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WATER MANAGEMENT PLAN

Approval Record			
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ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
AFL	Agreement for Lease
AHD	Australian Height Datum
AIP	Aquifer Interference Policy
BCD	Biodiversity and Conservation Division (now part of Department of Planning, Industry and Environment)
CoA	Conditions of Approval (SSI 9208)
CEMP	Construction Environmental Management Plan
CSSI	Critical State significant infrastructure
DMP	Dredging Management Plan
DOI	Department of Industry
DPIE	NSW Department of Planning, Industry and Environment
DPI	Department of Primary Industries
EIS	Environmental Impact Statement
Exploratory Works EIS	*Environmental Impact Statement Exploratory Works for Snowy 2.0*
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
EWAR	Exploratory Works Access Roads
Future Generation	Future Generation Joint Venture
Future Generation-PMS	Project Management System
GDE	Groundwater Dependent Ecosystem
GWMP	Groundwater Management Plan
KNP	Kosciusko National Park
Leed	Leed Engineering
NPWS	National Park and Wildlife Services
PEP	Project Execution Plan
POEO Act	*Protection of the Environment Operations Act 1997*
POEO Regulation	*Protection of the Environment (General) Regulation 2009*
QMP	Quality Management Plan
REMM	Revised Environmental Management Measures
Submissions Report or RTS	*Response to Submissions Exploratory Works for Snowy 2.0*
SHC Act	*Snowy Hydro Corporatisation Act 1997*

Acronym	Definition
Snowy Hydro	Snowy Hydro Limited
SWA	Surface Water Assessment
SWMP	Surface Water Management Plan
TBM	Tunnel Boring Machine
WAL	Water Access Licence
WM Act	*Water Management Act 2000*
WM Regulation	*Water Management (General) Regulation 2011*
WMP	Water Management Plan (this Plan)
WSP	Water Sharing Plan

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 (Snowy Hydro) 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 Water Management Plan (WMP or Plan) forms part of the 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 WMP 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 and 27 March 2020;
- the *Environmental Impact Statement Exploratory Works for Snowy Hydro 2.0* (Exploratory Works EIS);
- the revised environmental management measures (REMMs) within the *Response to Submissions Exploratory Works for Snowy 2.0* (Submissions Report or RTS);
- 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 on behalf of Snowy Hydro:

- **Stage 1a – Pre-construction Minor Works** - Stage 1a has been approved and commenced I 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 Snowy Hydro:

- **Stage 2 – Exploratory Works** – Stage 2 has been approved and works commenced in October 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.

Further detail on construction activities and staging is presented in Section 2.8 and Figure 1-1.

This Plan identifies the project's environmental management measures in relation to water management for the Exploratory Works – Stage 2. It has been specifically developed for Exploratory Works – Stage 2.

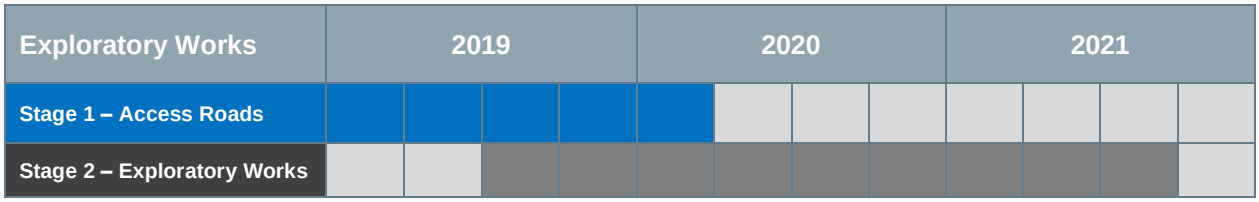

Figure 1-1: Timing of Exploratory Works stages

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.

Table 1-1 presents the relationship of activities relating to water management with respect to this Plan and other management plans being prepared for the Project. Some distinct work activities such as surface water, groundwater and dredging management are included as appendices to this Plan, also shown within Table 1-1.

Table 1-1: Relationship to other plans

Activities	Relevant plan	Timing of the plan*	
		Stage 1	Stage 2
General environmental compliance including inspection, monitoring and auditing	Environmental Management Strategy	P	R
Road construction and tunnelling – general management of water	This Plan	P	R
Surface Water	Surface Water Management Plan	P	R
Erosion and sedimentation management and soil disturbance	Surface Water Management Plan	P	R
Process and wastewater management	Surface Water Management Plan	P	R
Groundwater	Groundwater Management Plan	P	R
Excavated tunnel rock stockpiling	Excavated Material Management Plan	P	R
Geodiversity and karst features	Historic and Natural Heritage Management Plan	P	R

* P – prepare, R - revise

Specific on-site management measures identified in this Plan will be incorporated into site documents. These site-specific 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 is the proponent of the Project which is a pumped hydro-electric storage and generation project proposed to 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.

Future Generation proposes to carry out the Exploratory Works – Stage 2 project prior to the main construction works for the Project, to inform the detailed design and to reduce project risk. Exploratory Works are required to obtain detailed geological data for the location of the underground power station. An exploratory tunnel is to be constructed to gain this information. The Exploratory Works – Stage 2 project will predominantly be in the Lobs Hole area of KNP. If the Exploratory Works are not undertaken, risks to the design and construct elements of the power station cavern are significantly increased.

The Exploratory Works EIS was prepared to assess the impact of these works on the environment, including an assessment of water impacts within Chapters 5.4 and M and N.

The RTS included REMMs within Chapter 8. The management measures from that report have been addressed within this WMP.

The Exploratory Works EIS identified the potential for direct and indirect impacts on water quality from surface water runoff from disturbed and operating areas of the site, dredging, subaqueous excavated rock placement and discharges of process water and waste (effluent) water. The Exploratory Works 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.

With respect to groundwater modelling undertaken as part of the Exploratory Works EIS predicted localised drawdown in the vicinity of the tunnel alignment, primarily around the portal. Only minor impacts to the baseflow of the Yarrangobilly River and tributaries are expected during construction. Losses are predicted to increase post construction until a new equilibrium is reached.

1.2.1. Modification 1

In accordance with section 5.25 of the EP&A Act, the Infrastructure Approval issued for Exploratory Works was modified 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 was submitted to Department of Planning, Industry and Environment (DPIE) in June 2019, and was publicly exhibited between 26 June 2019 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 WMP has therefore been revised to address the groundwater 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-seven submissions were received, and following consideration, approval was granted by the Minister for Planning and Public Spaces on 27 March 2020.

This WMP 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 EMS. This WMP forms part of Future Generation'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 System 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 WMP is required to support the deliverable plans.

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 the Project proposes to minimise and manage construction impacts on water during construction of the Project.

The key objective of the WMP is to describe the management measures that are to be implemented to ensure that impacts to water are minimised and within the scope permitted by the Project CoA. To achieve this, Snowy Hydro and Future Generation will:

- ensure appropriate measures are implemented to address the relevant CoA and the REMMs listed within the Submissions Report, the Submissions Report for Modification 1 and the Submissions Report for Modification 2, as detailed within Section 2.2 and 0 of this Plan;
- address the relevant water management approvals detailed within Table 2-1;
- describe the management measures to be implemented to ensure that water impacts are minimised during Stage 2 delivery; and
- describe the monitoring programs to be implemented to ensure that water impacts are minimised during Stage 2 delivery.

1.6. 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.

1.7. Consultation

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

On 20 May 2019, the Plan was issued to relevant stakeholders for review and comment. No comments relating to the WMP were received. Comments were received however for Appendix A Surface Water Management Plan, Appendix B Groundwater Management Plan and Appendix C Dredging Management Plan. These comments are addressed within the respective appendices.

A separate document titled Agency Consultation Evidence Report was prepared detailing the consultation process with Future Generation's responses. This plan has been provided to DPIE.

Revision 1 of the WMP (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 4 of this plan, and its appendices (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.

1.8. 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 (undertaken by Snowy Hydro or their contractors);
- a turnaround area on Link Road (undertaken by Snowy Hydro or their contractors) 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 placed in one of two on land emplacement areas. The eastern emplacement area has been designed to safely treat reactive material during temporary storage. The western emplacement area will be used for temporary storage of materials for re-use or offsite disposal *(Note: 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;
- post-construction revegetation and rehabilitation, management and monitoring.

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

1.8.1. Works approved through Modification 1

The Exploratory Works - Modification 1 works scope is included in Table 1-2. 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 this plan.

Table 1-2: 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, 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, 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, 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, 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, Figures 1j, 1k, 1l, 1m and 1n)
Talbingo Laydown	Outside of KNP, Snowy Hydro 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, 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, Figures 1m)
Operating Hours	Modify operating hours for the use of Upper Lobs Hole Ravine Road from 7 am to 6pm to sunrise to sunset.

1.8.2. Works approved through Modification 2

The Exploratory Works - Modification 2 scope for Stage 2 works is included in Table 1-3.

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

Table 1-3: 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).

Modification 2 - Stage 2 works	
Activity	**Description**
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).
Road upgrades (undertaken by Future Generation and Snowy Hydro or their contractors)	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).
Vegetation Clearing (undertaken by Future Generation and Snowy Hydro or their contractors)	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).
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. (Illustrated in Appendix E).
Link Road Turnaround Area (undertaken by Snowy Hydro or their contractors)	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).
Lobs Hole Ravine Road (south) (undertaken by Snowy Hydro or their contractors)	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).
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).
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).
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).

2. ENVIRONMENTAL REQUIREMENTS

2.1. Legislation

Legislation relevant to water management includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act);
- *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation);
- *Protection of the Environment Operations Act 1997* (POEO Act);
- *Protection of the Environment (General) Regulation 2009* (POEO General Regulation);
- *Water Management Act 2000* (WM Act);
- *Water Management Amendment Act 2014* (WMA Act);
- *Water Management (General) Regulation 2011* (WM General Regulation);
- Water Sharing Plan for the Murrumbidgee unregulated and alluvial water sources (2012); and
- *Snowy Hydro Corporatisation Act 1997* (SHC Act).

The Surface Water, Groundwater and Dredging Management Plans (Appendices A, B and C) contain legislation applicable to their respective aspects.

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the EMS.

2.2. Conditions of Approval

Table 2-1 details the CoA that are relevant to water management and demonstrates where these conditions are addressed.

Table 2-1: Conditions of Approval

Condition	Requirement	Where Addressed
Sch 3, Cond 31	The Proponent must ensure that it has sufficient water for all stages of the development; and if necessary, stage the development to match its available water supply. *Note: Under the Water Management Act 2000, the Proponent must obtain the necessary water licences for the development.*	WMP Section 2.4
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.*	WMP Section 2.4, Section 5.1 WMP - Appendix A Surface Water Management Plan, Table 5-1 WMP - Appendix B Groundwater Management Plan, Table 5-1 WMP – Appendix C Dredging Management Plan
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 the approved disturbance areas on site; (c) minimise the flow rates from any clean water runoff diversions to	WMP - Appendix A Surface Water Management, Table 5-1 WMP - Appendix B Groundwater Management Plan,

Condition	Requirement	Where Addressed
	adjoining watercourses; (d) minimise any soil erosion associated with the development; (e) ensure all chemical and hydrocarbon products are stored on site in bunded areas in accordance with the relevant Australian Standards.	Table 5-1 WMP – Appendix C Dredging Management Plan
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:	
	(a) be prepared in consultation with the EPA, NPWS, DoI Water and DPI - Fisheries by a suitably qualified and experienced person/s whose appointment has been approved by the Planning Secretary;	WMP - Section 1.6 and 1.7.
	(b) include a Site Water Balance for the development and a program to review and update the site water balance each calendar year;	WMP – Section 4.2 and 5.3.
	(c) include a Surface Water Management Plan with: • detailed baseline data on surface water flows and quality in the watercourses that could potentially be affected by the development; • a program to augment the baseline data during the development; • a description of the measures that would be implemented to minimise the impacts of: – 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. • surface water assessment criteria, including trigger levels for investigating 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, and comply with the performance measures in Condition 33 above; • 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; • a program to monitor and report on the surface water impacts of the development • 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;	WMP - Appendix A Surface Water Management Plan
	(d) include a Dredging Management Plan with: • a description of the measures that would be implemented to minimise the generation and dispersion of sediments outside	WMP - Appendix C Dredging Management Plan (to be prepared

Condition	Requirement	Where Addressed
	the identified works zone during dredging; • monitoring at representative locations to determine the extent of suspended sediment concentrations and any other potential pollutants dispersed by dredging; • 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;	prior to dredging)
	(e) include a Groundwater Management Plan with: • detailed baseline data on groundwater levels, yield and quality on the aquifers that could be affected by the development; • a program to augment the baseline data during the development; • groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts; • a description of the measures that would be implemented to minimise the groundwater impacts of the development • a program to monitor and report on: • groundwater inflows to the tunnel, including inflows to relevant water sources; • groundwater takes from the groundwater bore • the impacts of the development on: • regional and local (including alluvial) aquifers; • groundwater dependent ecosystems, stygofauna and riparian vegetation; and • base flow to surface water sources; • a plan to respond to any exceedances of the trigger levels and/or assessment criteria and mitigate and/or offset any adverse groundwater impacts of the development.	WMP - Appendix B Groundwater Management Plan
Sch 3, Cond 35	The Proponent must implement the approved Water Management Plan for the development.	WMP – Section 1.6
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*).	WMP - Appendix A Surface Water Management Plan and Aquatic Habitat Management Plan
Sch 3, Cond 40	The Proponent must: (a) ensure that permanent bridges over Wallace 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);	WMP - Appendix A Surface Water Management Plan and Aquatic Habitat Management Plan

Condition	Requirement	Where Addressed
	(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*).	

2.3. Revised Environmental Management Measures

Environmental safeguards and management measures are included in the Exploratory Works EIS in Section 6.3. During preparation of the Submissions Report, REMMs were developed and are included in Section 8 of the Submissions Report. The REMMs that relate to water management are included in Appendix D of this Plan, including some measures applicable to Stage 1 work only which have been included for completeness. If additional measures are cross-referenced from another section of the Exploratory Works EIS or Submissions Report, these measures are also included.

2.4. Licences and Permits

Environment Protection Licence (EPL) (No 21266) has been issued for the Project for the scheduled activity of extractive activities. The EPL details conditions which must be complied with when undertaking the extractive activities works. This plan is written in accordance with all requirements in the EPL. The water quality objectives required in the Project EPL will be adhered to, implemented during erosion and sediment control planning and site activities that have the potential to impact on receiving water quality under this Plan.

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.

Section 60A of the WM Act requires that a water access licence be obtained to extract water from a water source. The WM General Regulation does however provide exemptions for the requirement to obtain water access licences. These exemptions include for the use as dust suppression, bore testing, monitoring bores, operation of a hydro-electric power station for the purpose of generating power. Water access licences would therefore not be required if Snowy Hydro, as the licence holder, are using the water for dust suppression; pump testing a bore; or monitoring. Any other water required for construction purposes would however require a water access licence. This includes extraction for:

- potable uses for human consumption associated with the accommodation camp;
- process water via the services pipeline from Talbingo reservoir for the emplacement area, tunnelling and pad preparation and other construction maintenance facilities including plant and equipment maintenance.

Snowy Hydro is required to licence groundwater extraction in accordance with the Aquifer Interference Policy 2012 (AIP), the WM Act, and the relevant statutory Water Sharing Plans (WSPs). This includes water taken for use as well as water intercepted and managed as a result of tunnelling activities. Sufficient share components and Water Access Licences (WALs) must be held to account for the peak annual volume of water intercepted from all water sources (directly or indirectly) as a result of the project activities.

Snowy Hydro have secured two groundwater access licences (WAL42408, WAL42960) and a surface water specific purpose access licences (WAL42407) for the Exploratory Works Project. These three licences allow for direct and indirect take of water from the Lachlan Fold Belt (LFB)

Murray Darling Basin (MDB) Groundwater Source and direct take from the Upper Tumut water source (i.e. from Talbingo Reservoir).

