day rainfall period where the Project's water management dams or sediment basins have overflown as per design.
TARP monitoring	Comprehensive sampling monitoring/ inspections based on TARP triggered events.
Visual observation	Visual observation of in reservoir borehole drilling to determine if basic monitoring required.
Sampling analysis suite type	
Basic suite	Monitoring the basic monitoring parameters shown in Table 6-3.
Comprehensive suite	Monitoring the comprehensive monitoring parameters shown in Table 6-3.

Table 6-3 Proposed sampling analytes and analysis methods for surface water monitoring

Category	Monitoring analytes	Analysis method
Basic monitoring		
Physico-chemical Properties	pH and turbidity	Measured insitu using a hand-held water quality meter
Inspection	Visible oil and grease	Inspection of erosion and sediment controls, downstream drainage and clean water diversion
Comprehensive monitoring		
Physico-chemical Properties	pH, electrical conductivity, turbidity, dissolved oxygen, temperature and redox potential	To be measured using a portable water quality meter in the field
	Major cations (Na,K,Mg,Ca) and major anions (Cl,SO4,HCO3 and CO3)	Analysis to be undertaken by a NATA certified laboratory
	Total suspended solids, total dissolved solids, total hardness	
Nutrients	Total nitrogen, ammonia, oxidised nitrogen and total kjeldahl nitrogen	
	Total phosphorus and reactive phospohorus	
Metals (dissolved)	Al, As, Ag, Cr (total), Cu, Fe, Mn, Ni, Pb and Zn	
Inorganics	Cyanide	

6.2.5. Surface water and discharge monitoring locations

Proposed monitoring locations for Stage 2 are shown in Figure 6-3 and Figure 6-4 and are representative of the disturbance areas specific to Stage 2 construction activities. Monitoring will also be undertaken in accordance with EPL 21266.

Location descriptions are provided in Table 6-4. Some additional upstream locations will be monitored in response to the TARP process only (Section 6 of this Plan).

The inclusion of the baseline locations will allow for a representative control against which samples taken during construction can be compared.

Any changes to the monitoring locations during construction would be approved by Snowy Hydro prior to relocation or addition of monitoring locations and updated in subsequent revisions of the water quality monitoring program.

Table 6-4: Monitoring locations description

Location ID	EPL Identification No.*	Location Description	Sample Type / Monitoring Type	Comments
Rainfall gauge	n/a	Lobs Hole	Monitoring continuous using weather station.	Record date, time, weather conditions, location, rainfall volume.

Location ID	EPL Identification No.*	Location Description	Sample Type / Monitoring Type	Comments
Stream gauge monitoring locations				
PN_SW_001	n/a	Yarrangobilly Caves, 20km upstream of Lobs Hole	Continuous monitoring event type.	To be sampled consistent with existing record regime implemented by Snowy Hydro.
Yarrangobilly River sampling locations				
RW_8	12	Downstream of Portal Pad disturbance area and sedimentation basin discharge	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_9	13	Yarrangobilly River, downstream of the Accommodation camp	Monthly surface water monitoring, (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_2	6	At the confluence of Yarrangobilly River and Wallaces Creek and downstream of Portal Pad disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_12	16	Upstream Accommodation Camp and downstream of Western Emplacement Stockpile disturbance area at Camp Bridge	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_10	14	Downstream of Roads Construction area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_11	15	Adjacent to remnant mine workings	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events.. TARP monitoring if TARP triggered.	
RW_5	9	Downstream of Accommodation Camp disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_4	8	Yarrangobilly River, downstream of Eastern Emplacement stockpile disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	

Location ID	EPL Identification No.*	Location Description	Sample Type / Monitoring Type	Comments
RW_1	5	Upstream of Portal Pad disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_3	7	Wallaces Creek, downstream of Stable Creek confluence	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_14	18	Lick Hole Gully, downstream of Eastern Emplacement stockpile disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_15	19	Watercourse 4, downstream of Western Emplacement stockpile disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_13	17	Lick Hole Gully, upstream of Eastern Emplacement stockpile disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_18	22	Watercourse 3, upstream of Accommodation Camp disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_19	23	Watercourse 3, downstream of Accommodation Camp disturbance area and discharge point	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_20	24	Watercourse 2. downstream of road access works disturbance area	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	
RW_21		Watercourse 4, upstream of Western Emplacement stockpile disturbance area	TARP monitoring if TARP triggered.	To be monitored based on TARP process for exceedances of RW_15. Comprehensive sample type.

Location ID	EPL Identification No.*	Location Description	Sample Type / Monitoring Type	Comments
Talbingo Reservoir sampling locations				
RW_6	10	Talbingo Reservoir upstream of process water discharge outlet	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.
RW_7	11	Talbingo Reservoir downstream of process water discharge outlet	Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.
TAL_01		Northern end of the reservoir, adjacent to the dam wall	**Once barge works, dredging or subaqueous emplacement commences**: Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.
TalS_SW_001		Tumut River, upstream of Talbingo Reservoir	TARP monitoring it TARP is triggered at TAL_01.	To be sampled below the surface of the reservoir away from the land edge. Location identified in the EIS SWA.
TAL_09		Middle portion of the reservoir	**Once dredging or subaqueous emplacement commences:** Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.
TAL_15		Long Creek inlet	**Once dredging or subaqueous emplacement commences:** Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.
TAL_19		Southern end of the reservoir, Tumut River inlet	**Once dredging or subaqueous emplacement commences:** Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.

Location ID	EPL Identification No.*	Location Description	Sample Type / Monitoring Type	Comments
TAL_20		Southern end of the reservoir, Yarrangobilly River inlet	**Once dredging or subaqueous emplacement commences:** Monthly surface water monitoring (basic and comprehensive). Monitoring will occur during baseflow conditions and / or during wet weather events. TARP monitoring if TARP triggered.	To be sampled below the surface of the reservoir away from the land edge.
Process Water Treatment Plant				
-		EPL 21266 licensed discharge location for Process Water Treatment Plant	Discharge Standard & once commissioning complete, Discharge Monthly, Comprehensive monitoring. Discharge Standard daily (or as required by EPL), Basic monitoring as required under Point monitoring in EPL during operation of the plant. TARP monitoring if TARP triggered.	
Sewage Treatment Plant				
-		EPL 21266 licensed discharge location for Sewage Treatment Plant	Discharge Standard & once commissioning complete, Discharge Monthly, Comprehensive monitoring. Discharge Standard daily (or as required by EPL), Basic monitoring as required under Point monitoring in EPL during operation of the plant. TARP monitoring if TARP triggered.	
Monitoring for in-reservoir GIP works (Talbingo and Tantangara)				
Adjacent to and within 10-15 metres of borehole drilling works		Talbingo and Tantangara Reservoir	Visual monitoring undertaken during in-reservoir borehole drilling works. Visual monitoring point to identify and visible oil or grease, or turbidity which is uncharacteristic to its surroundings. TARP monitoring if TARP triggered.	

*Subject to change due to variations to the EPL.