Water extraction wil be monitored in accordance with Section 6 of the Groundwater Management Plan (Appendix B) to ensure that there is sufficient water for all stages of the development available through the approved licences. If necessary, the development will be programmed to match the licenced available water supply.

2.5. Guidelines

The guidelines also considered in the completion of this Plan include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000);
- Managing Urban Stormwater: Soils and Construction (Landcom, 4th Edition March 2004 (reprinted 2006) (the “Blue Book”)) Volume 1 and Volume 2; and
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004.

The management plans appended to this Plan contain additional guidelines applicable to their respective aspects.

3. EXISTING ENVIRONMENT

3.1. Topography and Landscape

Elevation across the project area ranges from 550 m above Australian Height Datum (AHD) to 1,400 m AHD. The project area is within a steeply incised ravine, along the western fringe of the Long Plains fault escarpment. Most of the project area is characterised by deep gorges and steep sloping ridges, the product of incision from watercourse flow and glaciations, with localised areas of lower grade, such as ridgelines, saddles, benches, and alluvium beside watercourses.

Glacial landforms within the project area are of national and international significance as they are the only examples of glacial landforms on the mainland of Australia. Landform features include terracing, sliding and shattered boulders and block streams. Karst formations of regional and national significance are also present in the project area. The karst landscape is caused by the action of natural water on soluble rock such as limestone and tufa (porous deposits of calcium carbonate with a sponge-like appearance). The Devonian limestone is also of interest for its fossils (which include corals, trilobites, brachiopods and molluscs. Fossiliferous rock is present in an outcrop adjacent to Lobs Hole Ravine Road and has been exposed and disturbed as a result of previous road construction.

3.2. Geology

The Exploratory Works project area is within a steeply incised ravine, along the western fringe of the Long Plains fault escarpment. Elevations typically range from around 550 to 1,400 metres AHD. Most of the project area is characterised by deep gorges and steep sloping ridges, the product of incision from watercourse flow and historic glaciation.

Two distinct geological terrains (‘Incised Ravine Area’ and the ‘Plateau Area’) are within the broader Snowy 2.0 project area, separated by an escarpment caused by movement on the Long Plain Fault. The Exploratory Works project is situated on the western side of this fault structure, in the Incised Ravine Area.

The area is dominated by sedimentary and igneous rock of Silurian to Devonian age. The Silurian aged Ravine Beds, composed of stratified altered siltstone, sandstone and limestone, provide the structural framework and topographic control for this area. The Yarrangobilly Caves, a karstic limestone, is approximately 8 km north of the project is one occurrence of this Silurian age formation.

The Ravine Beds are overlain in areas, typically along the escarpment, by younger volcanic rock.

3.3. Surface Water

3.3.1. Project Locations

Lobs Hole

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 stream baseflows. Recharge to the groundwater system is via rainfall infiltration. The existing surface water environment is shown in Figure 3-1.

Marica area

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.

Talbingo Reservoir

Talbingo Reservoir makes up a large portion of the storage of the Snowy Hydro Scheme. Talbingo Reservoir is also accessible by Lobs Hole Ravine Road. It is approximately 200 m lower in elevation than the main Exploratory Works areas located around tunnel portal. The reservoir has inflows from several major rivers and creeks, most notably the Yarrangobilly and Tumut rivers which enter from the south, and Middle Creek which joins the reservoir from the east. Proposed drilling activities will be located on the south east arm of the reservoir, where the Yarrangobilly River discharges to the reservoir, and just upstream of Middle Creek.

Tantangara Reservoir

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. Figure 3-3 shows the location of the works in relation to Tantangara Reservoir. Figure 3-4 indicates the proximity of the geotechnical works to Nungar Creek.

3.3.2. Water Quality Monitoring

A pre-construction water quality monitoring program has been undertaken by Snowy Hydro, furthering the baseline water quality monitoring undertaken for the Exploratory Works EIS. This data will be used to evaluate broader water quality trends throughout and following construction of the Project. Available data at the time of submission is provided within Appendix A Surface Water Management Plan.

3.4. Groundwater

The groundwater units within the Project area are defined as:

- localised unconsolidated shallow Quaternary gravels episodically recharged through rainfall/flooding events; and
- deep groundwater associated with deeper fractured rock (i.e. Ravine Beds).

The Ravine Beds is the main groundwater bearing unit to be intercepted by the exploratory tunnel. Groundwater within the Ravine Beds has a marginally brackish water quality and is low yielding. The groundwater quality is described as slightly alkaline with typically low concentrations of most dissolved metals. This is typical of alpine areas where groundwater is readily recharged via rainfall and snow melt.

Ecosystems that rely on groundwater (groundwater dependent ecosystems or GDEs) are important environmental assets and typically occur where groundwater is at or near the land surface. Within the project area they are associated with:

- creeks (such as Yarrangobilly River) where deep groundwater is discharging and provides baseflow;
- shallow (perched) groundwater systems;
- springs associated with the steep escarpment across the eastern extent of the project area; and
- terrestrial vegetation overlying shallow groundwater (within the vegetation's root zone).

There are no identified high-priority GDEs within the project area. Yarrangobilly Caves is the only High Priority GDE listed within the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011 relevant to Snowy 2.0 and is approximately 8 km north east of the Exploratory Works project area.

Three native vegetation types were identified as having potential to access groundwater sporadically. None of these terrestrial ecosystems are highly dependent or entirely dependent on groundwater.

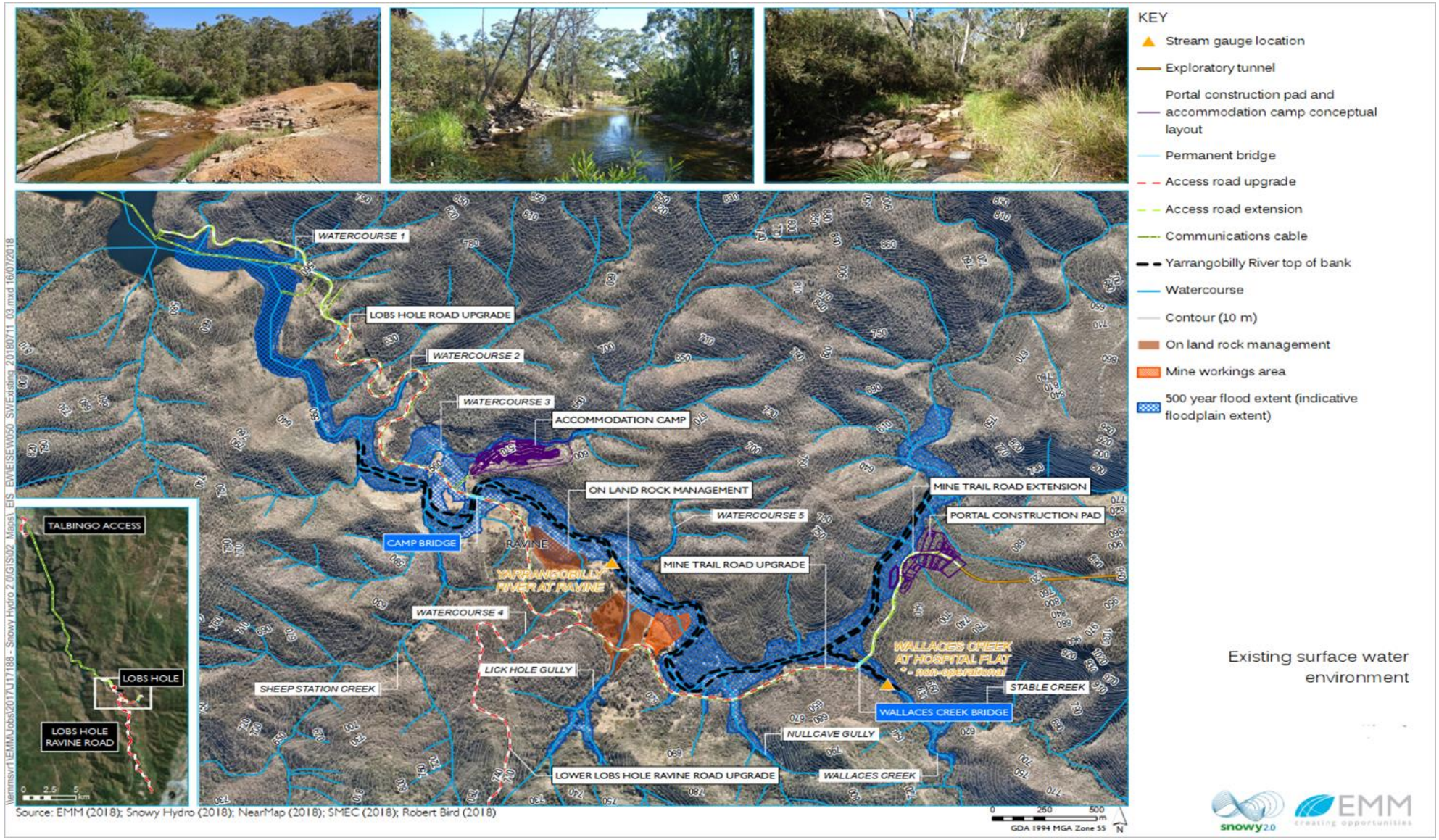

Figure 3-1: Existing surface water environment

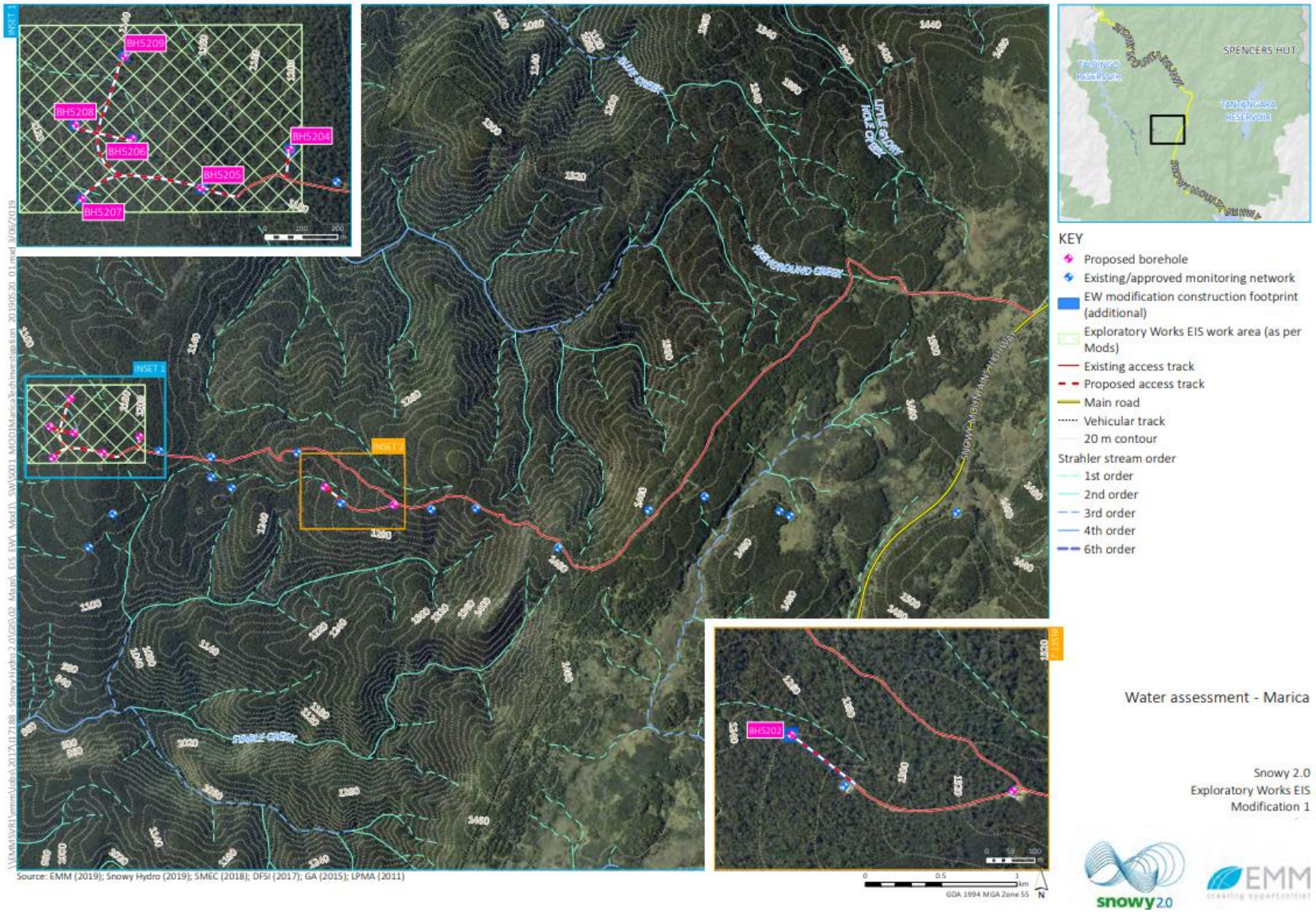

Figure 3-2: Watercourses - Marica Area (EMM, Modification 1)

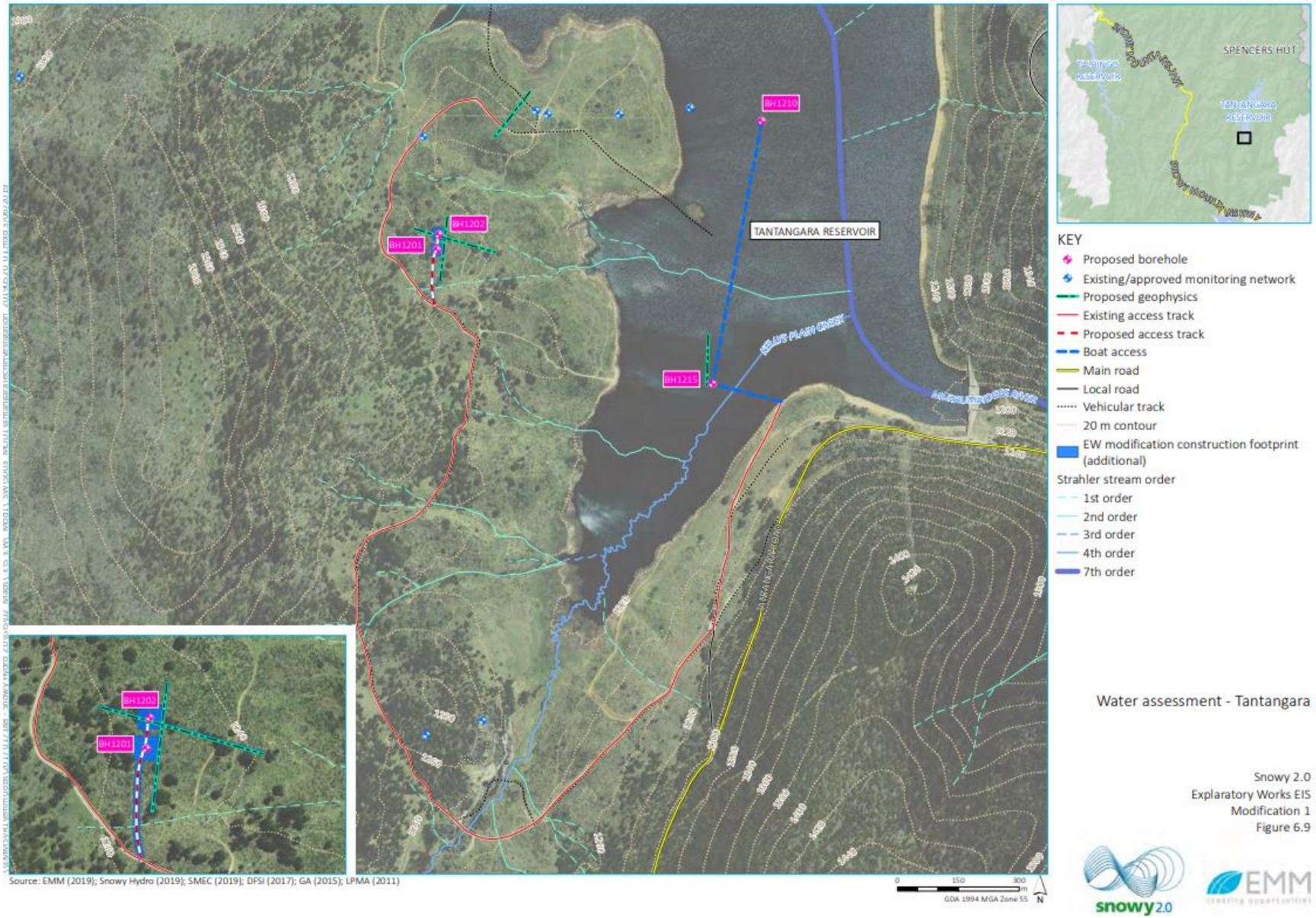

Figure 3-3: Watercourses – Tantangara (EMM, Modification 1)

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

4. SITE WATER BALANCE

4.1. Stage 1 – Exploratory Works (Roads)

During Stage 1 - Exploratory Works (Roads), construction water will be required for the following processes:

- earthworks to modify soil and gravel moisture conditions allowing proper compaction;
- dust suppression; and
- the wash down on plant and equipment.