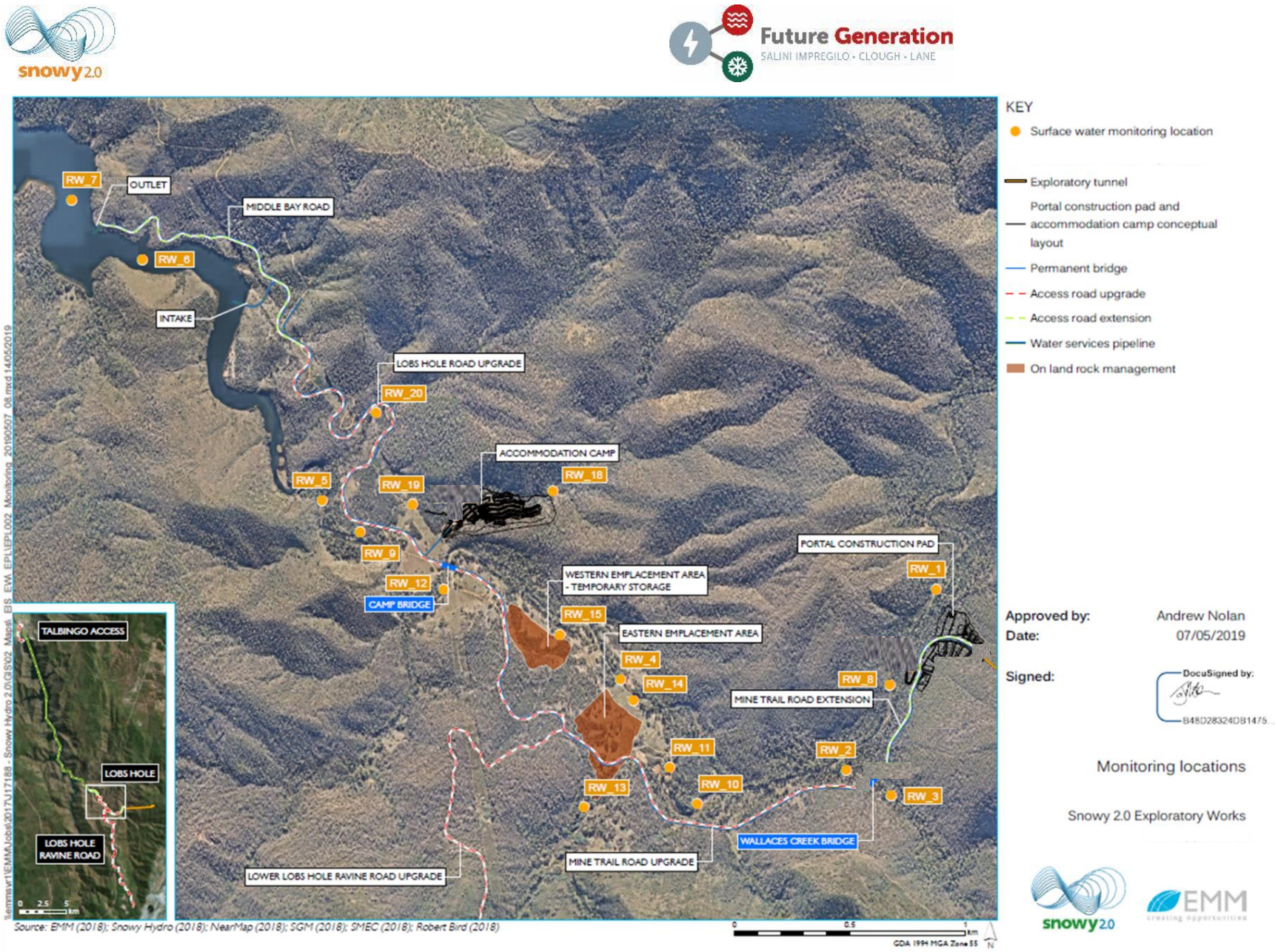


Figure 6-3: Stage 2 - Surface water monitoring locations within Lobs Hole

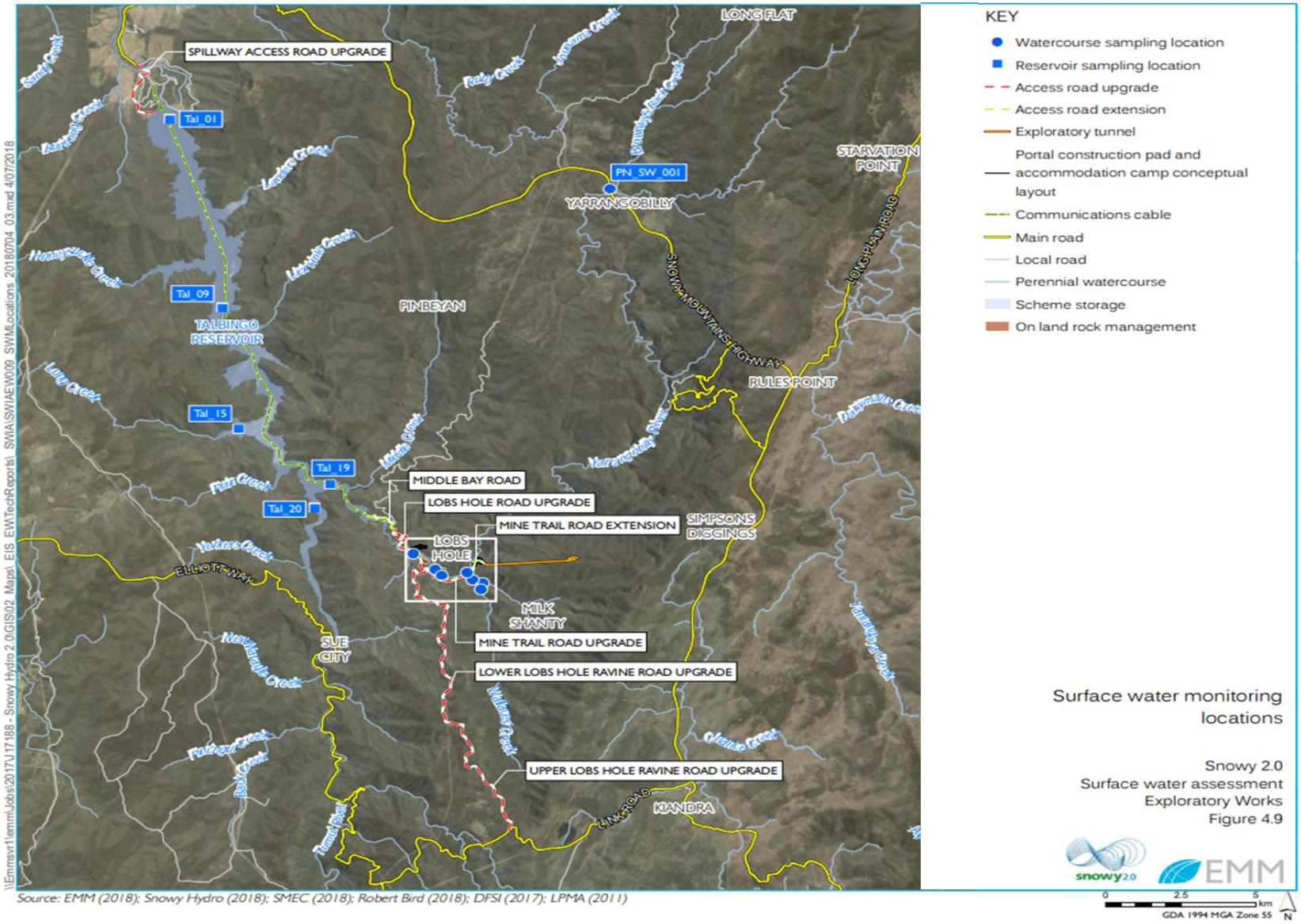


Figure 6-4: Surface water monitoring locations outside of Lobs Hole

6.3. Departures from the Water Quality Objectives

This program includes monitoring at both discharge and receiving water locations. Receiving water monitoring results will be bench-marked to the relevant WQOs as presented in Figure 6-1. Monitoring at discharge locations will be bench-marked to the discharge limits or target criteria (discharge monitoring locations only that are presented in (Figure 6-2 and Table 6-2).

It must be noted that at the time of approval of this plan default to ANZECC/ARMCANZ water quality values was required due to the baseline data having been collected over less than two (2) years despite there being known existing exceedances above ANZECC/ARMCANZ. Baseline water quality results presented in Appendix A have identified several analytes that exceeded WQO values either on a frequent or occasional basis. All baseline monitoring was undertaken during either base flow or shortly following wet weather conditions.

During wet weather conditions streams flows will predominantly comprise surface water runoff (rather than groundwater fed base flow) and may have different water chemistry. As sediment laden runoff from existing access tracks and other disturbed areas (non-construction related) is known to occur in Lobs Hole, it is likely that turbidity levels may exceed WQO values in some minor watercourses and potentially the Yarrangobilly River. Elevated concentrations of phosphorus and some metals can also be associated with sediment laden runoff and may therefore exceed WQO values. Generally, it is expected that during wet weather conditions, the water quality in minor watercourses in Lobs Hole will be degraded relative to the water quality in the Yarrangobilly River. Monitoring of wet weather conditions is proposed.

The SWA baseline receiving water quality monitoring (Appendix A) has identified that WQO values for several analytes are exceeded on a frequent or occasional basis. The baseline monitoring has only characterised water quality during baseflow and after wet weather events. There is also potential for exceedances of additional analytes during wet weather conditions. Hence, regular exceedances of some analytes are expected to occur due to natural or anthropogenic catchment processes that are not associated with Exploratory Works.

Identified and expected WQO departures are considered in the trigger value exceedance protocols that are discussed in Section 6.5.

6.4. Review and Response

It is noted that additional or varied/reduced monitoring frequencies and parameters may be warranted following detailed design and during construction as risk requires or where it can be demonstrated that no risk remains. Changes to the frequencies and parameters would be approved by Snowy Hydro prior to amendment and update in subsequent revisions of the water quality monitoring program. Snowy Hydro will refer any changes to the SWMP to DPIE.

Pre-construction and Stage 1 data collected by Snowy Hydro will be provided to the Contractor for analysis, investigation, water quality objective update and TARP reporting as described in Section 6 of this Plan.

Monitoring from locations within the water management system (ie upstream of Stage 2 work areas and water treatment systems) will be undertaken to indicate the effectiveness of the water treatment systems. As this data relates to the pre-treatment water quality, it will not be bench-marked to either WQOs, discharge limits or target criteria but will be taken into consideration in the event that there is an exceedance of the WQOs downstream of a project work area, but consistent with the upstream monitoring result.

As discussed in Section 6.1 the baseline monitoring has only characterised water quality during baseflow and after wet weather events. There is also potential for exceedances of additional analytes during wet weather conditions. Hence, regular exceedance of some analytes are

expected to occur due to natural or anthropogenic catchment processes that are not associated with Stage 2 Exploratory Works. Subsequently Trigger Action Response Plans (TARPs) have been developed to establish methods to identify the source of each exceedance and if necessary, establish actions to either improve water management or further investigate the exceedance.

Additional requirements and responsibilities in relation to inspections are documented in Section 8 of the EMS.

6.5. Trigger Action Response Plan

6.5.1. Purpose

The purpose of the Trigger Action Response Plan (TARP) is to detail a standardised, response procedure in the event that trigger value banding is exceeded during a monitoring event for surface water quality monitoring. The TARPs aim to:

- undertake supplementary monitoring to try and determine the extent of water quality variation;
- identify the potential cause of the water quality variation, if possible;
- identify and implement potential mitigation measures to minimise continuation of the water quality variation, if possible;
- perform due diligence when variation is identified; and
- meet CoA and REMMs requirements for trigger response.

The TARP applies to all surface water quality monitoring locations with the exception of TalS_SW_001, PN_SW_001 and RW_21. These excepted monitoring locations are upstream of Stage 2 works and therefore water quality variation attributable to construction works can be disregarded as being impacted by the Project.

6.5.2. Objective

TARPs that have been prepared are as follows:

- receiving water monitoring results obtained during monthly routine monitoring (note this may include wet weather events) will be bench-marked to the relevant WQOs (Figure 6-1);
- stormwater overtopping events will be bench-marked to the target criteria for all sediment basins (Figure 6-2), and relevant WQOs up and downstream of the overtopping location

Table 6-5 provides an overview of the TARPs. All TARPs are provided in Appendix C.