During Stage 1 construction water will be sourced predominantly from the groundwater extraction from bores within Lobs Hole, the extraction of water from Talbingo Reservoir and the harvesting of water from the site erosion and sediment control basins.

It is currently predicted that the site demand for water demand during Stage 1 will be a maximum of 219 ML/year at peak construction sourced from a combination of one or more or more of the above or other approved water sources.

4.2. Stage 2 – Exploratory Works

The Project is located in a remote location with no municipal potable water supply available in the area. At the commencement of Stage 2 Exploratory Works groundwater bores will be the primary water source for construction activities. The quantity drawn from bores during initial site establishment is predicted to be no greater than the EIS assessed maximum bore extraction quantity of 354ML/year. The extraction figure will be consistent with groundwater extraction licence obtained by Snowy Hydro.

A services pipeline is to be constructed for the purpose of extracting water from the Talbingo Reservoir at Middle Bay. Extraction from Talbingo Reservoir via this pipeline will then be the primary water source for the majority of Stage 2 Exploratory Works. During Stage 2 – Exploratory Works, construction water will be required for the scope of works detailed in Section 2.8 of this Plan for construction purposes including:

- ground compaction for earthwork activities;
- dust suppression of potential dust generating activities;
- maintenance wash down of plant and equipment;
- concrete batching production;
- tunnelling and dewatering of the exploratory tunnel; and
- establishment and operation of the accommodation camp.

It is currently predicted that the site demand for water demand during Stage 2 will be a maximum of 227 ML/year (detailed in the EIS) at peak construction. The process water system will source additional water from the sediment basins as required to meet demand. Any surplus treated process water will be discharged to Talbingo Reservoir.

A preliminary Site Water Balance (Balance) was completed in the EIS and SWA, the objectives of which were to:

- demonstrate the functionality of the process water system over the 26-month tunnel construction period;

- estimate the probable range in water transfer volumes over the above period, having regard to variable weather conditions; and
- assist in the determination of water licensing requirements

The Balance estimated the probable range in water transfer volumes during the 26-month exploratory tunnel construction period. The model predicts the water management system functionality at the 1st, 12th and 26th month of tunnel construction considering the 10%, 50% and 90% rainfall conditions. The results from each scenario are presented in Table 4-1 as annualised monthly average.

The following modelling assumptions were applied in the Balance:

- Rainfall Data - Daily rainfall data from the Talbingo (72131) rainfall gauge over the January 1997 to December 2017 period was applied to the model.
- Evaporation Average - monthly evaporation and evapotranspiration rates were calculated for evaporation loss as a function of the evaporation rate and the surface area of the storage. A pan factor of 0.7 was applied to the calculation of evaporation losses from surface water storages. Evapotranspiration factors were applied in the hydrologic model to simulate evapotranspiration losses from catchments.

Table 4-1: Site Water Balance (EIS SWA)

	Water Balance - Tunnelling Month 1 (Ml/Mth)			Water Balance - Tunnelling Month 12 (Ml/Mth)			Water Balance - Tunnelling Month 26 (Ml/Mth)		
Rainfall Year Percentile	**10th**	**50th**	**90th**	**10th**	**50th**	**90th**	**10th**	**50th**	**90th**
Stormwater Summary									
Total runoff	1.71	2.08	3.19	1.88	2.28	3.19	1.89	2.29	3.20
Stormwater harvested	1.60	1.91	2.69	1.41	1.74	2.36	0.79	0.98	1.50
Overflows	0.28	0.38	0.50	0.47	0.55	0.83	1.10	1.31	1.70
Process Water Use Summary									
Total process water produced	17.89	17.42	16.28	18.01	17.53	16.48	19.16	18.55	18.01
Total process water use	17.90	17.42	16.28	17.90	17.42	16.28	17.89	17.42	16.28
Sources									
Tunnel affected water	0.79	0.79	1.09	5.82	5.82	5.82	13.71	13.71	13.71
Stormwater	1.60	1.91	2.69	1.41	1.74	2.36	0.79	0.98	1.50
Talbingo Reservoir	15.16	14.37	12.43	10.74	9.91	8.23	4.63	3.82	2.73
Tunnel Affected Water Summary									
Process water use	1.09	1.09	1.09	5.71	5.72	5.62	12.44	12.58	11.98
Talbingo Reservoir (controlled discharge)	0.00	0.00	0.00	0.12	0.10	0.20	1.27	1.13	1.72

The Site Water Balance for the maximum predicted tunnel water consumption level (Month 26 at 90th percentile rainfall conditions) is presented in Figure 4-1. Groundwater modelling undertaken for the Exploratory Works predicts that groundwater inflows into the tunnel will increase from zero

at tunnel commencement to 0.45 ML/day (161 ML/year) near completion. Hence the volume of water that requires management will progressively increase over the tunnel construction period. During initial site establishment and construction Future Generation will undertake groundwater monitoring in order to review and update the Balance (Section 5.1 and 5.3).

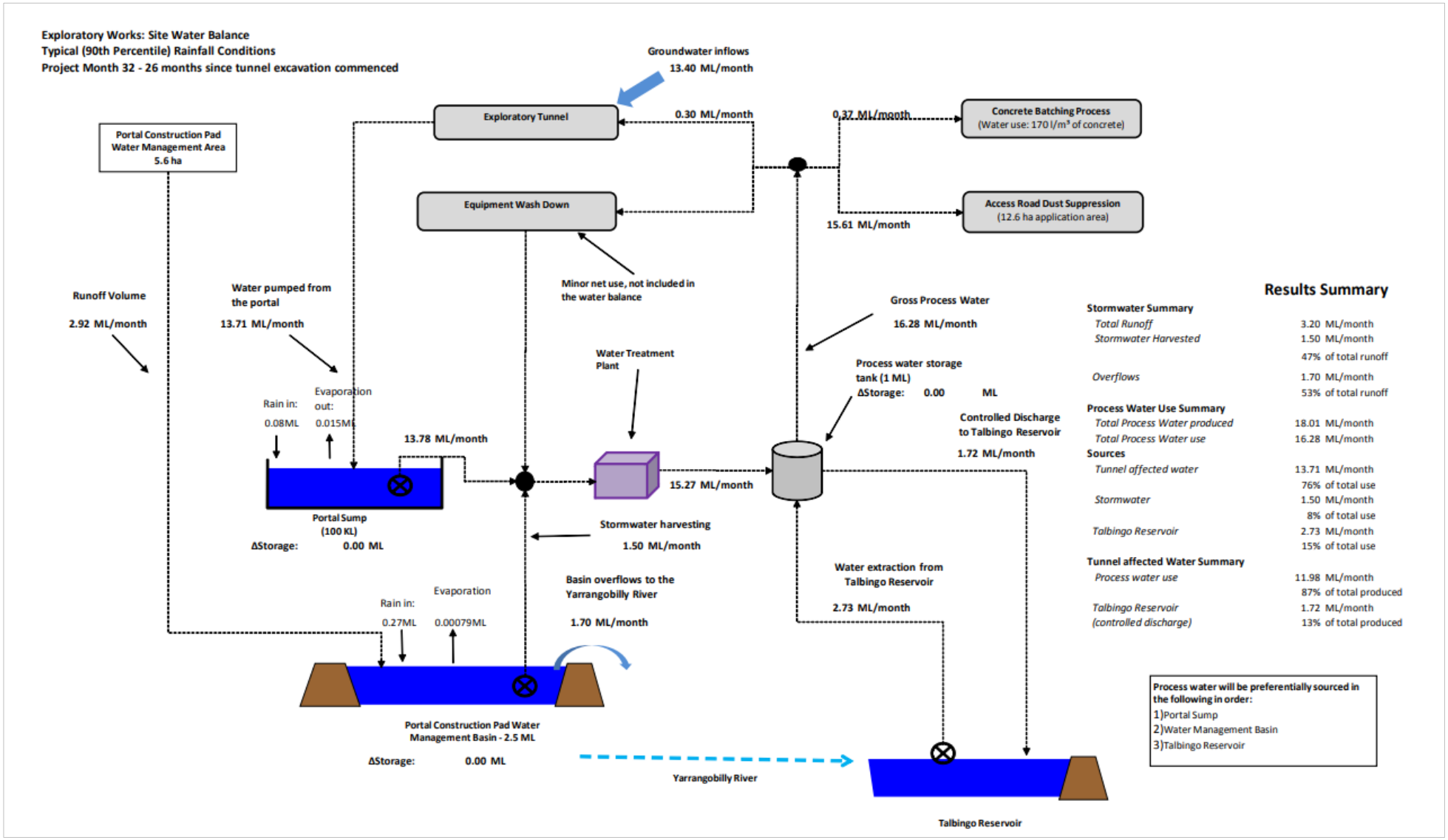

Figure 4-1: EIS Exploratory Works Water Balance flow diagram Month 26 median - rainfall year (EIS SWA)

The Balance is currently a conceptual model for Stage 2 works. Future Generation will continue to develop the Balance during construction and the completion of final tunnel design for the purpose of:

- demonstrating the functionality of the process water system for the duration of Exploratory Works
- estimate the probable range in water transfer volumes for the duration of Exploratory Works
- record, update and report on the water transfer volumes each calendar year for the duration of Exploratory Works

The Balance will be reviewed each calander year and included in future updates to the WMP. The next review will occur prior to the end of the 2020 calander year

4.2.1. Additional Water Consumption

It is noted that EIS Balance includes Total Process Water that is dust suppression and concrete batching water consumption (Table 4-1 and Figure 4-1) associated with tunnelling for the Exploratory Works. The below details the addition of the accommodation camp raw water consumption.

The 26-month 90th percentile rainfall EIS volumes in Table 4-1 have been updated to include the estimate for camp consumption in Table 4-2. The following predicted consumption rates are subject to change based on detailed design. These figures will be reviewed and updated in the annual Balance (Section 5.1) to reconcile transfer flow quantities.

The total consumption of potable camp water is 1.14 megalitres per month (ML/month) which, when tallied with the EIS process water use 11.98ML/month (based on the 26 month, 90th percentile rainfall rate) the Project consumption rate remains less that the required take maximum of 227ML/year. The volumes within this section are estimates only. The Project commits to not exceeding the EIS predicted 227ML/year against the approved scope of works for Exploratory Works. Volumes will be routinely reviewed and updated in accordance with Section 5.1 and Section 5.3 of this Plan.

Potable water consumption for accommodation camp

The water requirements for domestic supply is based on the provision of approximately 200L per person per day (pp/day) for the accommodation camps that provides shower, laundry and dining facilities. An additional 50L/pp/day potable water unit demand of will be provided for construction sites for the crib, toilet, office and first aid demand. At the peak of exploratory works 152 people will be occupying the accommodation camp. Based on these figures it is currently predicted that potable water consumption from the raw water in-take from Talbingo Reservoir will contribute approximately 1140kL/month.

Table 4-2: Site water balance updated with accommodation camp

Updated Water Balance - Tunnelling Month 26 (ML/mth)	
Rainfall year percentile	**90th**
Stormwater Summary	
EIS Total runoff	3.20
EIS Stormwater harvested	1.50
EIS Overflows	1.70
Process Water Use Summary	
Total process water produced	18.01
Total process water use	16.28
[1]Future Generation Raw to Potable accommodation camp consumed	1.14
[1]Total consumed process water	19.15
Sources	
EIS Tunnel affected water	13.71
EIS Stormwater	1.50
EIS Talbingo Reservoir	2.73
Tunnel Affected Water Summary	
EIS Process water use	11.98
EIS Talbingo Reservoir (controlled discharge)	1.72

[1] Underlined figures have been updated to include Future Generation estimates

5. COMPLIANCE MANAGEMENT

5.1. Monitoring and Inspection

Inspections of waterways surrounding the Project boundary will be undertaken consistent with the frequencies required for the surface water monitoring program detailed in Appendix A. Weekly environmental 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.

Monitoring including sampling of waterways surrounding the Project boundary will be undertaken specific to surface water monitoring program (Appendix A) and the groundwater monitoring program (Appendix B). These plans include requirements for the monitoring of water quantities extracted and used during construction in order to make comparisons against the site water balance model and groundwater model. Undertaking and reporting these comparisons are required under Schedule 3 Condition 34.

All baseline monitoring will be undertaken by Snowy Hydro.

5.2. Auditing

Audits of this Plan and the appendices will be undertaken to assess compliance against the requirements including relevant approvals, licences and guidelines detailed in Section 3 of this plan and requirements detailed in Section 8.3 of the EMS.

5.3. Reporting

Reporting will include monthly internal project reports and six-monthly compliance reports as required by the Infrastructure Approval. The six-monthly reports will track compliance against this Plan and its appendices consistent with the Infrastructure Approval and the REMMs. Reporting will be undertaken in accordance with Section 8.4 of the EMS.

Yearly calendar revision of the Site Water Balance will be undertaken and provided to DP&E. The next review will occur prior to the end of the 2020 calander year. This review will involve using monitored quantities to verify predicted quantities, adjust the Balance where required, and provide explanation of any differences between predicted and actual quantities. Any water infrastructure retrospectively added or changes in water access/extraction licences will be included in the revision on a yearly basis.

Reporting on surface waters is detailed in Appendix A including reporting on the surface water quality monitoring program exceedances of the established surface water trigger levels, revision of the appropriateness of the assessment criteria and impacts of the development during the reporting period.

Reporting on groundwater is detailed in Appendix B including:

- groundwater take from the identified groundwater bores in Appendix B including pre-construction level comparison
- groundwater inflow monitoring:
    - into the tunnel;
    - inflow into surrounding waterways from groundwater sources;
    - level monitoring on regional and local aquifers, groundwater dependent ecosystems, stygofauna and riparian vegetation for the purposes of analysis impacts on these items if any.

APPENDIX A – STAGE 2 – S2-FGJV-ENV-PLN-0025-SURFACE WATER MANAGEMENT PLAN

APPENDIX B – STAGE 2 - S2-FGJV-ENV-PLN-0026-GROUNDWATER MANAGEMENT PLAN

APPENDIX C – STAGE 2 - S2-FGJV-ENV-PLN-0027-DREDGING MANAGEMENT PLAN

APPENDIX D – STAGE 2 – REVISED ENVIRONMENTAL MANAGEMENT MEASURES

Table D 1: Revised Environmental Management Measures relevant to the Surface Water Management Plan

Impact	Reference		Revised Environmental Management Measures	Where addressed
Impact to aquatic ecology from erosion and sedimentation	ECO14	1	The water quality controls described in in WAT01 to WAT05 and WM1.1 to WM 8.8 will be implemented.	WMP - Appendix A Surface Water Management Plan
Impacts to aquatic habitat and biota during dredging and subaqueous placement	ECO15	1	The subaqueous placement monitoring program for Talbingo Reservoir will be developed and implemented.	WMP - Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan
		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;	WMP – Appendix A Surface Water Management Plan WMP –Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan
		3	Measures relevant to aquatic ecology will be implemented as described below including: • the extent of the placement area will be minimised as far as practicable;	Subaqueous Emplacement Management Plan
		4	Measures relevant to aquatic ecology will be implemented as described below including: • the extent of the dredge footprint will be minimised as far as practicable;	WMP - Appendix C Dredging Management Plan
		5	Measures relevant to aquatic ecology will be implemented as described below including: • subaqueous placement would not occur shallower than 3 m below minimum operating level (i.e. where aquatic habitat, such as aquatic plants are less likely to occur);	Subaqueous Emplacement Management Plan
		6	Measures relevant to aquatic ecology will be implemented as described below including: • placement of large rocks within the placement area will occur and is expected to enhance the value of this habitat for fish and mobile invertebrates by providing hard surface and refuges;	
		7	Measures relevant to aquatic ecology will be implemented as described below including: • un-necessary noise and vibration disturbances should be kept to a minimum where practicable to avoid impacts to fish and other aquatic species;	WMP - Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan
		8	Measures relevant to aquatic ecology will be implemented as described below including: • removing wood debris from within the dredge footprint and subaqueous placement location and spreading it back into the reservoir in relatively shallow water (0-10 m) where	

Impact	Reference		Revised Environmental Management Measures	Where addressed
			fish are more likely to occur;	
		9	Measures relevant to aquatic ecology will be implemented as described below including: • where feasible, mapping/identification of aquatic habitats within and adjacent to the subaqueous placement areas and other reference areas to characterise the habitat and place this in context of that present throughout the entire reservoir; and	WMP - Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan Aquatic Habitat Management Plan
		10	Measures relevant to aquatic ecology will be implemented as described below including: •mapping of aquatic habitats would include searches for crayfish burrows along the shoreline, as these could indicate the presence of Murray crayfish and would inform the final placement area extent. Deployment of crayfish traps along the shorelines adjacent to the placement area and within the placement area could be used to re-locate any large mobile invertebrates (including any Murray crayfish) from these areas to nearby sections of the reservoir that would not be affected by placement;	
		11	Measures relevant to aquatic ecology will be implemented as described below including: • prior to commencement of seismic surveys, smaller releases of compressed air will be undertaken just below the surface;	WMP - Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan
		12	Measures relevant to aquatic ecology will be implemented as described below including: • during seismic surveys, operators will be vigilant to potential harm to fish and invertebrates. If any harmed or dead biota are observed during works then this would result in the scaling back of works or review and adjustment of methodology (e.g. magnitude, frequency and/or duration of releases);	
		13	Measures relevant to aquatic ecology will be implemented as described below including: • minimising suspension of sediment and turbidity by implementing WAT14 and WAT15.	WMP – Appendix A Surface Water Management Plan WMP - Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan
Impacts to soil resources	SOIL01	1	Soil management procedures (including stripping, stockpiling and application) will be implemented as part of the CEMP.	WMP - Appendix A Surface Water Management Plan Excavated Material Management Plan
		2a	The objectives of soil management will be to: • preserve as much of the topsoil and subsoil as possible;	
		2b	The objectives of soil management will be to: • minimise the risk of contamination;	
		2c	The objectives of soil management will be to: • minimise the risk of any topsoil degradation or compaction during construction and following reinstatement;	WMP - Appendix A Surface Water Management Plan Excavated Material Management Plan

Impact	Reference		Revised Environmental Management Measures	Where addressed
		2d	The objectives of soil management will be to: • ameliorate subsoil where required for use in rehabilitation works;	WMP - Appendix A Surface Water 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	WMP - Appendix A Surface Water 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.	
		3	Topsoil and subsoil will be stripped, stockpiled and handled during construction to avoid degradation.	
		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;	
		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;	
		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;	
		4d	Management measures that will be implemented include: • nutrient decline will be minimised by managing stockpile methods and heights;	WMP - Appendix A Surface Water Management Plan
		4e	Management measures that will be implemented include: • stockpiles will be regularly inspected for weeds; and	
		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.	
Erosion and sediment transport	SOIL02	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.	
Flood risks	FM1.1	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;	
Leaching/ running	WAT01	1	Management measures will be implemented to minimise potential environmental impacts to	

Impact	Reference		Revised Environmental Management Measures	Where addressed
into groundwater/ creeks			water and soil from hydrocarbon and chemical spills and leaks including • minimizing direct access to the river by construction vehicles and mechanical plant;	
		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;	
		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;	
		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;	
		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;	
		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;	
		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;	
		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;	
		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;	
		10	Management measures will be implemented to minimise potential environmental impacts to	

Impact	Reference		Revised Environmental Management Measures	Where addressed
			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;	
		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	
		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;	WMP - Appendix A Surface Water Management Plan
Surface and groundwater	WAT02	1	A Surface and Groundwater Monitoring Program will be developed and implemented to monitor the effectiveness of water quality controls.	WMP - Appendix A Surface Water Management Plan and The 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;	
		3	The program will include: • monitor groundwater inflows indirectly through the process water system and groundwater levels as well as groundwater quality during construction; and	WMP – Appendix B Groundwater Management Plan
		4	The program will include: • set out annual monitoring requirements for Yarrangobilly Caves and plant community types potentially reliant on groundwater.	
	WAT03	1	Areas of groundwater inflow will be shotcrete or sealed by other methods to minimise further ingress.	
	WAT03	2	If groundwater is intercepted and reductions to groundwater inflows to watercourses predicted, then groundwater should be discharged to waterways. This would occur following appropriate treatment of discharge water.	
Impacts from barge access construction	WAT04	1	A dredge environmental management plan (DEMP) and associated mitigation measures will be implemented for dredging and construction of barge access infrastructure including:	WMP - Appendix C Dredging Management Plan
		2	including: • a water quality monitoring program at the dredge area prior to, during and following completion of dredging and barge access infrastructure construction works;	
		3	including: • installation of silt curtains around dredging and active construction work areas within waterways;	
		4	including:	

Impact	Reference		Revised Environmental Management Measures	Where addressed
			• selecting uncontaminated granular fill with less than 2% fines and selecting granular bedding material;	
		5	including: • ensuring skip bins for land disposal of excavated material are watertight;	
		6	including: • all activities would be carried out in a manner that minimises the potential for leaks and spills and in compliance with waste handling and disposal procedures outlined in the DEMP;	
		7	including: • establishing a bunded area and sediment and erosion control measures around the land disposal area;	
		8	including: • subaqueous placement of dredge spoil will include the mitigation measures described in WAT17;	WMP - Appendix C Dredging Management Plan and the Subaqueous Emplacement Management Plan
		9	including: • subaqueous placement of any dredged material would be in a confined placement location rather than spreading the material across a wider section of the reservoir bed;	
		10	including: • a silt curtain would be placed around the backhoe dredger or other suitable equipment at the dredge area; and	WMP - Appendix C Dredging Management Plan
		11	including: • the dredged material once placed on barges would not be drained at the dredging site. Barges for subaqueous placement and skip bins for land placement would be watertight.	WMP - Appendix C Dredging Management Plan
Spills of hydrocarbons	WAT11	1	Procedures to address spills and leaks will be developed and implemented as part of the CEMP.	WMP - Appendix A Surface Water Management Plan
Controls for construction disturbance areas Controls for all construction areas	WM1.1	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;	
	WM1.2	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.;	
	WM1.3	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	

Impact	Reference		Revised Environmental Management Measures	Where addressed
			watercourses; and.	
	WM1.4	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.	
	WM2.1	1	An Erosion and Sediment Control Plan (ESCP) will be prepared for each construction area.	
		2	Each ESCP will: • consider local soil characteristics, clean water management and the proposed construction methods;	
		3	Each ESCP will: • apply all practical source control and rehabilitation methods; and	
		4	Each ESCP will: • be progressively amended as required during construction.	
		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.	WMP - Appendix A Surface Water Management Plan
	WM2.7	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 2,500 m^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.	
	WM2.2	1	The clean water management controls WM_1.1 to 1.4 apply to all ESCPs.	
	WM2.3	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.	
	WM2.4	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	WMP - Appendix A Surface

Impact	Reference		Revised Environmental Management Measures	Where addressed
			erosion and soil loss. This will also provide good mulch for native plant establishment.	Water Management Plan
	WM2.5	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.	
Additional controls for construction areas that are constrained by terrain or the proposed disturbance boundary	WM2.6	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	
Additional controls for construction areas that are not constrained by terrain	WM2.8	1	When practical, water captured in sedimentation basins will be used for dust suppression.	
Water management controls for access roads Controls for all access roads	WM3.1	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;	
	WM3.2	1	all cut and fill batters will be stabilised as soon as practicable;	
	WM3.3	1	The clean water management controls WM_1.1 to 1.4 will apply to the design of all access roads.	
	WM3.4	1	• access road surfaces will be maintained with appropriate aggregate material to reduce the risk of erosion;	
	WM3.5	1	• 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 as required;	
	WM3.6	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;	
Additional controls for access roads that are not constrained	WM3.7	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	

Impact	Reference		Revised Environmental Management Measures	Where addressed
by terrain or the proposed disturbance footprint.			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.	
Water management controls for the accommodation camp	WM4.1	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.	WMP - Appendix A Surface Water Management Plan
	WM4.2	1	Clean water from upslope areas will be diverted around the accommodation camp.	
	WM4.3	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.	
	WM4.4	1	All pervious areas including batters will be vegetated with endemic native vegetation where practicable.	
	WM4.5	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.	
	WM4.6	1	Source controls including permeable pavers and rain gardens will be used where practicable.	
	WM4.7	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.	
	WM4.8	1	Collectively, the stormwater controls will be sized and configured to achieve the water quality specifications provided in SWA Table 6.12.	
	WM4.9	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.	
Water management controls for the portal construction pad	WM5.1	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.	
	WM5.2	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.	WMP - Appendix A Surface Water Management Plan

Impact	Reference		Revised Environmental Management Measures	Where addressed
	WM5.3	1	Clean water from upslope areas will be diverted through or around the portal construction pad in a designated clean water drainage system.	
	WM5.4	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.	
	WM5.5	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.	WMP - Appendix A Surface Water Management Plan and Excavated Material Management Plan
	WM5.6	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.	
	WM5.7	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.	WMP - Appendix A Surface Water Management Plan
Water management controls for the process water system	WM6.1	1	A process water management system will be established to manage any potentially contaminated water that may be produced by the construction activities.	
	WM6.2	1	The process water management system will be separated from the stormwater system to avoid uncontrolled overflows associated with stormwater ingress.	
	WM6.3	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 the RTS.	
	WM6.4	1	The process water management system will have the ability to extract water from the portal	

Impact	Reference		Revised Environmental Management Measures	Where addressed
			construction pad's water management basin. This will be done to top-up supply.	
	WM6.5	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).	
Water management controls for the waste water management system	WM7.1	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.	
	WM7.2	1	Water efficient fittings will be used to minimise waste water loads.	
	WM7.3	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.	WMP - Appendix A Surface Water Management Plan
	WM7.4	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.	
	WM7.5	1	A waste water treatment plant will meet the water quality specifications provided in Table 4.4 of the RTS.	
	WM7.6	1	Treated waste water will be disposed to Talbingo Reservoir via the controlled discharge pipeline.	
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.	WMP - Appendix A Surface Water Management Plan and Excavated Material Management Plan
	WM_8.6	1	Runoff from Lock 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 even occurs.	
	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.	

Impact	Reference		Revised Environmental Management Measures	Where addressed
Flood risks	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	WMP - Appendix A Surface Water Management Plan
	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.	
	FM_1.2	1	The western emplacement will be designed to prevent the risk of emplacement material being entrained in flood waters during a 1 in 5000 year flood event.	
	FM_1.3	1	Flood emergency procedures will be prepared in implemented as part of the Emergency Response Plan.	Emergency Response Management Plan
Modification 1				
Borehole drilling	M1.6	1	During borehole drilling slurries used will be of appropriate grade and composition such that it poses no threat to groundwater quality should it infiltrate intersected aquifers.	WMP - Appendix B Groundwater Management Plan
Clean water	M1.8	1	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.	WMP - Appendix A Surface Water Management Plan
Regrading	M1.9	1	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.	WMP - Appendix A Surface Water Management Plan Rehabilitation Management Plan
Refuelling	M1.10	1	A refuelling protocol will be developed for in-reservoir borehole drilling and will be included in the Construction Environment Management Plan (CEMP).	WMP - Appendix A Surface Water Management Plan
Erosion and sedimentation	M1.11	1	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.	WMP - Appendix A Surface Water Management Plan
Spills	M1.12	1	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.	WMP - Appendix A Surface Water Management Plan

Impact	Reference		Revised Environmental Management Measures	Where addressed
			• 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.	
Flooding	M1.13	1	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 Plan
Modification 2				
Barge ramp establishment	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