Table 6-5: Overview of Trigger Action Response Plans

TARP Type	Trigger	Objective
TARP 1 – Receiving water comprehensive water quality monitoring	If a WQO / latest monthly SSTV is exceeded in receiving waters.	To identify (where possible) if the exceedance is naturally occurring or due to exploratory works
TARP 2 – Stormwater overtopping event	If stormwater controls overtop	To identify the source (where possible) of each exceedance. To establish actions to either improve water management or further investigate the exceedance mechanism.

A revised or specific trigger action reponse plan will be developed prior to the commissioning of the water treatment plants, during the time of the detailed design report submission to the EPA in

accordance with EPL requirement E1.

At all times during construction, Future Generation will lead the initiation of the TARP and implementation of corrective measures.

6.5.3. Limitations

The following limitations apply for the TARPs:

- response to Basic monitoring can be immediately implemented within 24 hours of the monitoring event however response to Comprehensive monitoring cannot be immediately implemented at the time of the monitoring event due to the delay in receiving laboratory results. Considering this, it is deemed appropriate that response actions based on Comprehensive monitoring will be undertaken as soon as reasonable. A greater depth of understanding of water quality impacts and impact mechanisms can be gained from Comprehensive monitoring. This information can then be applied to establish specific improvements to the water management system.

6.6. Reporting

Reporting will include monthly internal project reports and six-monthly compliance reports as required by the CoA. The six-monthly reports will track compliance against the CoAs and REMMs Reporting requirements. Responsibilities for these tasks are documented in Section 8 of the EMS.

Where required by the EPL monitoring results of sampling undertaken within the receiving waters and licenced discharges will be posted on the project website. A monthly water quality report will be prepared by Future Generation that presents all monitoring data; exceedances and identified sources; and any response measures that have been undertaken in accordance with EPA's *Requirements for publishing pollution monitoring data* (EPA 2013).

6.7. Auditing

Independent audits of this Plan and the appendices will be undertaken by an independent auditor to assess compliance against the requirements assigned to this Plan at the frequency detailed in the Section 8 of the EMS.

6.8. Training

All site personnel will undergo site induction training relating to surface water and soil management issues. The induction training will address elements related to surface water management including:

- existence and requirements of this SWMP;
- roles and responsibilities for surface water management;
- surface water mitigation and management measures;
- procedures to be implemented in the event of an incident (e.g. spill or contamination).

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in surface water management. Examples of training topics include:

- erosion and sediment control installation methodology;
- sediment basin and treatment system construction, operation and maintenance;
- working near or in drainage lines and creeks;

- emergency response measures in high rainfall events;
- lessons learnt from incidents and other event e.g. high rainfall/flooding;
- spill kit use, spill response and Pollution Incident Response Management Plan (PIRMP) if required;
- stockpile locations and requirements; and
- identification of potentially contaminated materials.

Further details regarding the staff induction and training are outlined in Section 5 of the EMS.

APPENDIX A – BASELINE WATER QUALITY DATA

Table A 1: Baseline water quality summary - Yarrangobilly River and Wallaces Creek

			Yarrangobilly River (PN_SW_001, LH_SW_004, LH_SW_006, LH_SW_007)				Wallaces Creek (LH_SW_001, LH_SW_002, LH_SW_003)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Field Parameters										
Temperature	°C	-	34 / -	4.0	13.1	21.4	13 / -	4.0	13.0	14.6
Dissolved Oxygen (DO)	%	90 – 110[1]	34 / 28	33	78	105	13 / 10	69	77	102
Electrical Conductivity (EC)	µS/cm	30 – 350[1]	34 / -	27	71	173	13 / -	39	73	182
pH		6.5 – 8.0[1]	34 / 13	7.3	7.9	8.2	13 / 2	7.2	7.8	8.1
Oxidising and Reducing Potential (ORP)		-	34 / -	54	124	197	13 / -	62	146	203
Turbidity	NTU	2 - 25	20 / 0	0.0	1.4	4.4	8 / 0	0.2	1.2	1.5
Analytical Results - General										
Suspended Solids (SS)	mg/l	-	34 / -	3	5	5	13 / -	<2	5	5
Total Alkalinity (as $CACO_3$)	mg/l	-	8 / -	16	77	109	3 / -	38	99	104
Total Hardness (as $CACO_3$)	mg/l	-	27 / -	7	29	65	10 / -	16	30	88
Analytical Results - Nutrients										
Ammonia	mg/l	0.013	29 / 3	<0.01	<0.01	0.012	10 / 0	<0.01	<0.01	<0.01
Oxidised Nitrogen (NOx)	mg/l	0.015	30 / 15	<0.01	0.015	0.041	10 / 5	<0.01	0.015	0.031
Total Kjeldahl Nitrogen (TKN)	mg/l	-	29 / -	<0.1	<0.1	<0.1	10 / -	<0.1	<0.1	0.12

			Yarrangobilly River (PN_SW_001, LH_SW_004, LH_SW_006, LH_SW_007)				Wallaces Creek (LH_SW_001, LH_SW_002, LH_SW_003)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Total Nitrogen (TN)	mg/l	0.25	29 / 1	<0.1	<0.1	<0.1	10 / 1	<0.1	<0.1	0.12
Reactive Phosphorus	mg/l	0.015	27 / 1	<0.01	<0.01	<0.01	10 / 2	<0.01	<0.01	0.02
Total Phosphorus (TP)	mg/l	0.020	29 / 1	<0.01	<0.01	<0.01	10 / 0	<0.01	<0.01	0.011
Total Organic Carbon	mg/l	-	26 / -	<1	2	8	10 / -	<1	<1	10
Dissolved Organic Carbon	mg/l	-	26 / -	<1	2	5	10 / -	<1	2	4
Analytical Results - Inorganics (Dissolved)										
Cyanide	mg/l	0.004	8 / 0	<0.004	<0.004	<0.004	2 / 0	<0.004	<0.004	<0.004
Analytical Results - Metals (Dissolved)										
Aluminium (Al)	mg/l	0.027	26 / 17	<0.01	0.03	0.125	10 / 0	<0.01	<0.01	0.02
Arsenic (As)	mg/l	0.0008[4]	26 / 0	<0.001	<0.001	<0.001	10 / 0	<0.001	<0.001	<0.001
Boron (B)	mg/l	0.09	26 / 0	<0.05	<0.05	<0.05	10 / 0	<0.05	<0.05	<0.05
Cobalt (Co)	mg/l	0.0014[3]	26 / 0	<0.001	<0.001	<0.001	10 / 0	<0.001	<0.001	<0.001
Total Chromium (Cr)	mg/l	0.0001[5]	26 / 1	<0.001	<0.001	<0.001	10 / 0	<0.001	<0.001	<0.001
Copper (Cu)	mg/l	0.001	26 / 2	<0.001	<0.001	<0.001	10 / 3	<0.001	<0.001	0.0021
Manganese (Mn)	mg/l	1.2	26 / 0	<0.001	<0.001	0.002	10 / 0	<0.001	<0.001	0.0011
Nickel (Ni)	mg/l	0.008	26 / 0	<0.001	<0.001	<0.001	10 / 0	<0.001	<0.001	<0.001

			Yarrangobilly River (PN_SW_001, LH_SW_004, LH_SW_006, LH_SW_007)				Wallaces Creek (LH_SW_001, LH_SW_002, LH_SW_003)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Lead (Pb)	mg/l	0.001	26 / 0	<0.001	<0.001	<0.001	10 / 0	<0.001	<0.001	<0.001
Selenium (Se)	mg/l	0.005	26 / 0	<0.01	<0.01	<0.01	10 / 0	<0.01	<0.01	<0.01
Silver (Ag)	mg/l	0.0002	26 / 0	<0.001	<0.001	<0.001	10 / 0	<0.001	<0.001	<0.001
Vanadium (V)	mg/l	0.006[3]	26 / 0	<0.01	<0.01	<0.01	10 / 0	<0.01	<0.01	<0.01
Zinc (Zn)	mg/l	0.0024	26 / 7	<0.005	<0.005	0.0065	10 / 3	<0.005	<0.005	0.0079
Mercury (Hg)	mg/l	0.00006	26 / 0	<0.0001	<0.0001	<0.0001	10 / 0	<0.0001	<0.0001	<0.0001
Iron (Fe)	mg/l	0.3[3]	26 / 0	<0.05	<0.05	0.08	10 / 0	<0.05	<0.05	0.057

Notes:

1. The trigger values for field parameters and nutrients refer to the trigger values for physical and chemical stressors in south-east Australia (upland rivers) that are reported in Tables 3.3.2 and 3.3.3 of ANZECC/ARMCANZ (2000).

2. WQO values refer to the values established in EIS SWA. It is noted that no hardness adjustments have been made.

3. WQO value refers to a low reliability trigger value.

4. For As (V).

5. For Cr (VI).

6. If less than 10 samples are available, the minimum value is reported instead of the 10th percentile value and the maximum value is reported instead of the 90th percentile value.

Table A 2: Baseline water quality results summary - minor watercourses and Tumut River

			Minor watercourses (LH_SW_005, LH_SW_008, LH_SW_009)				Tumut River (TaIS_SW_001)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Field Parameters										
Temperature	°C	-	8 / -	8.6	11.7	13.9	7 / -	4.5	7.7	21.6
Dissolved Oxygen (DO)	%	90 – 110[1]	8 /8	37	59	75	7 / 6	52	81	160
Electrical Conductivity (EC)	µS/cm	30 – 350[1]	8 / 4	42	241	641	7 / 0	36	68	157
pH		6.5 – 8.0[1]	8 / 0	6.6	7.3	7.9	7 / 2	5.6	7.8	9.5
Oxidising and Reducing Potential (ORP)		-	8 / -	131	147	175	7 / -	84	149	185
Turbidity	NTU	2 - 25	6 / 0	0.4	2.6	5.7	5 / 0	0.2	3.7	7.7
Analytical Results - General										
Suspended Solids (SS)	mg/l	-	8 / -	<5	<5	18	7 / -	<2	5	6
Total Alkalinity (as $CACO_3$)	mg/l	-	0 / -	-	-	-	1 / -	46	46	46
Total Hardness (as $CACO_3$)	mg/l	-	8 / -	21	168	497	6 / -	12	22	30
Analytical Results - Nutrients										
Ammonia	mg/l	0.013	8 / 1	<0.01	<0.01	0.02	6 / 2	<0.01	<0.01	0.02
Oxidised Nitrogen (NOx)	mg/l	0.015	8 / 2	<0.01	<0.01	0.11	6 / 3	<0.01	0.015	0.04
Total Kjeldahl Nitrogen (TKN)	mg/l	-	8 / -	<0.1	<0.1	<0.1	6 / -	<0.1	<0.1	<0.1
Total Nitrogen (TN)	mg/l	0.25	8 / 0	<0.1	<0.1	<0.1	6 / 0	<0.1	<0.1	<0.1

			Minor watercourses (LH_SW_005, LH_SW_008, LH_SW_009)				Tumut River (TalS_SW_001)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Reactive Phosphorus	mg/l	0.015	8 / 0	<0.01	<0.01	<0.01	6 / 0	<0.01	<0.01	<0.01
Total Phosphorus (TP)	mg/l	0.020	8 / 0	<0.01	<0.01	<0.01	6 / 0	<0.01	<0.01	<0.01
Total Organic Carbon	mg/l	-	8 / -	<1	<1	2	6 / -	<1	2	6
Dissolved Organic Carbon	mg/l	-	8 / -	<1	2.5	5	6 / -	<1	2.5	4
Analytical Results - Inorganics (Dissolved)										
Cyanide	mg/l	0.004	4 / 0	<0.004	<0.004	<0.004	2 / 0	<0.004	<0.004	<0.004
Analytical Results - Metals (Dissolved)										
Aluminium (Al)	mg/l	0.027	8 / 1	<0.01	<0.01	0.10	6 / 5	<0.01	0.03	0.11
Arsenic (As)	mg/l	0.0008[4]	8 / 1	<0.001	<0.001	0.002	6 / 0	<0.001	<0.001	<0.001
Boron (B)	mg/l	0.09	8 / 1	<0.05	<0.05	<0.05	6 / 0	<0.05	<0.05	<0.05
Cobalt (Co)	mg/l	0.0014[3]	8 / 0	<0.001	<0.001	<0.001	6 / 0	<0.001	<0.001	<0.001
Total Chromium (Cr)	mg/l	0.0001[5]	8 / 0	<0.001	<0.001	<0.001	6 / 1	<0.001	<0.001	<0.001
Copper (Cu)	mg/l	0.001	8 / 4	<0.001	0.002	0.004	6 / 0	<0.001	<0.001	<0.001
Manganese (Mn)	mg/l	1.2	8 / 0	<0.001	0.0015	0.015	6 / 0	0.002	0.0035	0.008
Nickel (Ni)	mg/l	0.008	8 / 0	<0.001	<0.001	0.002	6 / 0	<0.001	<0.001	<0.001
Lead (Pb)	mg/l	0.001	8 / 0	<0.001	<0.001	<0.001	6 / 0	<0.001	<0.001	<0.001
Selenium (Se)	mg/l	0.005	8 / 0	<0.01	<0.01	<0.01	6 / 0	<0.01	<0.01	<0.01

			Minor watercourses (LH_SW_005, LH_SW_008, LH_SW_009)				Tumut River (TalS_SW_001)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Silver (Ag)	mg/l	0.0002	8 / 0	<0.001	<0.001	<0.001	6 / 0	<0.001	<0.001	<0.001
Vanadium (V)	mg/l	0.006[3]	8 / 0	<0.01	<0.01	<0.01	6 / 0	<0.01	<0.01	<0.01
Zinc (Zn)	mg/l	0.0024	8 / 1	<0.005	<0.005	0.006	6 / 3	<0.005	0.006	0.007
Mercury (Hg)	mg/l	0.00006	8 / 0	<0.0001	<0.0001	<0.0001	6 / 0	<0.0001	<0.0001	<0.0001
Iron (Fe)	mg/l	0.3[3]	8 / 0	<0.05	<0.05	0.06	6 / 0	<0.05	0.08	0.09

Notes:

1. The trigger values for field parameters and nutrients refer to the trigger values for physical and chemical stressors in south-east Australia (upland rivers) that are reported in Tables 3.3.2 and 3.3.3 of ANZECC/ARMCANZ (2000).

2. WQO values refer to the values established in EIS Baseline. It is noted that no hardness adjustments have been made.

3. WQO value refers to a low reliability trigger value.

4. For As (V).

5. For Cr (VI).

6. If less than 10 samples are available, the minimum value is reported instead of the 10th percentile value and the maximum value is reported instead of the 90th percentile value.

7. An exceedance refers to any result that is above detection limit and exceeds the WQO value. Where a range is given for the WQO value, exceedances are determined in relation to the upper limit for turbidity and electrical conductivity, the lower limit for dissolved oxygen and the lower and upper limit for pH.

***Bold** denotes trigger value is exceeded.*

Table A 3: Baseline water quality results summary - Talbingo Reservoir

			Talbingo Reservoir (March 2018 Samples)				Talbingo Reservoir (October 2018 Samples)			
	Unit	**WQO value[2]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**	**# Samples / exceedances[7]**	**10th percentile[6]**	**Median**	**90th percentile[6]**
Field Parameters										
Temperature	°C	-	15 / -	6.9	13.3	18.4	24 / -	6.1	8.1	12.4
Dissolved Oxygen (DO)	%	90 – 110[1]	0 / -	-	-	-	0 / -	-	-	-
Electrical Conductivity (EC)	µS/cm	20 – 30	15 / 1	17	19	29	24 / 0	12	17	24
pH		6.5 – 8.0	15 / 3	**6.2**	6.8	7.0	24 / 13	7.7	8.1	8.2
Oxidising and Reducing Potential (ORP)		-	0 / -	-	-	-	0 / -	-	-	-
Turbidity	NTU	1 - 20	0 / -	-	-	-	24 / 0	0.4	0.6	0.8
Analytical Results - General										
Suspended Solids (SS)	mg/l	-	15 / -	<1	2	5	24 / -	<1	<1	2
Total Alkalinity (as $CACO_3$)	mg/l	-	15 / -	<20	<20	<20	24 / -	9	10	14
Total Hardness (as $CACO_3$)	mg/l	-	15 / -	6	7	10	24 / -	5	5	12
Analytical Results - Nutrients										
Ammonia	mg/l	0.010	15 / 0	<0.01	<0.01	0.01	24 / 20	0.006	**0.016**	**0.027**
Oxidised Nitrogen (NOx)	mg/l	0.01	15 / 3[8]	<0.05[8]	<0.05[8]	**0.066**	24 / 23	**0.015**	**0.032**	**0.045**
Total Kjeldahl Nitrogen (TKN)	mg/l	-	15 / -	<0.2	<0.2	<0.2	24 / -	0.07	0.09	0.20
Total Nitrogen (TN)	mg/l	0.35	15 / 1	<0.2	<0.2	<0.2	24 / 1	0.10	0.12	0.23
Reactive Phosphorus	mg/l	0.005	15 / 0[8]	<0.05[8]	<0.05[8]	<0.05[8]	24 / 0	0.002	0.002	0.003
Total Phosphorus (TP)	mg/l	0.01	15 /0[8]	<0.05[8]	<0.05[8]	<0.05[8]	24 / 4	<0.01	<0.01	**0.02**
Total Organic Carbon	mg/l	-	15 / -	<5	<5	<5	24 / -	<1	<1	2
Dissolved Organic Carbon	mg/l	-	15 / -	<5	<5	<5	24 / -	<1	2	2
Analytical Results - Inorganics (Dissolved)										
Cyanide	mg/l	0.007	0 / -	-	-	-	0 / -	-	-	-
Analytical Results - Metals (Dissolved)										

			Talbingo Reservoir (March 2018 Samples)				Talbingo Reservoir (October 2018 Samples)			
	Unit	WQO value[2]	# Samples / exceedances[7]	10th percentile[6]	Median	90th percentile[6]	# Samples / exceedances[7]	10th percentile[6]	Median	90th percentile[6]
Aluminium (Al)	mg/l	0.055	15 / 0	<0.05	<0.05	<0.05	24 / 0	<0.01	0.02	0.03
Arsenic (As)	mg/l	0.013[4]	15 / 0	<0.001	<0.001	<0.001	24 / 0	<0.001	<0.001	<0.001
Boron (B)	mg/l	0.370	15 / 0	<0.05	<0.05	<0.05	24 / 0	<0.05	<0.05	<0.05
Cobalt (Co)	mg/l	0.0014[3]	15 / 0	<0.001	<0.001	<0.001	24 / 0	<0.001	<0.001	<0.001
Total Chromium (Cr)	mg/l	0.001[5]	15 / 0	<0.001	<0.001	<0.001	24 / 0	<0.001	<0.001	<0.001
Copper (Cu)	mg/l	0.0014	15 / 10	<0.001	**0.015**	**0.057**	24 / 0	<0.001	<0.001	<0.001
Manganese (Mn)	mg/l	1.9	15 / 0	<0.005	<0.005	<0.005	24 / 0	<0.001	<0.001	0.0054
Nickel (Ni)	mg/l	0.011	15 / 0	<0.001	0.003	0.004	24 / 0	<0.001	<0.001	<0.001
Lead (Pb)	mg/l	0.0034	15 / 1	<0.001	0.002	**0.003**	24 / 0	<0.001	<0.001	<0.001
Selenium (Se)	mg/l	0.005	15 / 0	<0.001	<0.001	<0.001	24 / 0	<0.01	<0.01	<0.01
Silver (Ag)	mg/l	0.0005	15 / 0	<0.005	<0.005	<0.005	24 / 0	<0.001	<0.001	<0.001
Vanadium (V)	mg/l	0.006[3]	15 / 0	<0.005	<0.005	<0.005	24 / 0	<0.01	<0.01	<0.01
Zinc (Zn)	mg/l	0.008	15 / 12	0.0054	**0.024**	**0.065**	24 / 0	<0.005	<0.005	<0.005
Mercury (Hg)	mg/l	0.00006	15 / 0	<0.0001	<0.0001	<0.0001	24 / 0	<0.0001	<0.0001	<0.0001
Iron (Fe)	mg/l	0.3[3]	15 / 0	<0.05	<0.05	<0.05	24 / 0	<0.05	<0.05	<0.05