APPENDIX E – EXPLORATORY WORKS – PROJECT BOUNDARY FIGURES

APPENDIX 2 – SITE LAYOUT

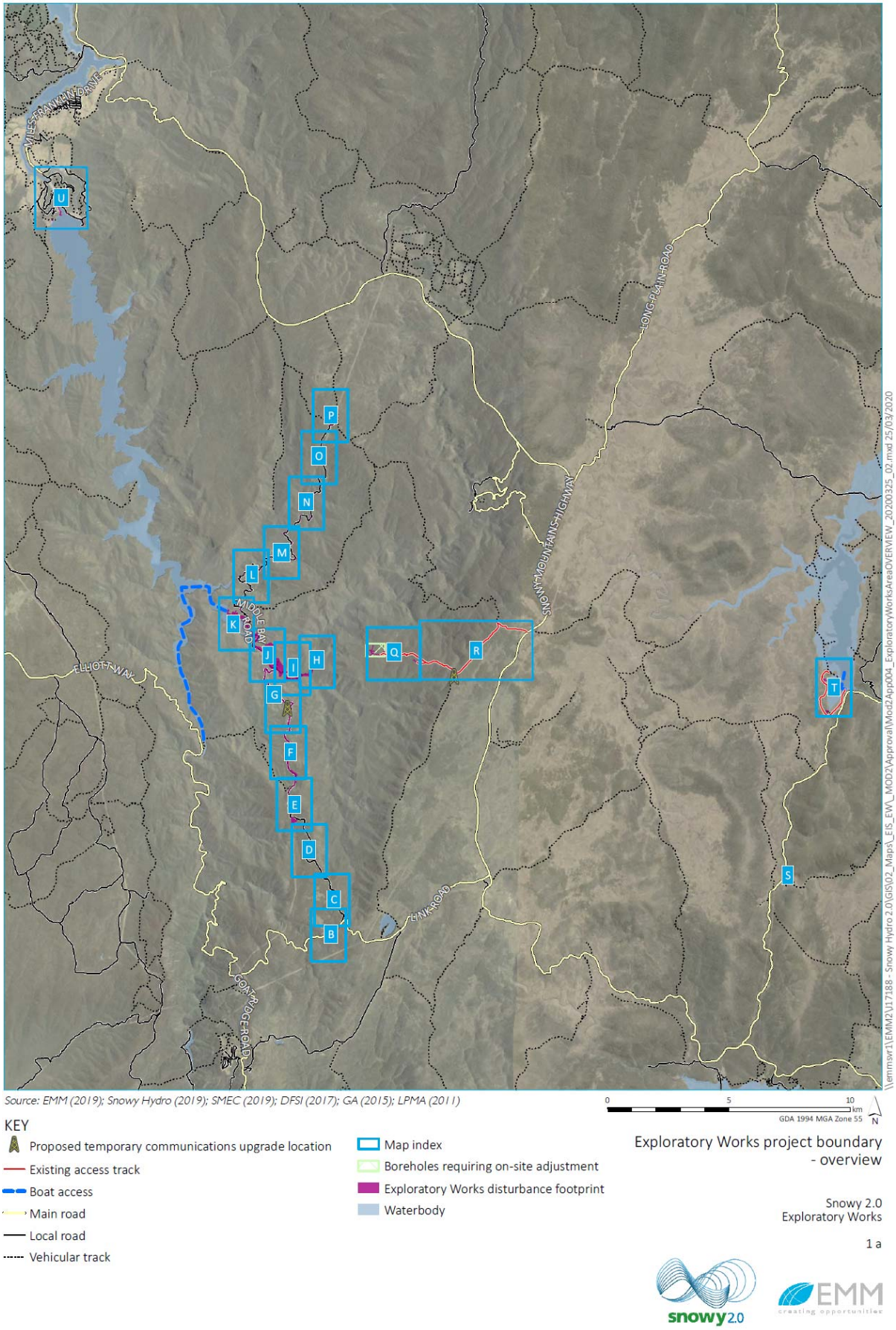

Figure 2-1: Project *Boundary – Overview*

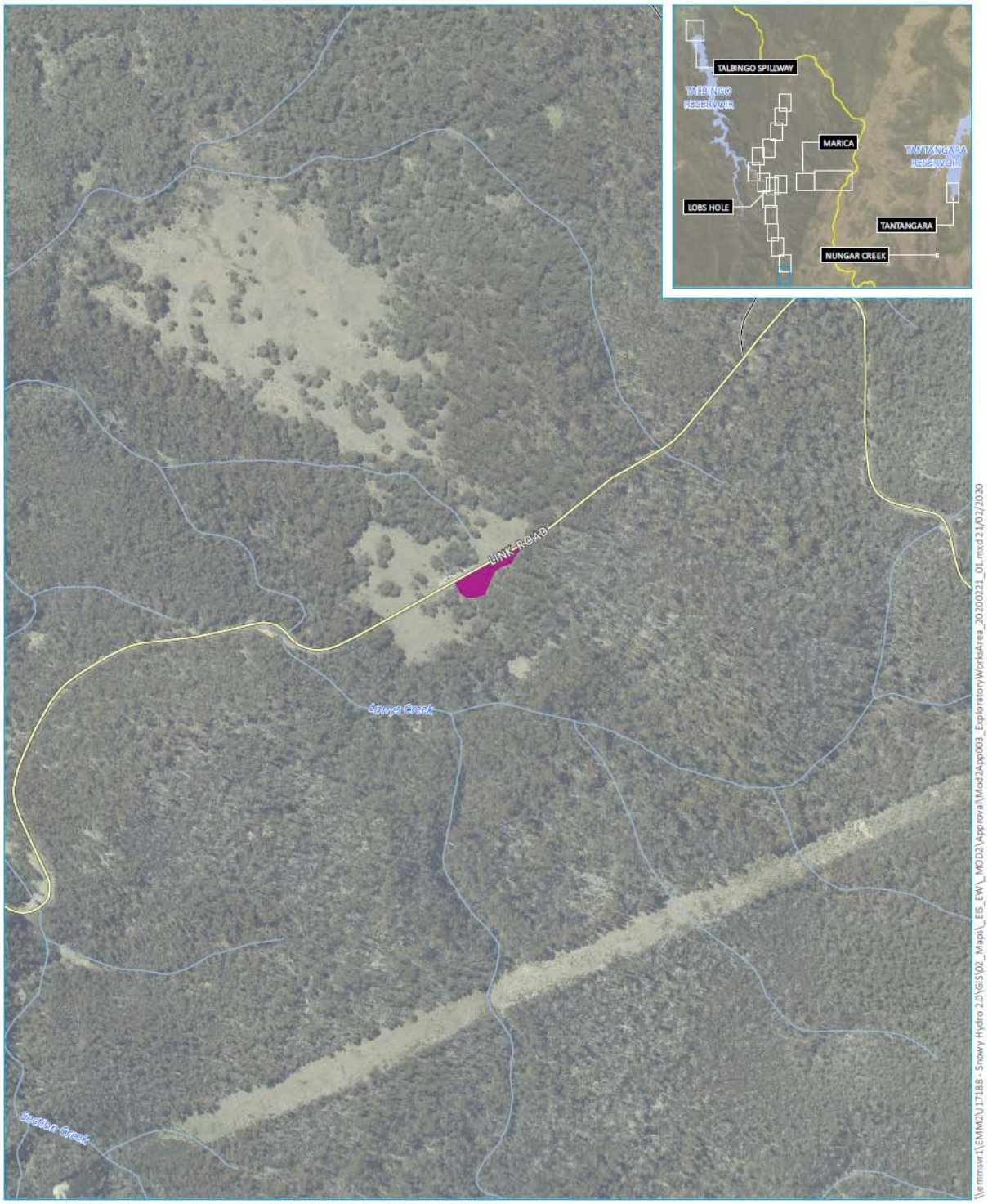

Figure 2-2: *Project Boundary – Link Road turnaround area*

Figure 2-3: *Project Boundary – Lobs Hole Ravine Road (Upper) 1*

Figure 2-4: *Project Boundary – Lobs Hole Ravine Road (Upper) 2*

Figure 2-5: *Project Boundary – Lobs Hole Ravine Road (Upper) 3*

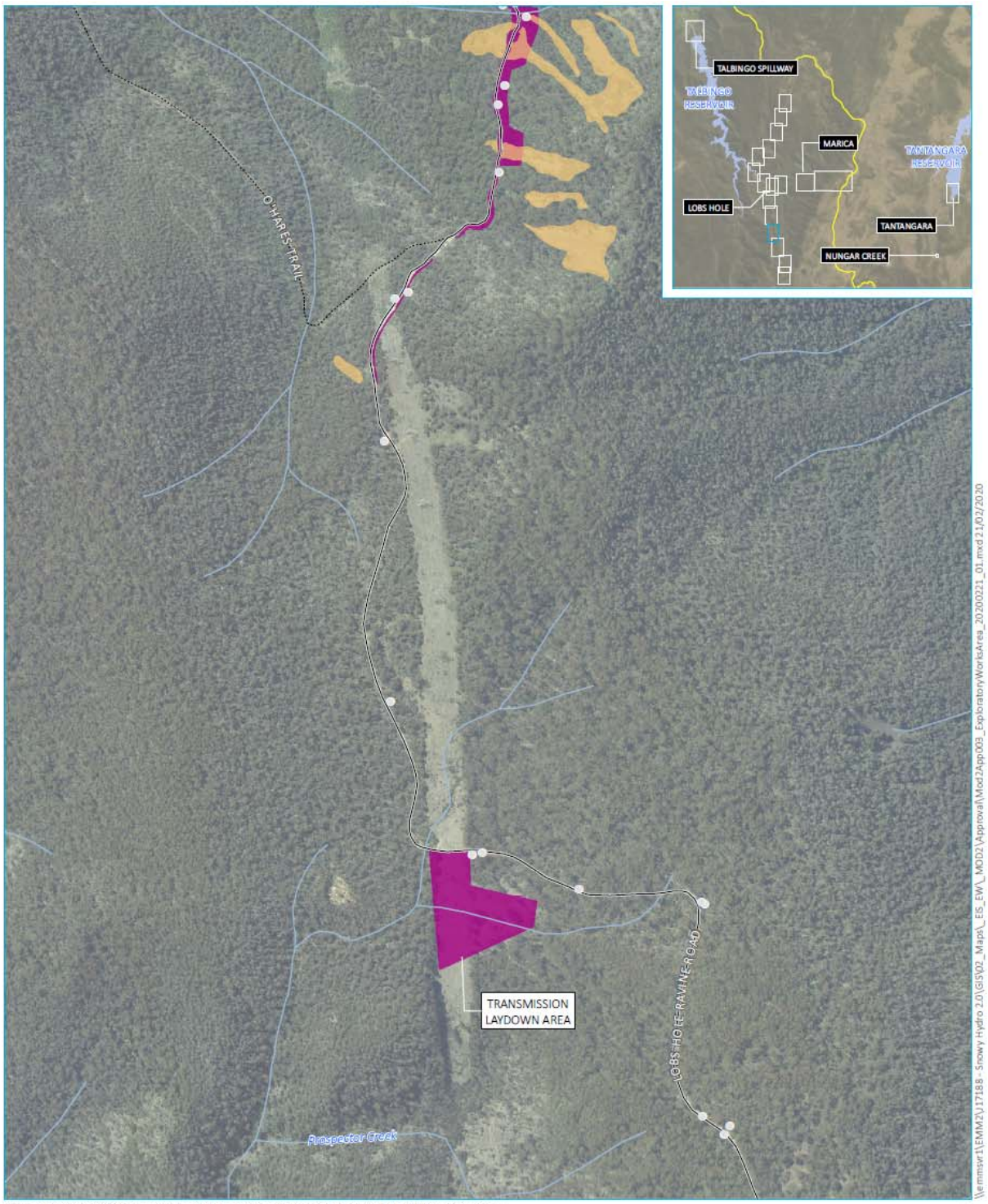