Notes: *1. The trigger values for field parameters and nutrients refer to the trigger values for physical and chemical stressors in south-east Australia (fresh water lakes and reservoirs) that are reported in Tables 3.3.2 and 3.3.3 of ANZECC/ARMCANZ (2000).*

2. WQO values refer to the values established in EIS SWA. t is noted that no hardness adjustments have been made.

3. WQO value refers to a low reliability trigger value.

4. For As (V).

5. For Cr (VI).

6. If less than 10 samples are available, the minimum value is reported instead of the 10th percentile value and the maximum value is reported instead of the 90th percentile value.

7. An exceedance refers to any result that is above detection limit and exceeds the WQO value. Where a range is given for the WQO value, exceedances are determined in relation to the upper limit for turbidity and electrical conductivity, the lower limit for dissolved oxygen and the lower and upper limit for pH.

8. For the March 2018 sampling round, analysis of oxidised nitrogen, and total and reactive phosphorous was undertaken using a Limit of Reporting that was greater than the Guideline Value. A lower Limit of Reporting that was lower or equal to the Guideline Value was applied to the October 2018 sampling round.

***Bold** denotes trigger value is exceeded*

APPENDIX B – SPILL RESPONSE PROCEDURE

S2-FGJV-ENV-PRO-0058

SPILL RESPONSE PROCEDURE

Approval Record			
Document preparation, review and approval		Name in print	Signature
Prepared by	Environmental Consultant	R Kristenson	
Reviewed by	Environmental Consultant	R Walker-Edwards	
Verified by	Environment Manager	L Coetzee	
Approved by	Project Director	A. Betti	

Document Revision Table		
Rev.	Date	Description of modifications / revisions
A	17.04.2019	For review and consultation
B	15.08.2019	Updated from DPIE comments
0	21.11.2019	Updated to address Modification 1

Introduction

This procedure has been developed and will be implemented in accordance with the requirements under the Project's Environmental Management Strategy (EMS) and corresponding approval requirements.

Objective

The objective of this procedure is to:

- detail the requirements for managing, containing and cleaning-up spills on-site including but not limited to chemical, fuel or oil spills or leaks that originate from the Project work area that have the potential to contamination soil and or water;
- to aid in minimising the emergency response time and in-turn minimise the potential impact to the environment;
- meet the requirements in Condition 34 of the Infrastructure Approval.

In the event of a spill the emergency response procedure provided on the following page will be implemented. All spills will be reported to the appropriate officer and immediately deploying spill containment and/ or absorption kits to restrict its spread.

Control Measures

Preventative Spill Measures

In order to minimise the potential environmental impacts to water and soil from spills the following will be undertaken by Future Generation:

- training in use of spill containment materials, their locations and spill response will be undertaken proactively as required particularly for personnel who are working within or near to aquatic environments such as dredging works;
- minimising vehicle and plant accessibility to waterways by maintaining the 50 metre exclusion zone around Yarrangobilly River and by situating facilities as far away from waterways as possible;
- refuelling, washing and maintenance of vehicles and mechanical plant will occur at least 50 metres from waterbodies;
- plant and equipment will undergo regular checks and subsequent repair for potential leakages or worn hydraulic hoses;
- all chemicals including fuels and oils will be stored when not in use in enclosed bunded areas;
- all chemicals and hydrocarbons will be stored and handled as per manufacturer's instructions;
- within the tunnel refuelling will be undertaken in dry, enclosed, bunded areas.

Regular inspection of chemical storage and usage will be undertaken to assess compliance of the above measures.

Reactive Spill Measures

This includes response to any spills during the following activities which have a higher likelihood or consequence of spill occurrence:

- vegetation clearing and stripping of soils;

- refuelling, wash down and or maintenance of plant and equipment including marine equipment used for in reservoir geotechnical investigations;
- operation of equipment that require fuel, chemicals, lubricants or similar including pumps and water treatment plants;
- working within particularly sensitive environments including marine dredging, subaqueous material placement, in reservoir geotechnical investigation, waterway crossings or diversions.

The impacts of the spill should be isolated and the Emergency Spill Response Flowchart implemented.

Spill containment material such as those listed in Table B 1 referred to as 'spill kits' will be kept, stocked on site at any location where there is significant risk/consequence of a spill including at refuelling areas, workshops, chemical storage and within the vicinity of waterways including on all marine vessels at all times.

The spill kits will be appropriately sized according to the volume of chemicals and fuels being stored or used as well as based on the potential for proliferation such as silt curtain lengths based on dredging extent (as required). All staff would be made aware of the location of the spill kit and trained in its use. Table B 1 provides examples of appropriate application of material types.

The Environment Team is available for assistance and advice in purchasing the correct spill containment materials. Spill kit inspections and required restocking and are to be undertaken on regular intervals such as during weekly site inspections in accordance with the EMS.

Table B 1: Spill containment materials

Name	Description
Hydrophobic booms	• Used to contain and absorb floating contaminants typically in aquatic environments including hydrocarbons. • Consider the need to install floating booms before starting works if there is potential for contamination in a waterbody • If the booms alone cannot absorb the contaminant then consider using absorbent material such as granules to soak up the spilled liquid on land or deploy additional surrounding booms or silt curtains when within a waterway
Silt curtains	• Used to contain contaminants within waterbody including sediments • Consider the need to install silt curtain(s) and the extent of the curtain(s) prior to commencing ground disturbance works including dredging in or near waterbodies • If one curtain alone cannot contain the contaminant then consider deploying additional curtains around the outer perimeter
Pads, Pillows and socks	• Used to clean-up (absorb) small to medium liquid spills on land rather than containing. Thin absorbent mats place over spills. Cushion shaped products containing absorbent fibres, used directly under a leak or drip. Absorbent socks placed at the low point of a spill • Consider the need to have a spill kit containing these at the source of the activity and extras in-stock on site • If these materials are not enough to clean-up the spill, consider using absorbent granular materials or equivalent

Name	Description
Drain Covers	• Used to filter or absorb contaminants as they enter a drainage system. Covers such as drain wardens placed over stormwater inlets and pit grates to filter sediments and, when installed with hydrophobic pillow, absorb hydrocarbons prior to entering to stormwater system • Covers should be installed within the pit/drain prior to works commencing. Consider regular checks and cleaning of drain covers to extend its life. • Consider installation of physical bunding, diversions away from drains or plastic pit gel covers if drain covers are frequently becoming laden with contaminant(s)
Sorbents	• Used to clean-up, sorbents are materials that soak up the spill such as saw dust and peat mixture. Spread the sorbent over the contaminant after control materials have been applied. Recover the contaminant/sorbent mixture using shovels/excavator bucket or similar • Sorbents can be used from small to large spills • Consider if a large quantity of sorbent needs to be used then manual recovery may be a more suitable method
Manual Recovery	• Used to physically remove the contaminant either by excavating the contaminant and adjacent soil on land or vacuum truck removal for contaminant and adjacent liquid/sludge in waterbodies • Control materials should be installed prior to manual recovery to prevent spread during recovery task
Drip trays and washout bunds	• Used to contain incidental leaks during plant and equipment maintenance and equipment washout post activities such as concrete works • Containers should be maintained and liquids/sludge collected should be regular removed appropriately • Consider if these containers are not sufficient to contain leaks/washout then construction of permanent bunding may be suitable

Incident management

Incidents are managed in accordance with the Section 7 of the EMS and the Pollution Incident Response Management Plan (PIRMP). The investigation will include a review of events leading up to the incident and a review of what improved practices may be required.

In the event of the occurrence of an incident, the Future Generation Environment Manager will immediately inform SHL who will contact Department of Planning, Industry and Environment in accordance with the requirements of Schedule 4, Condition 5 of the Infrastructure Approval.

Corrective actions will be implemented to reflect the root cause of the event. This may include:

- additional spill response training;
- installation of physical barriers or diversions;
- monitoring groundwater and/ or nearby surface waters for possible contamination.

In accordance with Part 5.7 the *Protection of the Environment Operations Act 1997*, the Environment Manager or Project Director will enact the Pollution Incident Response Management Plan (PIRMP) should the incident be deemed to have:

- resulted in actual or potential for material environmental harm, or
- the associated clean-up costs exceed $10,000.

EMERGENCY SPILL RESPONSE FLOWCHART

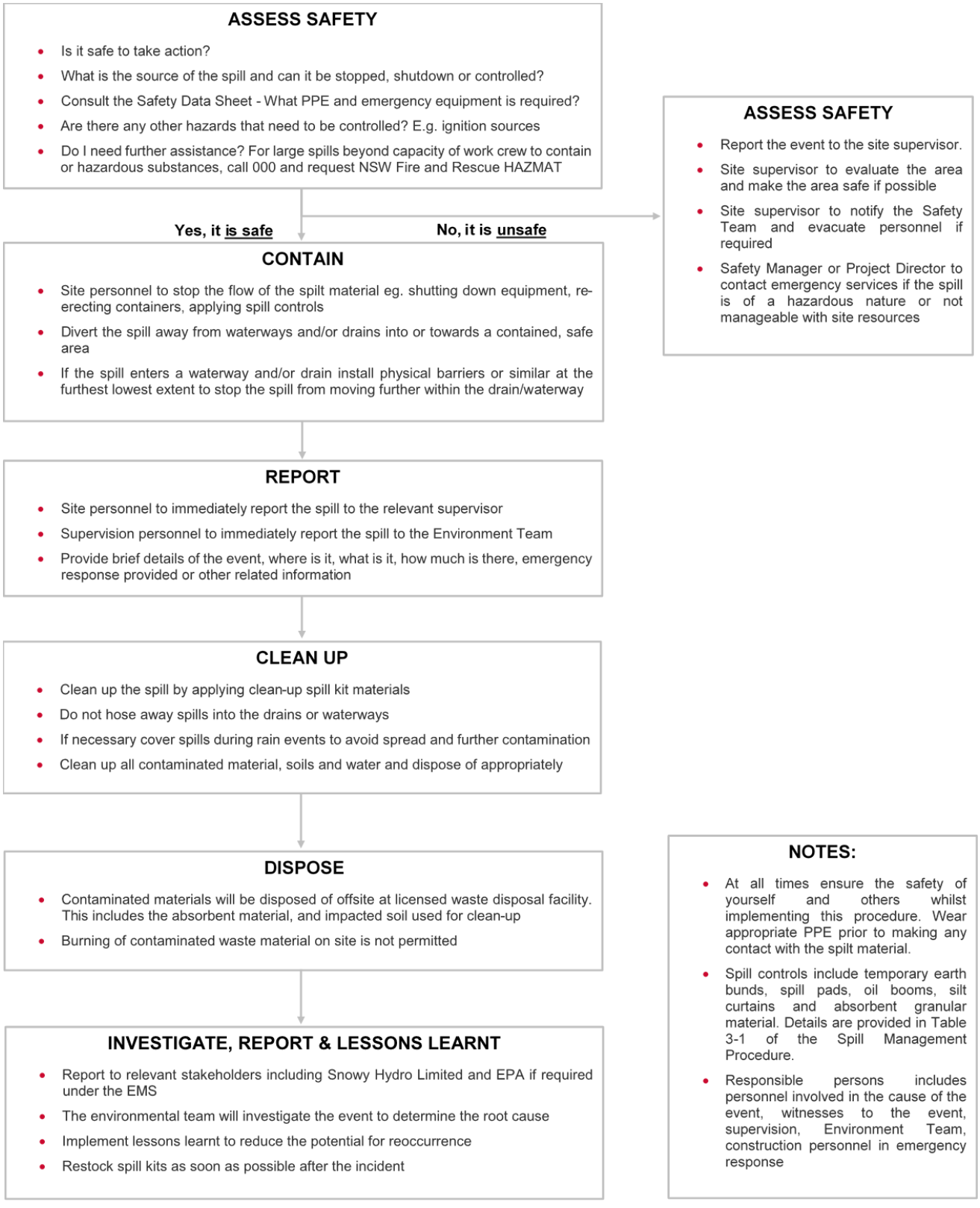


Figure B 1: Emergency Spill Response Flow Chart

APPENDIX C – TRIGGER ACTION RESPONSE PLAN

Trigger Action Response Plan 1 –
Receiving Waters Comprehensive Monitoring Exceedance

Trigger action response plan initiation
- Exceedance identified following comprehensive monitoring.

Monitoring details
- Comprehensive monitoring to be undertaken:
  - Monthly for baseflow conditions (12 monitoring events per year)
  - During/after wet weather events (quarterly)
  - Monitoring to occur at all locations identified in the Surface Water Monitoring Plan / EPL
- Monitoring includes a full range of physio-chemical parameters, nutrients and metals
- Monitoring results available around 2 weeks after monitoring.

Trigger action response plan objective
- To identify (where possible) if the exceedance is naturally occurring or due to construction activities
- To establish actions to either improve water management or further investigate the exceedance mechanism (if required)
- To meet EPL R4.1 and R4.2 Environmental Monitoring Report requirements

Exceedance(s) of one or more analytes identified at a receiving water monitoring location.

Note if exceedance is a metal, undertake adjustment (i.e. Is the post hardness adjustment above the WQO value?)

Does a similar exceedance(s) occur in any receiving water that is upstream of all disturbed work areas associated with construction?

YES → Exceedance is unlikely to be associated with construction. **Report monitoring results in monthly water quality report and in accordance with EPL**

NO

Review point of discharge monitoring and inspection results. Is there any evidence that exceedance is due to construction directly upstream of this monitoring location?

YES → **Source of exceedance identified. Potential incident***

Investigate root causes and identify measures to minimise discharge. Review controls and construction area to identify opportunities for improvement to meet discharge predictions. Report identified actions in accordance with EPL.

Report monitoring results in monthly water quality report and in accordance with EPL.

NO

Are water quality controls and treatment systems functioning to specifications / as designed prior to/ during monitoring

NO → (to Source of exceedance identified. Potential incident*)

YES

Has a similar exceedance occurred at this location in at least 1 of the last 3 monitoring rounds?

NO → Exceedance is to be noted in a database for consideration in future monitoring rounds. **Report monitoring results in monthly water quality report and in accordance with EPL.**

YES

Further actions are required to identify the source of the exceedance and potential improvements to the water management system.

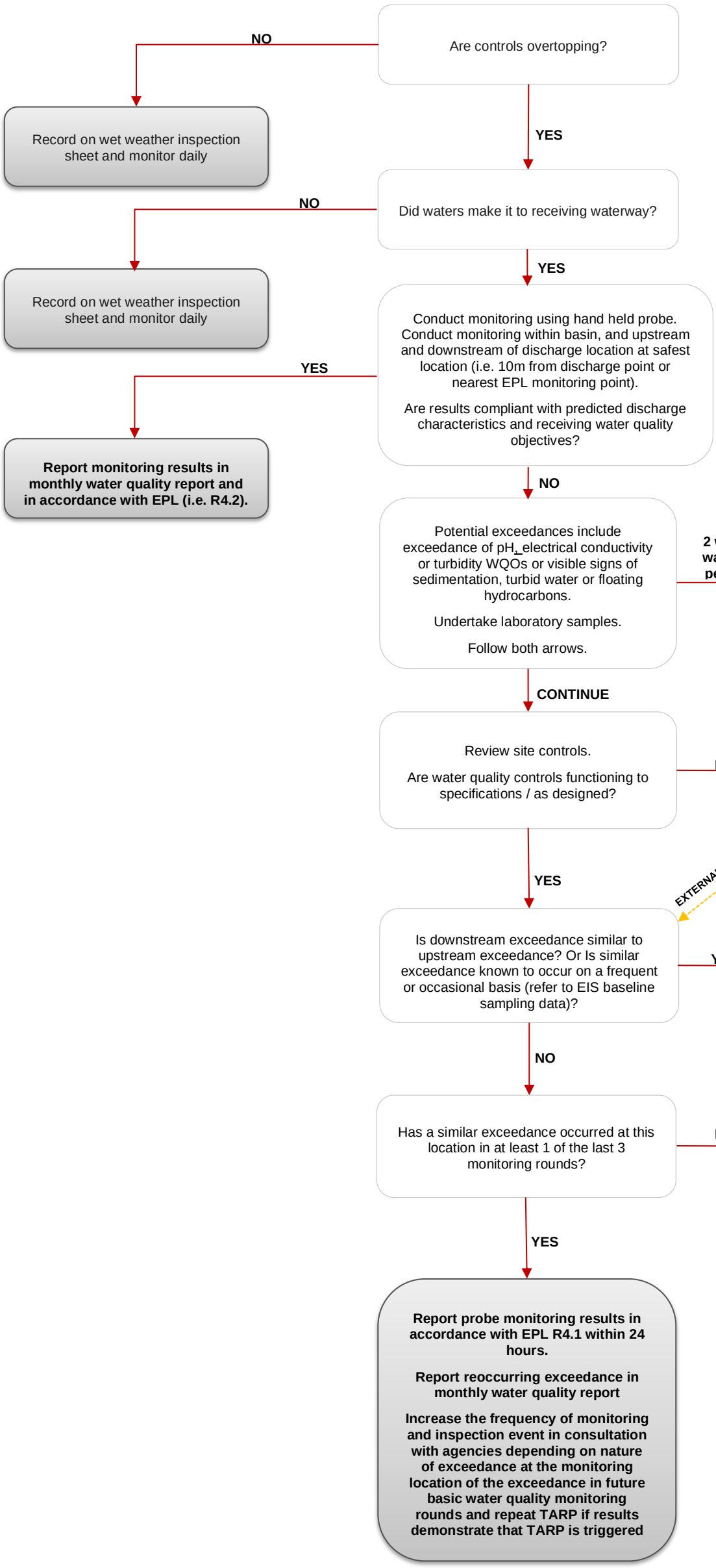
CONTINUE

Report monitoring results in monthly water quality report and in accordance with EPL.

Investigate the source of the exceedance and potential improvements to the water management system that can be made to reduce the risk of the exceedance reoccurring. The scope of the investigation will depend on the extent and nature of the exceedance. Report identified actions in accordance with EPL.