Figure 2-6: *Project Boundary – Lobs Hole Ravine Road (Upper) 3*

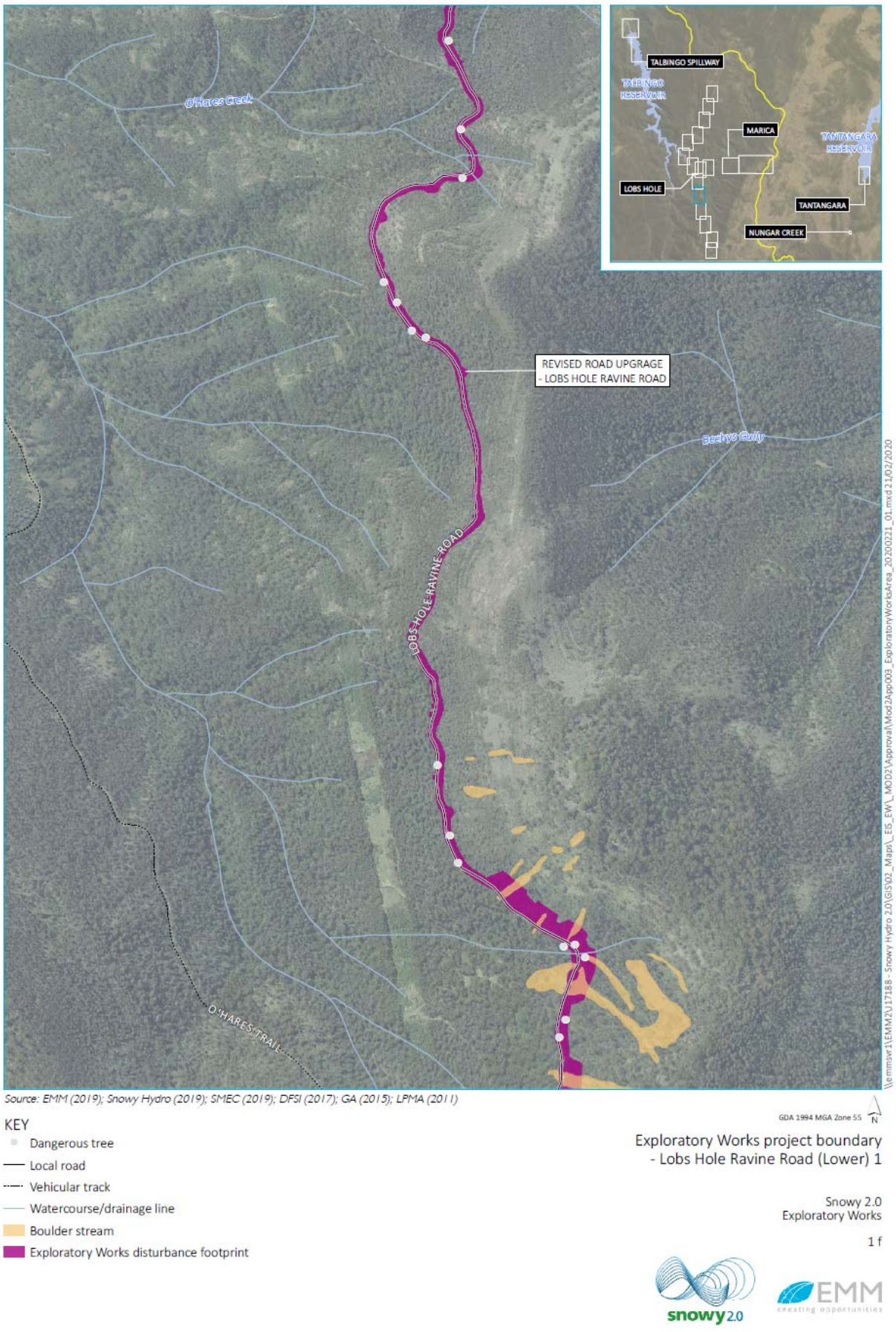

Figure 2-7: *Project Boundary – Lobs Hole Ravine Road (Lower) 1*

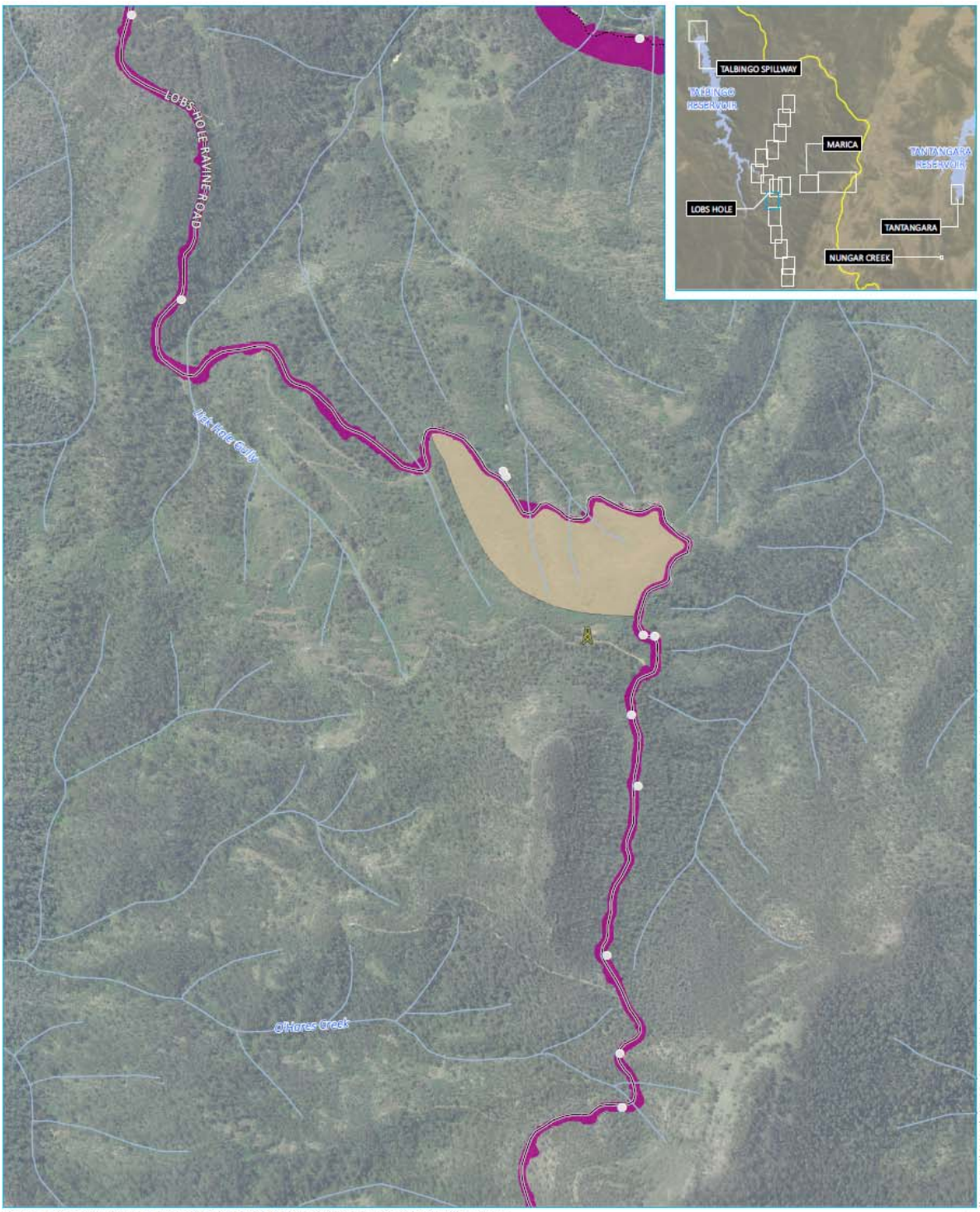

Figure 2-8: *Project Boundary – Lobs Hole Ravine Road (Lower) 2*

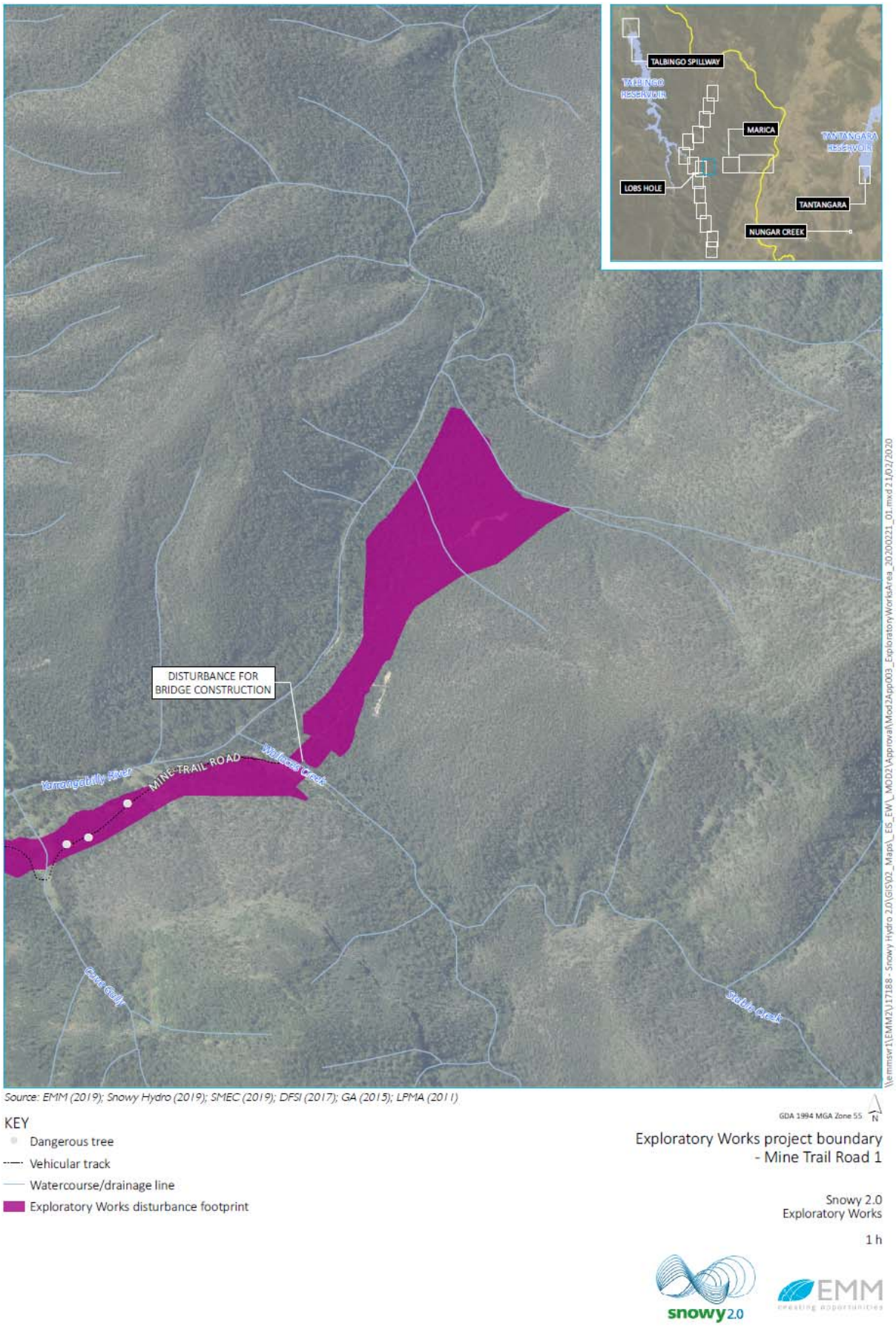

Figure 2-9: *Project Boundary – Mine Trail Road 1*

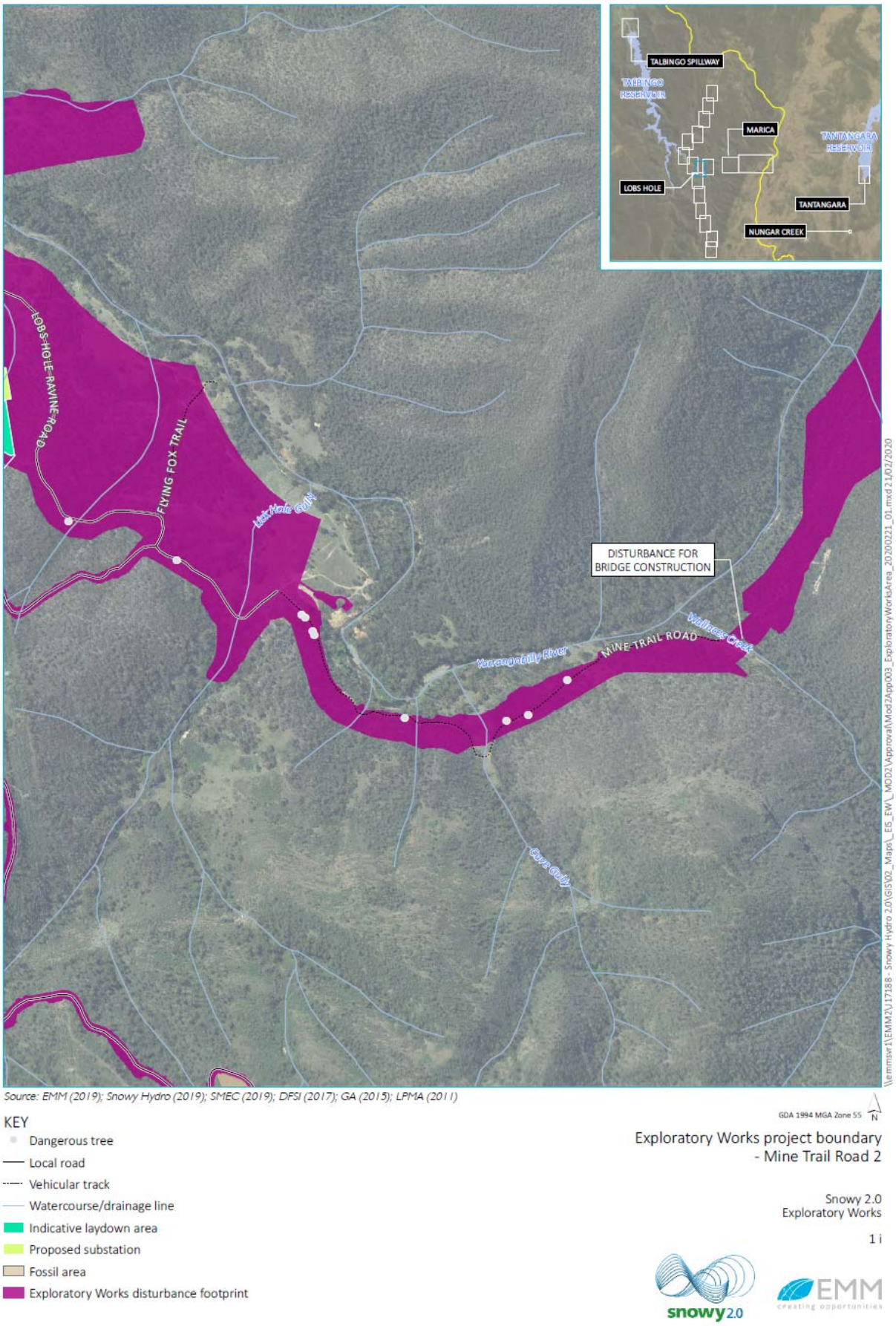

Figure 2-10: *Project Boundary – Mine Trail Road 2*

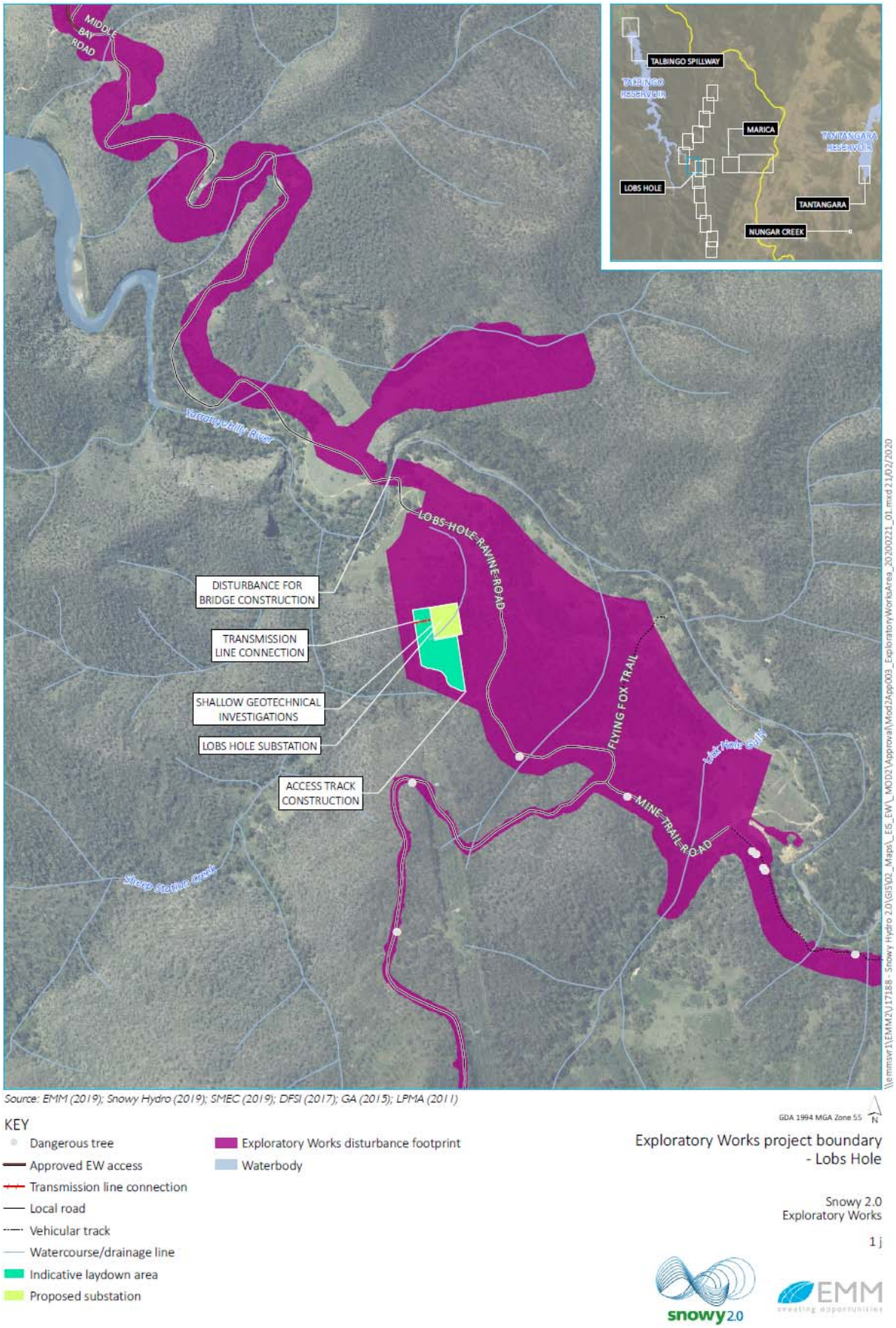

Figure 2-11: *Project Boundary – Lobs Hole*

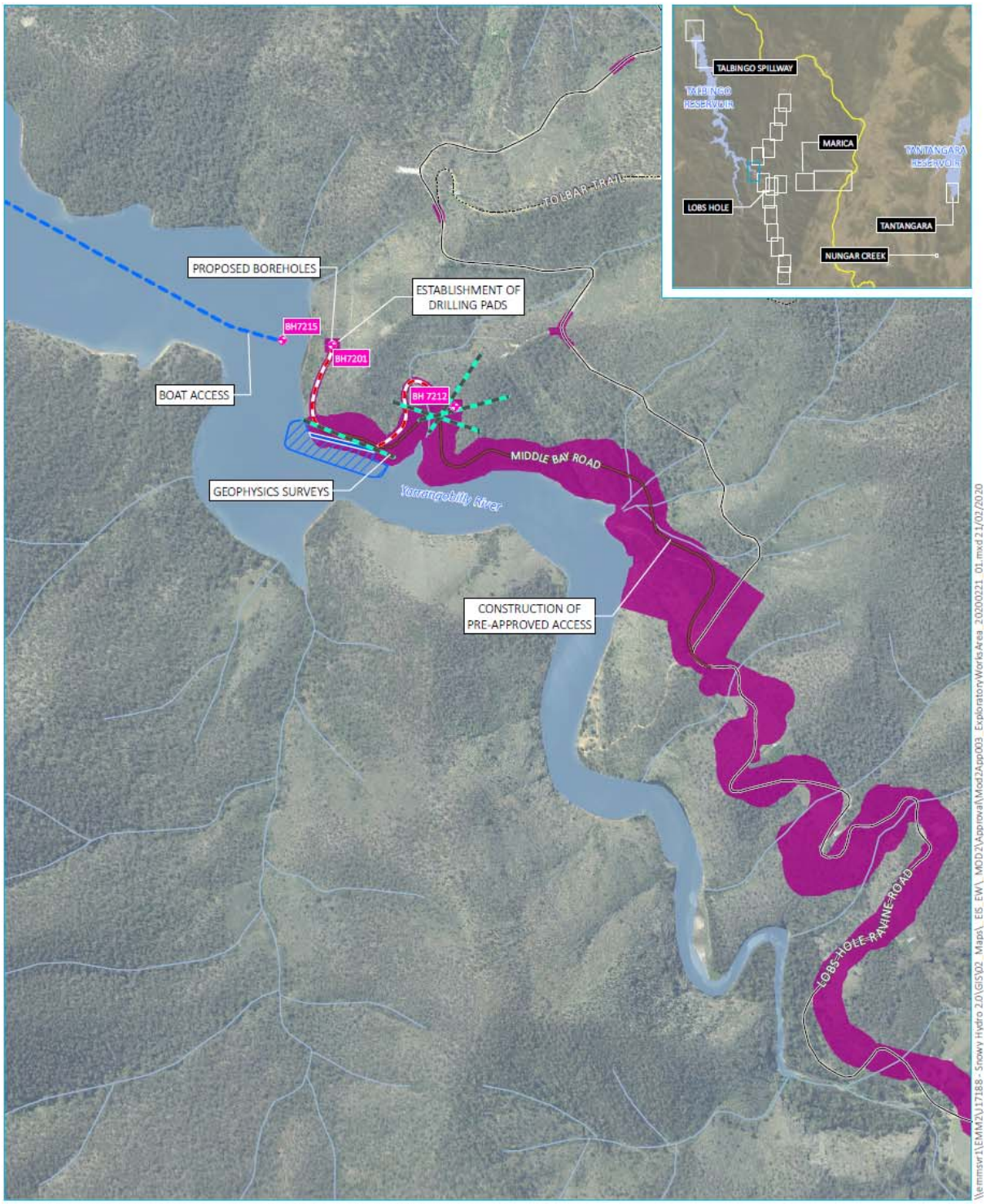

Figure 2-12: *Project boundary – Lobs Hole Ravine Road*

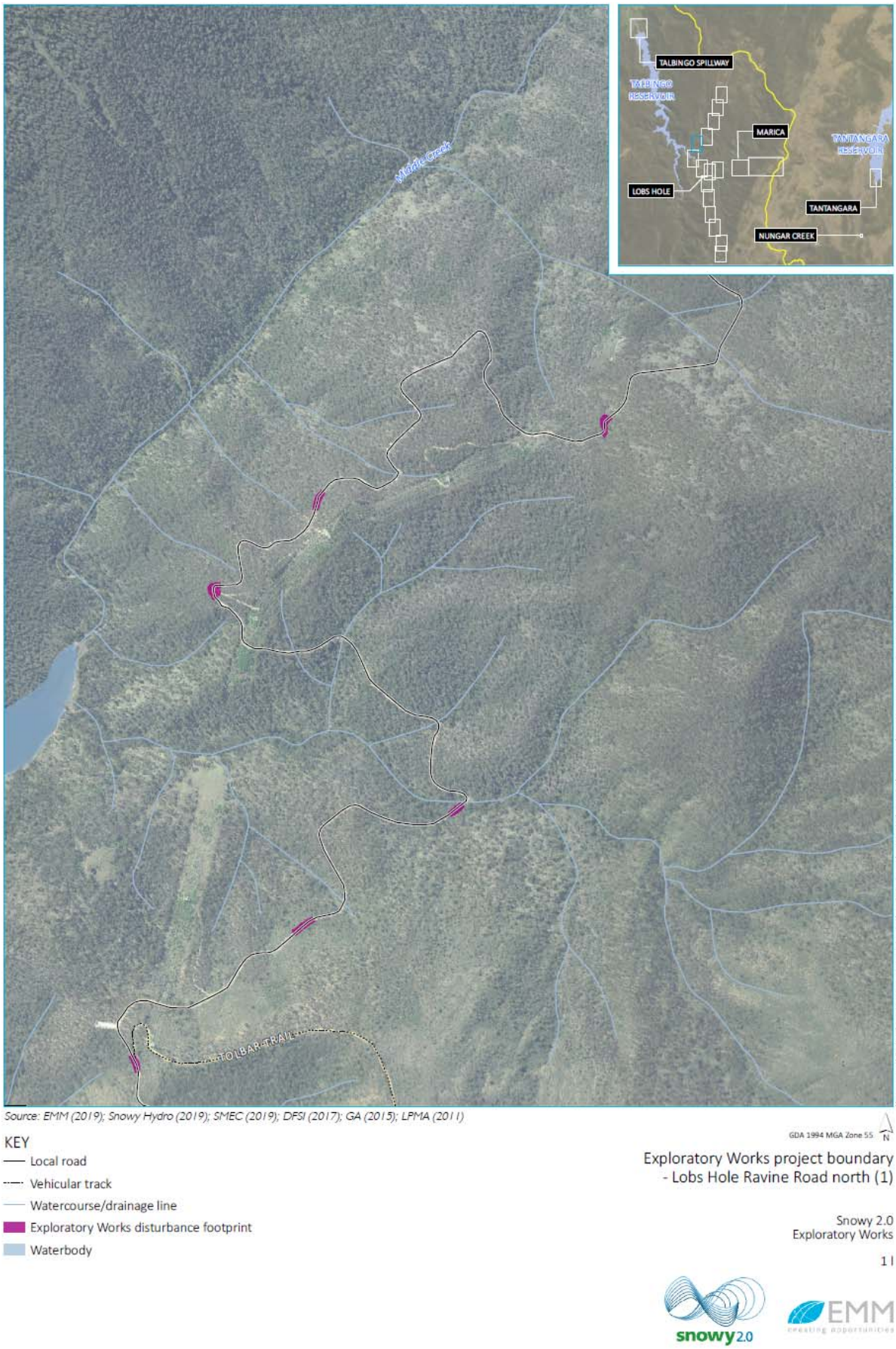

Figure 2-13: *Project boundary – Lobs Hole Ravine Road north (1)*

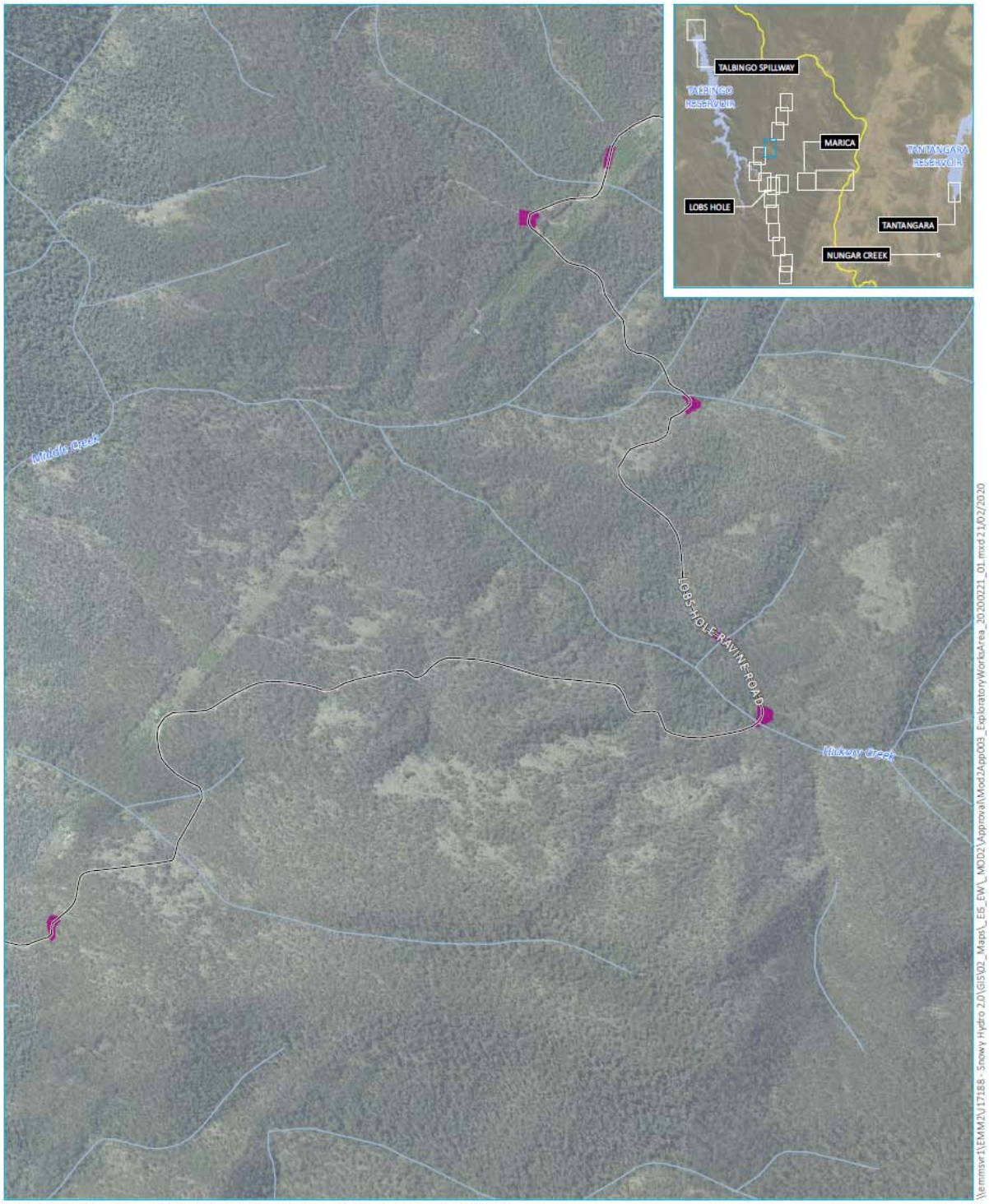

Figure 2-14: *Project boundary – Lobs Hole Ravine Road north (2)*

Figure 2-15: *Project boundary – Lobs Hole Ravine Road north (3)*

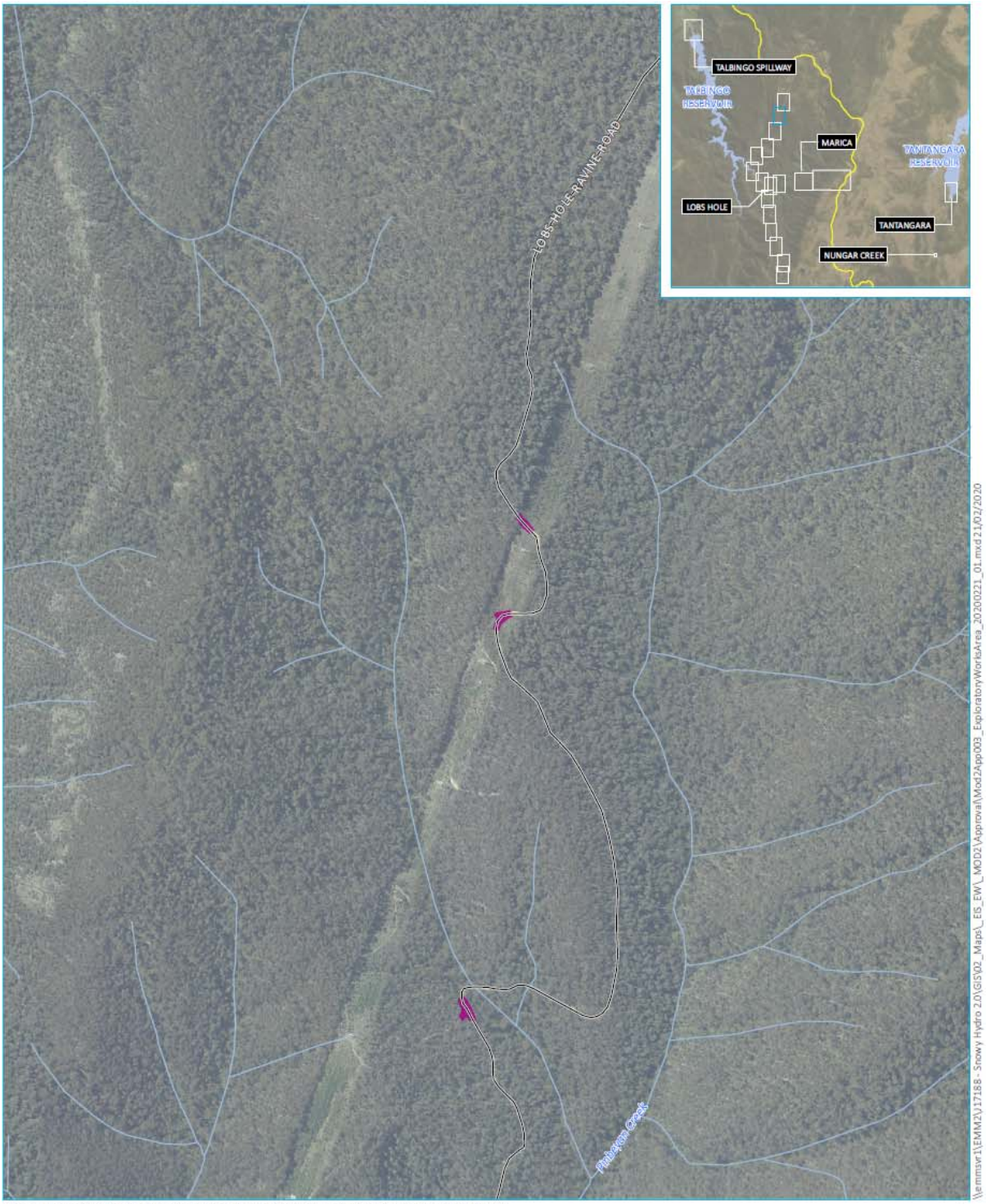

Figure 2-16: *Project boundary – Lobs Hole Ravine Road north (4)*

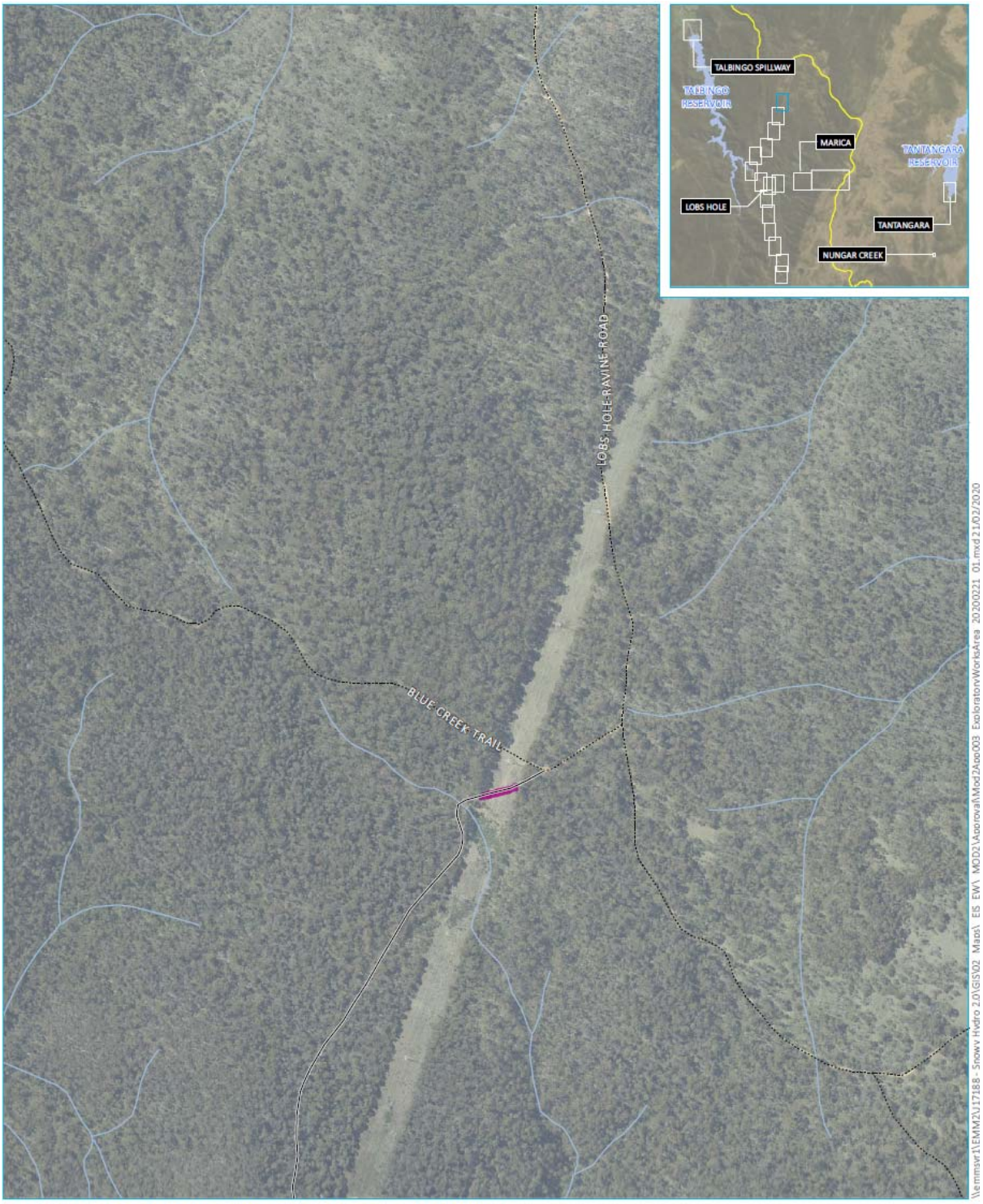