* In the event of the occurrence of an incident, the Future Gen Environment Manager will immediately inform SHL who will contact Department of Planning, Industry and Environment in accordance with the requirements of Schedule 4 Condition 6 of the Infrastructure Approval and the EPL (21266)

Trigger Action Response Plan 2 –
Overtopping Event (Basic water quality monitoring)



Trigger action response plan initiation

- Sediment basin / control overtopping event during / following rainfall event
- Irrigation event causing surface flow to waterway

Monitoring details

- Monitoring to be undertaken daily until discharge ceases at following locations:
  - Within basin or at point of discharge (if discharge occurring elsewhere); and
  - Downstream and upstream of discharge location at nearest EPL monitoring point
- Monitoring includes visual inspection and measurement of pH, electrical conductivity and turbidity using an in-situ data logger or portable water quality meter

Trigger action response plan objective

- To identify (where possible) if the exceedance is naturally occurring or due to construction activities
- To establish actions to either improve water management or further investigate the exceedance mechanism (if required)
- To meet requirement under EPL 21266 R4.1 which states that licensee must notify the EPA of any results of in situ monitoring that are outside the range of predicted discharge water quality characteristics or receiving water quality objective

* In the event of the occurrence of an incident, the Future Gen Environment Manager will immediately inform SHL who will contact Department of Planning, Industry and Environment in accordance with the requirements of Schedule 4 Condition 6 of the Infrastructure Approval and the EPL (21266)

APPENDIX D – IN-RESERVOIR GEOTECHNICAL WORKS

Geotechnical works

Process for in-reservoir and on land drilling

The below details provide information relating to the proposed procedure for undertaking geotechnical works both on the reservoir (in-reservoir) and on land. These measures are detailed and therefore may need to be modified to address any site specific requirements as they arise.

Environmental Clearance

Prior to commencing work activities, the project will ensure approvals and systems developed during the planning stages are complete.

Environmental inspections will be undertaken in accordance with EMS requirements, prior to establishment to identify acceptable clearing routes.

Track and Pad Preparation

The FGJV Permit to clear will be obtained where clearing is required.

The method to for track and pad establishment will include:

- pre-establishment vegetation inspections by the ecologists in accordance with EMS and Biodiversity Management Plan (BMP);
- disturbance boundary and / or clearing limits to be delineated with flagging in accordance with the Pre-clearing Procedure in Appendix C of the BMP;
- clearing of vegetation in approved locations and drill pads to occur using forestry mulcher, chainsaws and excavator crew;
- removed cover and woody debris / branches, to be pushed to the edges of the access track and drill pad sites for later use during site rehabilitation;
- placement of geofabric, track mats and / or gravel at track depression to maintain safe access and minimise impact on gully soils;
- installation of required sediments control measures along the tracks and around the drill pad sites;
- install track signage to allow UHF call up and communication protocol;
- minor earthworks and importation of sheeting gravel to level and stabilise drill sites;

The water supply infrastructure currently in place at Marica Track will be extended to supply new boreholes.

Water supply for drill sites outside of Marica track will generally consist of direct supply to on-site storage tanks using water carts.

Mobilisation of Drilling Equipment

The following points provide a summary of the key activities associated with mobilising equipment to site;

- drill rigs will be floated to the laydown areas where they will be taken to site using existing and constructed access trails. Laydown areas identified for use during mobilisation include:
    - Coppermine and Marica Laydown (for work on Marica Track);
    - Tantangara Quarry (for work near Talbingo);

  - Lobs Hole (for work near Talbingo Intake);
  - Tantangara Foreshores (for overwater work in Tantangara);
  - O'Hares Rest (for overwater work in Talbingo);
- drilling support equipment including rods, pumps, water tanks, mud tanks, spill kits, site compound, lighting, mobile generators and other equipment necessary for the operation of the drill rig will also be mobilised to laydowns and transferred to site pads accordingly;
- access (by personnel and for delivery and removal of equipment etc) will be via the existing and newly established tracks and the Snowy Mountains Highway.

Vehicle hygiene for all new plant, machinery and vehicles will be checked prior to accessing the site for the first time as per the Weed and Pest Inspection Form.

For all plant and machinery coming directly from the Tantangara area known to contain the invasive weed species Ox Eye Daisy specific wash-down will occur prior to re-entering the National Park to ensure the removal of seeds and potential seed-harbouring material.

Where possible, all ancillary equipment and personnel will be mobilised to site using light / tracked vehicles.

Drilling Activities and Downhole Testing

Drilling activities, including borehole establishment and in situ testing and will typically include the following:

1. Excavate surface sump at drill collar and line with suitable plastic liner to seal collar.
2. Install HW casing to suitable depth and seal in place with gypset or similar.
3. Core drilling of boreholes using triple tube coring methods. Most boreholes will be starting with PQ-3, size hole, then telescope to HQ-3 and where necessary to NQ-3.
4. Drill mud management - Containment of excess drilling fluids and cuttings in above-ground re-circulation tanks, excess fluids would be stored in portable industrial bulk containers (IBCs).
5. Clean water flushing of boreholes upon reaching target depths.
6. In situ down hole testing as required:

- In-situ Stress Test via overcore (IST)
- Dilatometer testing
- Hydro-fracture and hydro-jacking pressure testing
- Drill Stem permeability testing (DST)

7. Clean water flushing of boreholes upon reaching target depths.
8. Downhole borehole survey using acoustic teleview cameras and probes.
9. Survey of the as-built borehole location using GPS or suitable survey techniques.
10. Ongoing maintenance of the equipment and site as required.

An indicative site layout for the drill sites is shown below in Figure 1 and Figure 2.

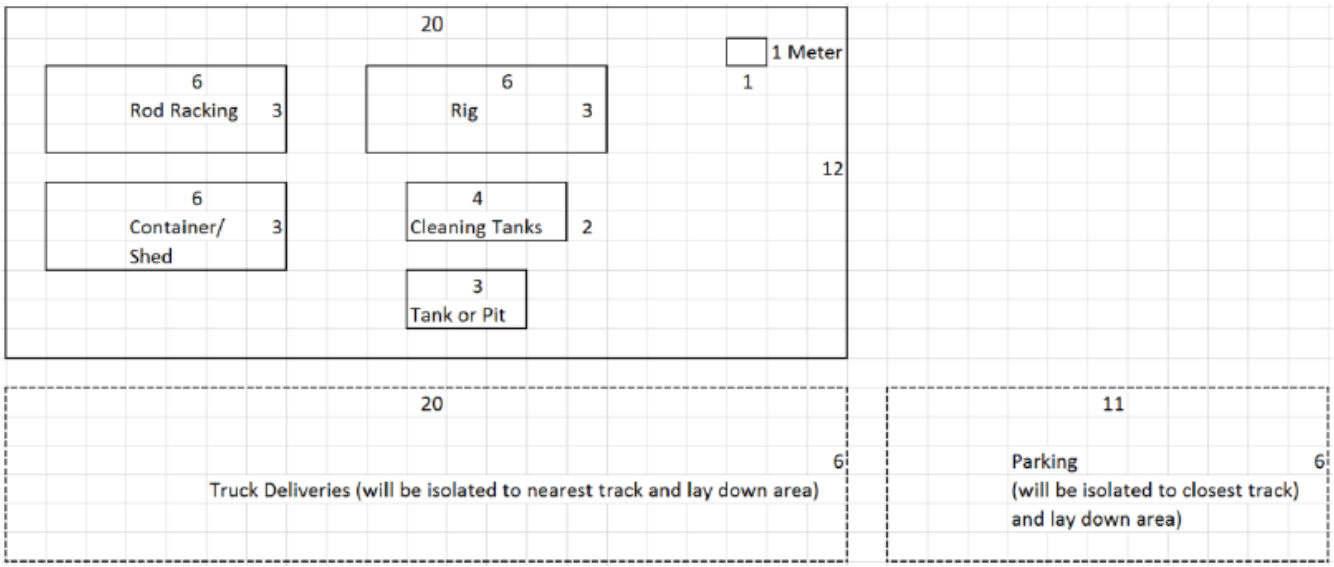


Figure 1 Indicative site layout

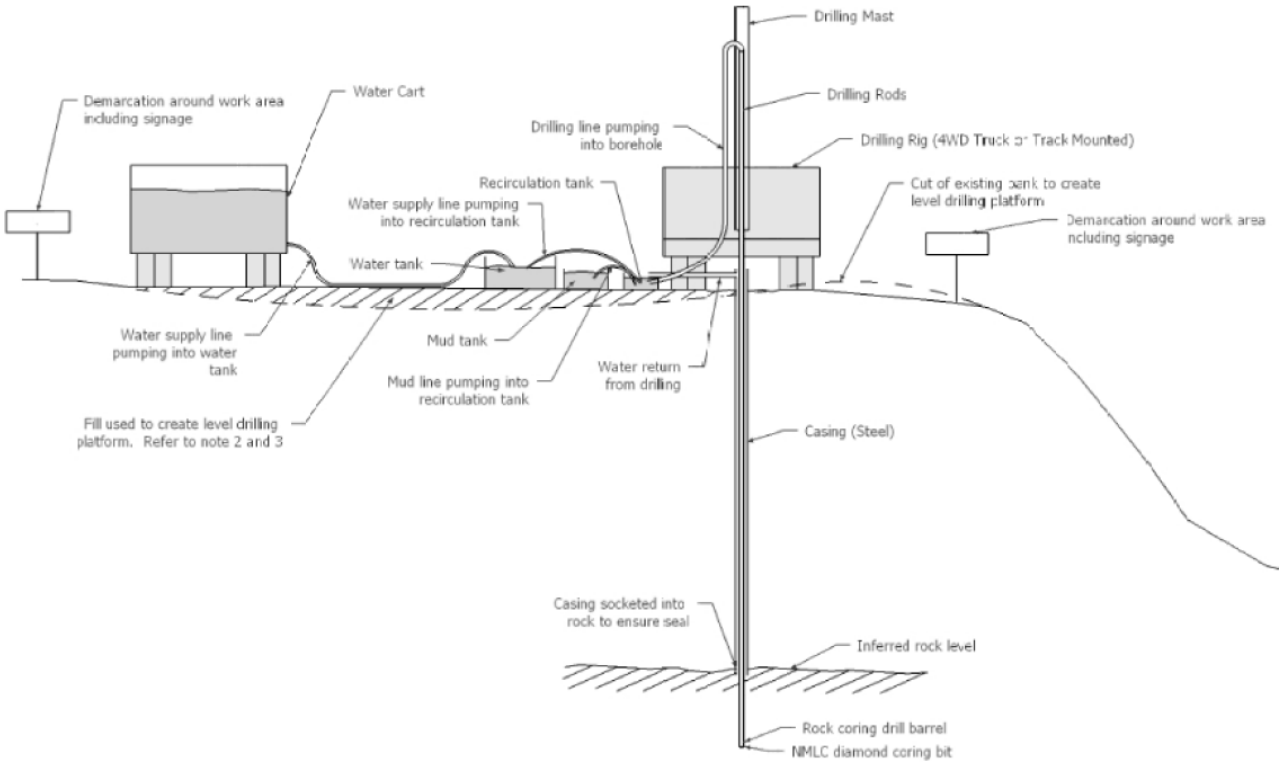


Figure 2 Indicative site layout (cross-section)

Auxiliary Support Services

Water Supply

Drilling activities require consistent fresh water supply circulate drilling muds through the borehole to return rock cuttings.

Water will be supplied using water carts by extraction and transfer to Marica tank farm, or directly to the drill sites.

Core Sample Transport

Removal of drill core (contained in light steel core trays) and other equipment will be undertaken as required on a daily basis. Transport of core trays will be done using a dedicated core transfer team in 4WD utes.

Drill Mud and Waste Disposal

Excess drilling muds and all drilling waste will be collected from drill sites using vacuum tankers and transferred to a holding facility. From this the waste will be disposed at a suitably licensed (NSW EPA) waste management facility in accordance with the NSW EPA *Waste Classification Guidelines* (2014).

Borehole Instrumentation and Decommissioning

Following successful completion of borehole drilling and in situ testing and sampling, the following borehole decommissioning activities will occur:

for boreholes with nominated VWP logging instrumentation, a series of grout tubes, sensors and cabling will be hung inside the borehole. The borehole will be grouted using displacement grouting techniques, and the sensor cables will be wired to a data logger box for completion;

for boreholes with no instrumentation to be installed, the borehole will be decommissioned by grouting in accordance with Minimum Construction Requirements for Water Bores in Australia.

Equipment Demobilisation

On completion of drilling activities and borehole installations and decommissioning, all equipment used during the works will be demobilised staged in the same laydown areas used during mobilisation.

Track and Pad Rehabilitation

Drill sites where any ground disturbance or clearing have occurred will be rehabilitated in accordance with Exploratory Works Modification 1 requirements, unless further approvals supersede Modification 1 requirements; ie. The tracks or pads are planned to be used for future approved works.

The drill pads will be rehabilitated in accordance with the following principles:

- successful rehabilitation is based on the principle of “No Bare Ground” after rehabilitation works have been carried out;
- implementation of strict vehicle hygiene protocol, such as washing down of equipment and vehicle wash bays before entering KNP;
- utilisation of cleared or mulched vegetation in the rehabilitation activities.

The approach to rehabilitation will aim to use existing ecological resources at the sites and to minimise the use of additional materials such as seed, tubestock and mulch. This approach to rehabilitation was used throughout the Feasibility stage geotechnical investigation program and has been undertaken successfully to date.

Following completion of all site activities, a visual inspection of the site by Snowy Hydro and NPWS personnel will be undertaken to ensure that the location of the drilling activities has been reinstated to an acceptable standard.

Overwater drilling

Overwater drilling activities, including in situ testing and borehole decommissioning are to include the following activities.

- mobilise and secure ‘jack up’ or floating barge to reservoir floor using concrete anchors that will be removed at completion of work;
- install a small anchor on the shore line or to deployed concrete anchor blocks to allow stabilisation of the barge;
- drill boreholes using auger and rotary wash bore drilling techniques through soils and weathered rock including collection of disturbed samples;
- rock core drilling using triple tube diamond coring techniques to the nominated target depth at each borehole location;
- during drilling works excess drilling fluids and cuttings will be captured in re-circulation tanks at the borehole location. Any excess fluids would be stored in portable IBC containers and disposed to NSW EPA licensed facility;
- in situ permeability testing using water pressure tests;
- clean water flushing of boreholes upon reaching target depths;
- downhole borehole survey using acoustic teleview cameras and gyronometers;
- coordinate survey of the as-built borehole location using GPS or suitable survey techniques.

At all times while the barge is moored it will comply with NSW Maritime safety requirements to ensure it is visible for other waterway users and will not pose a hazard to the public. A cross-sectional plan showing indicative site layout and operations of water based (barge) drilling is provided in Figure 3.

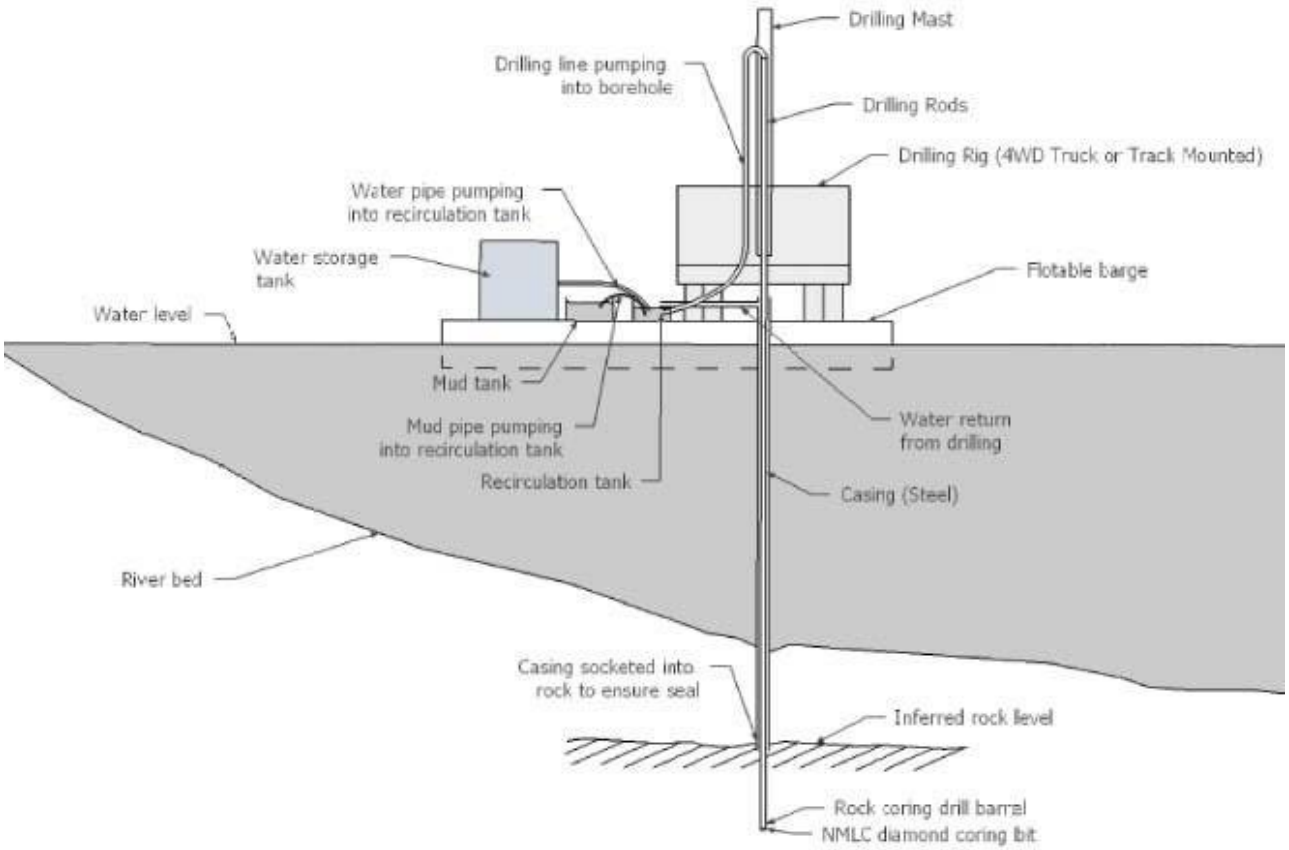


Figure 3 Typical barge geotechnical drilling set-up (cross section)

In-reservoir refuelling

During geotechnical works, some geotechnical drilling will be required to occur on Tantangara and Talbingo Reservoirs. The geotechnical drills will be based on barges and refuelling will be required to enable the works to occur.

The following steps are recommended to occur prior to and during refuelling.

Prior to refuelling

- Lock or shut all valves or taps which are not required to be used during refuelling.
- Ensure that spill kits are available on the barge and are suitably stocked.
- Ensure that personnel are aware of how to utilise the spill kit.
- Ensure that any safety requirements are met (as a priority).
- Ensure that relevant MSDSs are available for use (either in soft or hard copy).
- Where possible, locate machinery as close as possible to the refuelling point.
- Where located on the barge, ensure that any scuppers or drains are blocked.

During refuelling

- Carefully deploy the fuel hose.
- Lock shut all valves or taps which are not required for use.
- Where refuelled by fuel truck from shore, the vessel / barge being refuelled is positioned as close as possible to the quay/crane pad.
- Carefully deploy the fuel hose.
- Allowances must be made for the relative movement of the barge.
- Ensure spill kits and fire extinguishers are suitably positioned for each refuelling situation.
- Install a watch system on board both the vessel and the shore to watch for leaks and spills.
- Terminate the fuel transfer system immediately if a leak or spill occurs.
- Any spills are to be reported in accordance with the Spill Response Procedure (Appendix B).