Figure 2-17: *Project boundary – Lobs Hole Ravine Road north (5)*

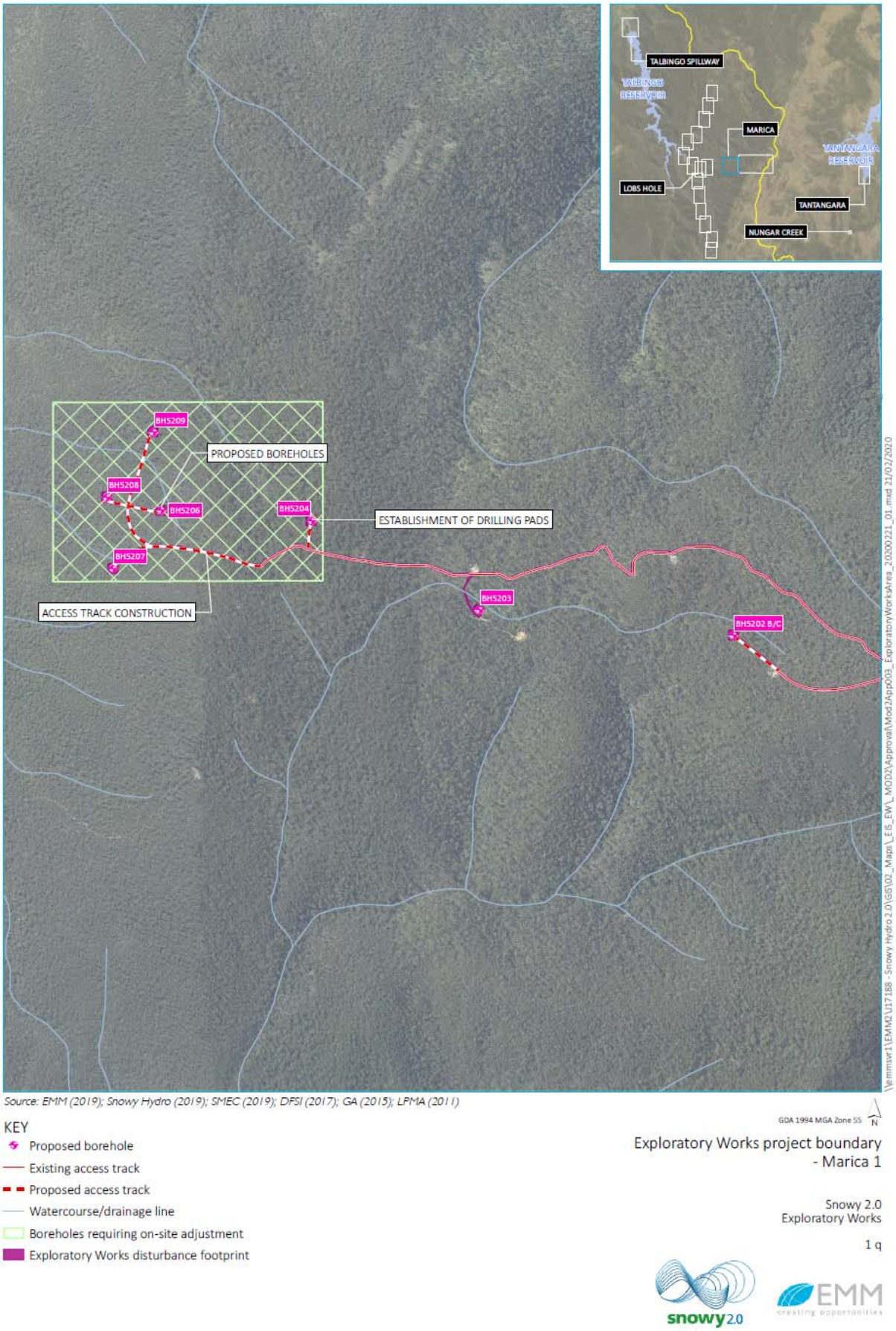

Figure 2-18: *Project boundary – Marica 1*

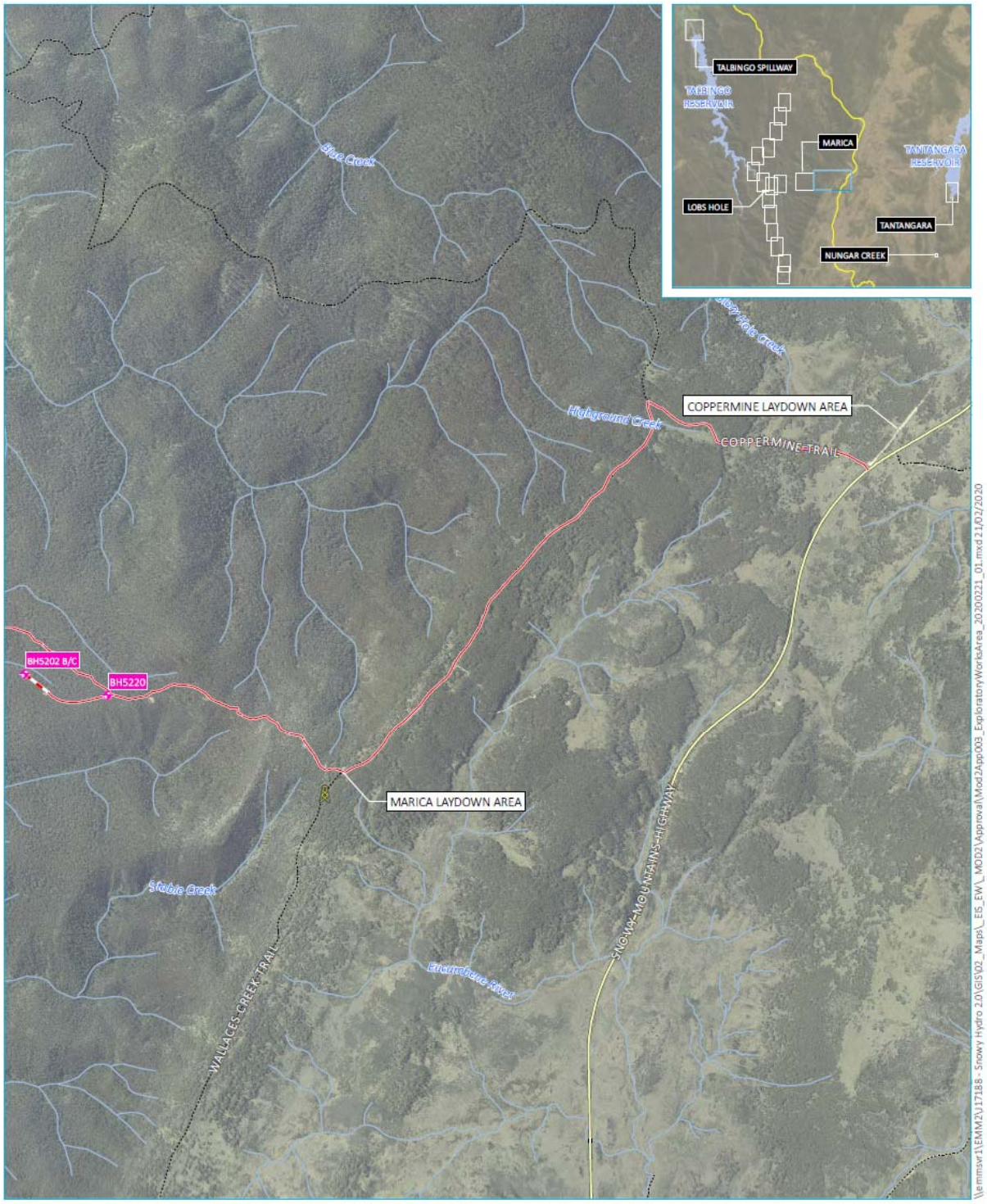

Figure 2-19: *Project boundary – Marica 2*

Figure 2-20: *Project boundary – Nungar Creek*

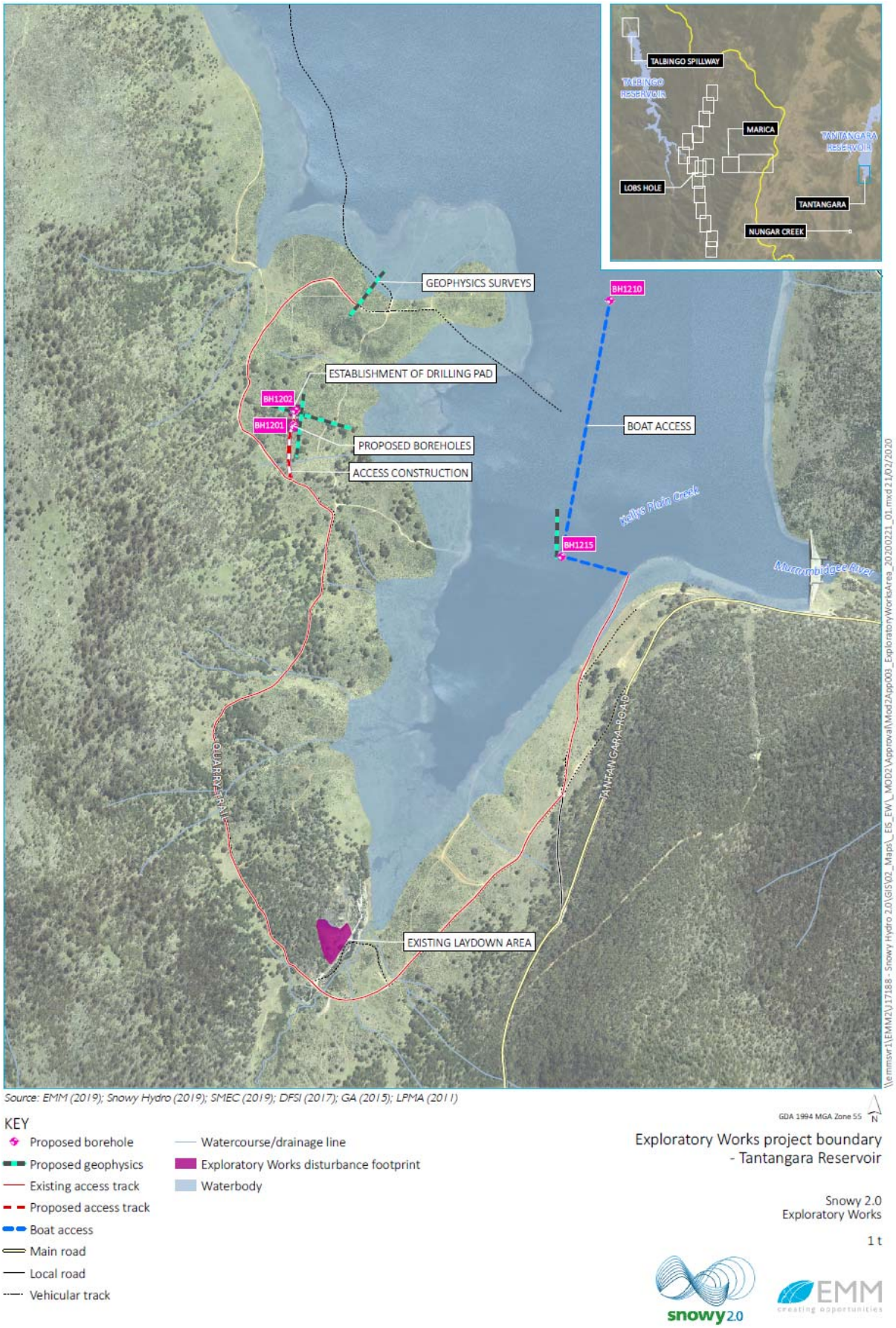

Figure 2-21: *Project boundary – Tantangara Reservoir*

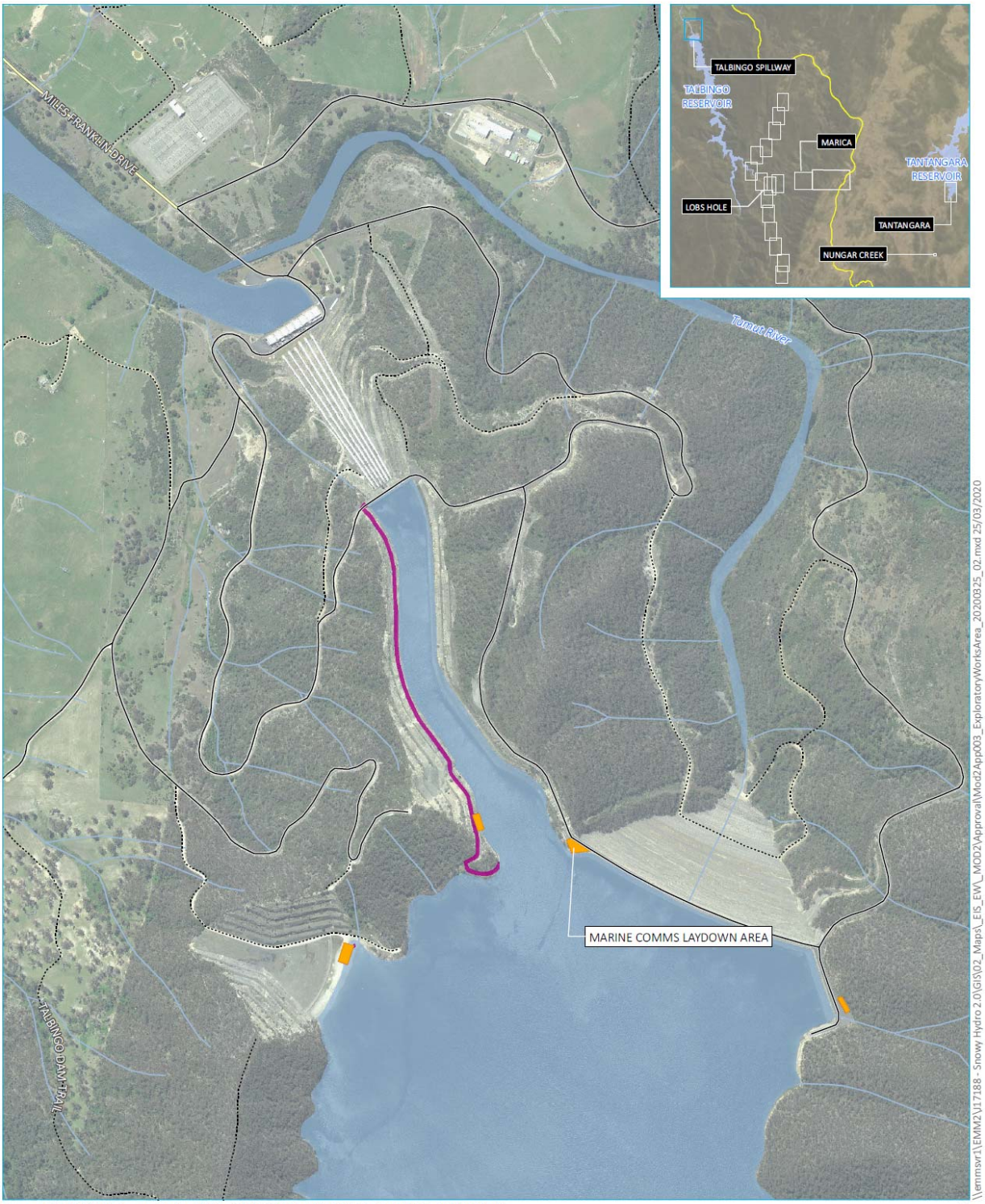

Figure 2-22: *Project boundary – Talbingo spillway*

2-24: Road Upgrades Sharp Street/Bombala Street and Sharp Street/Vale Street Roundabouts